

MECHANICAL ENGINEERING NEWS

VERTICALLY INTEGRATED PROJECT LEARNING

Design is in Our DNA

– Mike Maughan

Teaching design is deeply embedded in our Mechanical Engineering curriculum. A distinctive feature of our program is a purposeful series of design-based courses (stretching from the freshman to the senior year). These include our ME 123 Introduction to Engineering, ME 223 Mechanical Design Analysis, ME 301 Introduction to Solid Works, and ME 424/426 Capstone Design. There is also a variety of design experiences in content-based courses, and many of our faculty actively conduct educational research on improving design education.



Andrew Overby demonstrates Team Patent Pending's Coin-Sorting Machine.

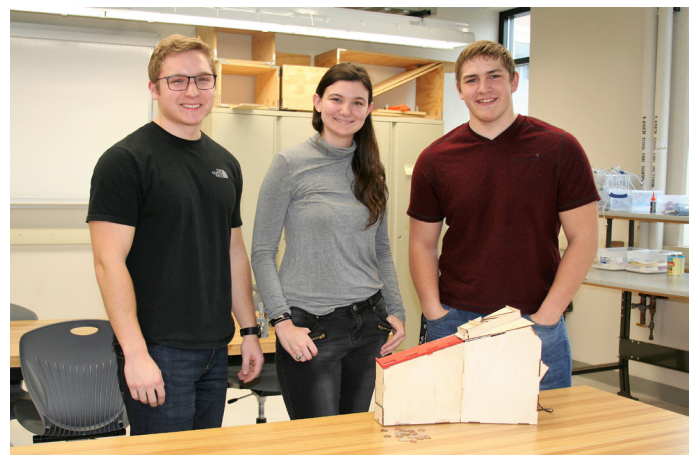
Design-based learning experiences start immediately during the first year of the program, with Introduction to Mechanical Engineering. This course does double duty, introducing students to the many topics in the broad field of mechanical engineering and beginning to develop their design and teamwork skills. Mistakes in design are a learning opportunity, so in this course, the design challenge is usually to use office supplies to convert potential energy into motion. This design project presents a number of challenges that stimulate thinking and encourage creativity.

(See "ME 123-Where it All Begins" in the spring 2016 newsletter <https://www.uidaho.edu/engr/departments/me/news/newsletters/2016-spring> for more information.)

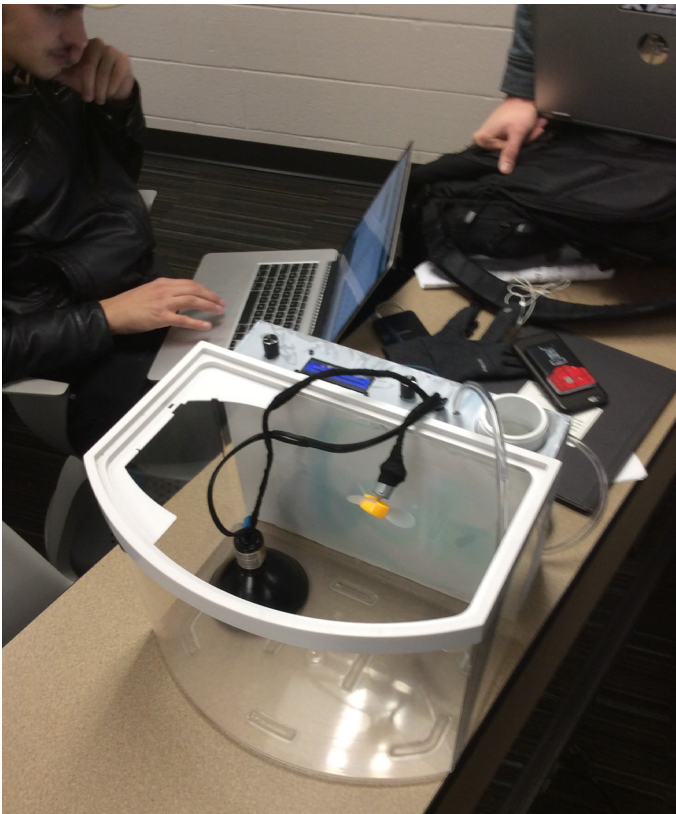
One recent design challenge involved designing, building and testing a gravitational potential energy vehicle with the goal of making it travel a specific distance that was not revealed until the competition date.

By the time students enter their second year of the program, they have completed a number of engineering and math courses to build their technical knowledge. At this point they take Mechanical Design Analysis, which both introduces students to applied computer programming and engages them in a major design challenge.

Teams select and build their own electromechanical consumer products using Arduino microcontrollers, purchased materials of their own choosing, and one integral 3D printed or laser-cut component.



Team Patent Pending Students Andrew Overby, Alyssa Keyes, and Luke Johnson with the coin-sorting machine they developed for the Mechanical Design Analysis course.



Arduino Controlled Terrarium Device

In approximately eight weeks the designs are completed, with mid-project feedback sessions attended by students, peer mentors, and faculty. See photo (page 1) of Andrew Overby demonstrating one recent project, a coin-sorting and counting device produced by Team Patent Pending.

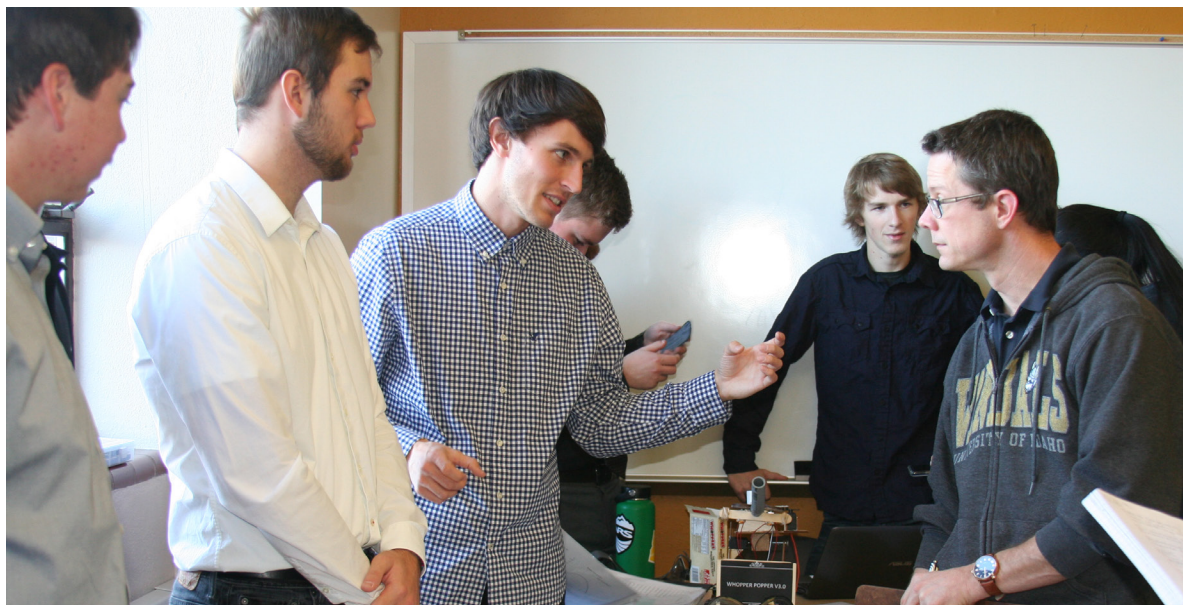
There are a number of additional design experiences embedded in our curriculum. In one such experience, students develop their own PID controlled self-balancing inverted pendulum in dynamic systems modeling. In Lean Manufacturing, considerable freedom is allowed



Team Ardoorino

in the design of over-molded tool handles, and in Thermal Systems modeling as well as component sizing and selection for major heating and cooling systems within the U of I district heating/cooling complex are conducted.

Matt Swenson, our new Inter-Disciplinary Capstone Design Coordinator, sees a direct connection between ME 223 and the Capstone Senior Design experience. "The ME 223 course is a great precursor for Senior Design. Students have the opportunity to develop an integrated design, setting them up for a more advanced interdisciplinary capstone design project. A linked progression in design-based coursework provides broader perspective with a highly relevant and authentic real-world experience."



Students explain their project to faculty member, Sean Quallen (right)

UNDERGRADUATE STUDENTS



College of Engineering Lead Student

We were honored to see Claire Majors identified as the lead student for the College of Engineering at the fall 2017 graduation. As reported in the recent Dean's Letter, her educational journey began in Kamiah Idaho, led to the University of Idaho in 2013 where she originally enrolled in political science, and ultimately to the Mechanical Engineering program shortly thereafter. Her path has been both unconventional and highly inspirational.

Claire has been an active participant in our ASME field trips and highly engaged in the Humanitarian Engineering Corps that has been working on water. For the last year, Claire has been fascinated with biomedical engineering where she has worked in Associate Professor Bryn Martin's Neurophysiological Imaging and Modeling Laboratory (NIML). This paved the way for her involvement in a biomedical project where she worked with three other Mechanical Engineering students on a compact, low-cost, oscillatory-flow pump that can reproduce Cerebral Spinal Fluid (CSF) flow conditions for a range of mammal species. Details about this project can be found on our capstone wiki archive http://mindworks.shoutwiki.com/wiki/Cerebrospinal_Fluid_Pump. The final product of the team's efforts is an elegantly packaged device, with multiple operating modes, and an intuitive user-interface.

Next on Major's adventure list is earning a doctorate in biological engineering, a program she began at the University of Idaho this past January. She will also be continuing her work with the Humanitarian Engineering Corps and will no doubt be continuing her legacy as a Vandal Engineering explorer. Read more about Claire: <http://www.uidaho.edu/claire>.

College of Engineering Ambassadors from Mechanical Engineering

– Brandon Hilliard and Nick Sentieri

During the 2017-2018 academic year, two mechanical engineering undergraduate students joined the College of Engineering Student Ambassador Program. Brandon Hilliard and Nicholas Sentieri represented the Mechanical Engineering Department at various on- and off-campus events. The goal of the Ambassador Program is to increase enrollment and interest in the College of Engineering, as well as the Mechanical Engineering Department, through events such as campus tours, classroom demonstrations, college fairs, and engineering competitions. Attendees at these events range from students in kindergarten through high school, in addition to students and families visiting universities.

In October 2017, Brandon and Nicholas traveled to Spokane, Washington to represent the College of Engineering at a college fair. Attendees ranged from freshman to seniors in high school and their parents. They brought a Stirling Engine made by U of I students in the ME 490 – Solid Modeling, Simulation, & Manufacturing technical elective course.

In January, Brandon and Nicholas attended the Future City Competition in Boise, Idaho. This was the first year U of I had attended the event.

The ambassadors awarded the Multidisciplinary award (sponsored by the University of Idaho) to Crystal Bay, a team from Cole Valley Christian School.

More recently, the ambassadors facilitated engineering activities to students at McDonald Elementary who are part of the Moscow Adventure Club. This organization hosts activities for young elementary students in the Moscow area during school in-service days. During their time there, Brandon and Nicholas explained the basics of what it means to be an engineer and aided in several engineering activities, including a seismic experiment in which the participating students had to build a static structure that could withstand a simulated earthquake, and a milk-and-soap experiment for the K-2 students, explaining the chemical reaction between the lipids in milk and the added soap. Food coloring was used to visualize this reaction occurring. The ambassadors hope that their involvement sparked a desire in these young minds to pursue a career in STEM.

Moving forward with the ambassador program, Nicholas and Brandon hope to continue outreach to various organizations and prospective students to expand participation in educational activities of the College of Engineering as well as the Department of Mechanical Engineering.



Nicholas Sentieri with the Moscow Adventure Club



Brandon Hilliard with the Moscow Adventure Club

American Society of Mechanical Engineers (ASME) Annual Field Trip

– Nick Sentieri

During the most recent 2018 American Society of Mechanical Engineers (ASME) trip, thirty-one students and two faculty members had the opportunity to attend industry tours at four different companies in the Portland area. ASME also hosted our second annual student-alumni mixer and were joined by some ME alumni who work in the Portland area. Profiles of several participating alumni appear in a separate section of this newsletter (pages 13-14).



Evergreen Aviation and Space Museum

We began our three-day adventure by visiting the Evergreen Aviation and Space Museum in McMinnville, Oregon. The museum has a wide variety of exhibits, from authentic World War II German fighter planes

to the largest plane ever constructed – the Hughes H-4 Hercules, otherwise known as the “Spruce Goose”.

The space side of the museum had interactive exhibits for visitors to try and land a rover on the moon and land the space shuttle on an air strip. However, most of the students were attracted to the SR-71 Blackbird and the Titan II Missile. The artifacts and insights from the docents at the museum provided much insight and inspiration to our next generation of Vandal Engineers.



Premier Gear and Machine Works

Our second tour stop was Premier Gear and Machine Works in downtown Portland. We saw the processes by which many types and sizes of gears are made and learned about special-purpose machines that make the gears. We also learned how Premier Gear rebuilds, remakes, and replaces old gear assemblies for the lumber and hydropower industries.

Oracle

Next, we toured Oracle, a multinational computer technology cooperation that specializes in developing and marketing database software and technology. The Portland facility produces state-of-the-art server equipment. We saw the applications of lean manufacturing as we toured the assembly lines. The design/manufacturing process that Oracle has developed allows them to customize and assemble a rack of servers for a customer in a very time-effective and cost-effective manner.



Student-Alumni Mixer

We held our second annual student-alumni mixer at our Portland hotel on Friday evening. We were joined by six area alumni who graduated from our program over the last 20 years. All worked for different companies from start-ups to large international organizations. Next year ASME plans to host our third annual student-alumni mixer in the Seattle area with an open invitation for alumni in the area to attend. Stay tuned for plans about this Vandal Engineering event!



Full Sail Brewing Company

We concluded our 2018 tours at Full Sail Brewing Company in Hood River, Oregon. Students viewed the machinery used for creating craft beer, including large boilers and an extremely large centrifuge. The tour also showed the bottling and testing areas that the beer goes through before shipping. Full Sail can create around 130,000 barrels of beer each year and each barrel holds around 248 pints. The group enjoyed reflecting on the tours and solidifying new friendships with fellow students in the Full Sail dining room overlooking the Columbia River.



A special thank you to all the tour guides at these companies who took the time from their busy schedules to show students real-world application of the knowledge they are gaining every day in the classroom. An additional thank you to the alumni who shared their personal stories and friendly advice at the mixer.

GRADUATE STUDENTS

Marc Compton

When I finally decided to go back to school, I had never considered a field other than engineering. I'm constantly looking for the next challenge and nothing else would have been satisfying. Sustainability has always been a passion of mine, everything from recycling to renewable energy, and is ultimately why I pursued a degree.



Graduate Student, Marc Compton

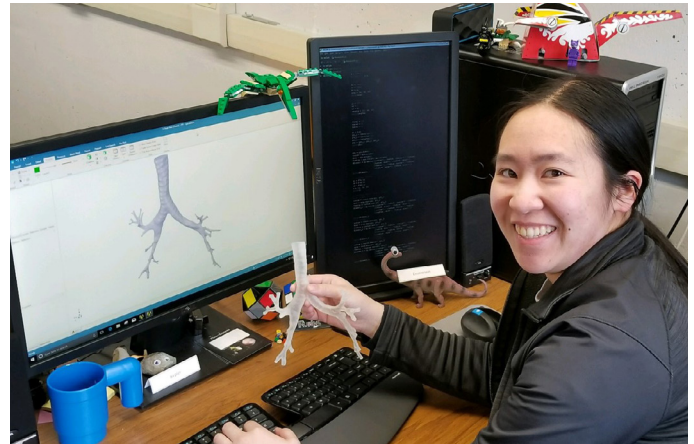
The minute details of a subject were never very interesting to me growing up. I was always more interested in the big picture and I still am to this day. I remember as a kid being fascinated by wind turbines as we drove by. But not at how tall they were, rather it was how this great field of turbines, blades slowly spinning, were working together to power some distant city. This led me to pursue a focus in energy generation in my undergraduate studies.

I joined Assistant Professor Dr. Behnaz Rezaie's Applied Energy Research Lab at the end of my senior undergraduate year. As a graduate student here at U of I, my research has involved using energy and exergy analysis techniques to improve the performance of district heating and cooling systems while reducing their impact on the environment. I have been working to demonstrate the ability of older district heating and cooling networks to compete with more expensive, state-of-the-art systems. Much of my work has been spent in the steam plant on campus. I have developed combustion models for biomass and natural gas fired boilers to investigate the primary emissions products and the impact moisture content has

on CO₂ emissions. I have quantified the major sources of exergy destruction in the steam plant to increase efficiency in a more sustainable manner. Recently, I built a transient model of the steam plant and district heating network to investigate the economic and environmental impacts of modifications such as absorption chillers and turbines to produce power. My research has been published twice and is currently under review in two more journals.

Sally Mei

Growing up, I enjoyed disassembling then reassembling mechanical things and building with Lego bricks (I still do these things). I also appreciate learning about different cultures—especially their history and language. I graduated from the University of Idaho in 2016 with



Graduate Student, Sally Mei

a degree in both Mechanical Engineering and History. I am now a Master's student, teaching assistant, and engineer in industry.

I am researching the Fluid Structure Interactions (FSI) inside of human lungs with Dr. Tao Xing. FSI is a type of simulation that takes into account both the fluid flow and structural behaviors of systems. Simulations allow researchers to visualize the various situations that cannot be experimentally or analytically performed. In addition, these complex situations are difficult and time consuming to accurately measure. In the case of human lungs, the geometry of the lower respiratory tract is intricate. Therefore, FSI simulations allow precise modeling of structural deformations, fluid flows, as well as being able to visually see the imperceptible behavior of flow fields. To prove the validity of my FSI results, I am performing a series of simulations and experimental tests on increasingly complicated situations. Starting with classic cases such as balloon inflation and bifurcating pipe flow. In order to perform these FSI simulations, I needed to obtain material properties of both healthy and diseased tissues from porcine specimens.

The results of my research can be applied widely. Academically, future researchers can use my FSI studies as examples of hyper-elastic material modeling, compressible ideal gases, and complex geometries. Medically, the research will allow a better evaluation of treatment for individual patients by accounting for lung volume and pre-existing medical conditions. Lastly, designers can use the research to improve the mechanical design of next generation ventilators. I look forward to seeing my research applied in real world applications.

Alex Olson

I have strong roots to the University of Idaho. While I grew up in central Washington, the Olsons have lived in northern Idaho for many generations. Almost all of my family has been U of I alumni, many of whom were engineers. Additionally, I have always loved finding out how things work and marveling at their elegant design. Therefore, it was entirely natural for me to come to U of I to become a mechanical engineer.



Graduate Student, Alex Olson

When I finished my undergraduate degree in 2006 I had considered moving straight to a Master's degree, but I was ready to start contributing to real-world problem solving. I went to work for the Department of Defense and Energy at the Idaho National Laboratory. There I developed a passion for maintenance engineering. I enjoyed identifying the root causes of a failure and then designing, planning and observing its correction. I eventually earned my Professional Engineering license which had always been a personal goal for me. Later I found an opening back in my home town in Washington working for ALCOA refining pure-aluminum. As a reliability engineer, I enjoyed using predictive technologies such as vibration or thermal analysis to focus on problem prevention instead of reactionary response.

While I was working professionally I would occasionally encounter a problem or situation for which I didn't have a good answer. I intellectually knew there was a solution, but I simply didn't have the education to approach it (other than gross over-engineering). Fate intervened and the smelter I was working at shut down. This presented me with a golden opportunity to return to school and get the tools I needed for those hard problems.

My research topic is focused on reverse engineering legacy mechanisms. When I was working I found it particularly challenging to repair/replace old equipment where the original specs or designs are no-longer available. I was told that it was a skill that you just learned with experience and I always found that an unsatisfying explanation. I have been working to formulate and apply a specific methodology to the reverse engineering process. My primary case study has been the Antikythera mechanism (a 2000 year

old mechanical calculator for predicting the position of planets). It is a great challenge because almost nothing is known about its construction: including who built it, their techniques, or the exact configuration of the gears.

Overall, as a non-traditional student, I have had some difficulty readjusting to the student lifestyle. However, in the end, I am glad I returned and I hope that I can successfully take what I've learned back to industry.

The Western States Section Combustion Institute (WSSCI)

– Rick Leathers and Sammy Stuhlman

In October 2017 Energy Systems Lab members Rick Leathers and Sammy Stuhlman attended the Western States Section Combustion Institute (WSSCI) Fall Technical Meeting in Laramie, Wyoming. The semi-annual event allows students to promote research that is related to the application of combustion for the benefit of society, and to attend presentations from fellow researchers sharing the same interests. The Fall Technical Meeting had presentations from students and faculty from San Diego State, Caltech, University of Colorado, Oregon State, and more.

The meeting was a two-day event, and attendees were invited to a reception on the night of the first day. The reception was held at



Sammy Stuhlman presenting his research.

the Laramie Historic Railroad Depot, a small museum that was built in 1924, and served as Laramie's train station until 1983. At the reception attendees enjoyed hors d'oeuvres and beverages while socializing with the other researchers and viewing antique railroad equipment.

On the second day Rick and Sammy presented (separately) research they had completed concerning the ignition delay times and derived cetane numbers (DCN) of three in-house produced bio-fuels made from canola, corn, and soy. Rick defended his thesis later that fall and is now working in Idaho Falls. Sammy has switched his focus to oxidation of solids, he will be attending the spring WSSCI meeting in Bend Oregon.

AWARDS

Capstone Biochar Team Places in Vandal Pitch Competition

–Will Seegmiller

In the fall of 2017 our team competed in the Vandal Pitch Competition organized by the College of Business. In preparation, the team presented the idea to various businesses and members of the business community to determine levels of interest for the project. This competition allowed for us to determine if we should proceed with moving on to other business plan competitions. Over the course of the night the team finished third overall. This provided us with the motivation to pursue more pitch competitions in the future. The team looks forward to presenting a tabletop model of a biochar production system at the 2018 Engineering Design Expo.

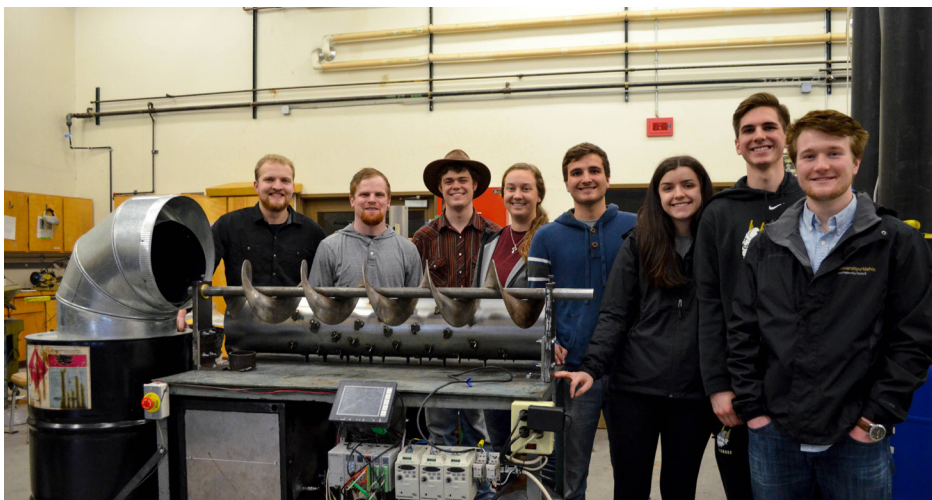
(View video: <https://youtu.be/mXknQwdFBGg>)

What is Biochar?

In the timber-rich, Palouse region of North Idaho and Eastern Washington, there is over 2 million tons of waste biomass accumulated by lumber mills each year. Even though there are some cases where biomass is sold at breakeven prices of \$25, per ton. Mills frequently pay to have the valueless by-product hauled away. At the same time, our regional farming industry struggles with topsoil degradation. Topsoil is becoming less productive, impacting crop yields, nutritional values, and profitability for farmers. As a result, agricultural operations are using more fertilizer to keep yield up. The overuse of these components is harmful to the soil and causes shortages in the supply of phosphorous.

Our team has researched an innovative solution to both problems. Biochar is the solid residue left after burning wood under low oxygen conditions, a process that is known as pyrolysis. Biochar has porous properties that easily absorbs and maintain moisture and nutrients in soil. The product is also rich in fixed carbon. It is a powerful soil enhancer that boosts yields of food crops and reduces the need for fertilizers.

Our team has designed an attachment that will produce biochar at a continuous rate when retrofitted on existing boilers at sawmills. This design extracts waste heat out of the boiler and ducts it through a heat exchanger device that cooks wood chips which are fed through a counter-flow augering device. Our project is sponsored by the Industrial Assessment Center, a DOE funded program, at the University of Idaho.



Biochar Team with Business Team next to their first prototype.



Dr. Tao Xing

Mid-Career Faculty Award

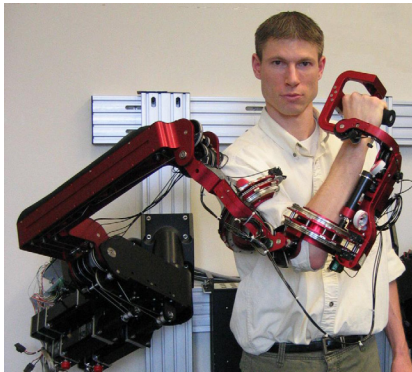
Dr. Tao Xing has been selected to receive the University of Idaho Mid-Career Faculty Award.

The award was established in 2012 to acknowledge faculty, usually during early to middle stage of their career, who have demonstrated a commitment to outstanding scholarship, teaching, and engagement. As a recipient of the award, Dr. Xing is considered as one of the university's most gifted faculty members who serves as a role model, a source of inspiration for students, and whose scholarship contributes to the intellectual development and lives of people in Idaho and globally.

Tao Xing received his doctorate in mechanical engineering from Purdue University in 2002. He joined the Department of Mechanical Engineering in 2011. His research focuses on computational fluid dynamics with applications to Pulmonary Ventilation, offshore wind turbine designs, ship hydrodynamics, boundary layer flows, and desalination. He developed the factor of safety method for solution verification that was evaluated by others to be one of the most accurate uncertainty estimates for monotonically converged numerical solutions.

NIH K12 Interdisciplinary Rehabilitation Engineering Research Career Development Scholarship

Mechanical Engineering Assistant Professor Joel Perry was recently named a 2018 IREK12 scholar. The program is dedicated providing career development opportunities for promising researchers focused on interdisciplinary rehabilitation engineering topics. The honor comes with \$125K of funding to support teaching release as well as research and career development activities.



The BLUE SABINO exoskeleton design is the third iteration of a previous exoskeleton developed by Dr. Perry.

Building a cutting-edge research program while teaching engineering courses is a challenging task for seasoned faculty, and even more-so for early-career assistant professors. This is especially true for researchers working in highly interdisciplinary fields, such as Dr. Perry's work in rehabilitation robotics. This field of robotics requires a close collaboration with clinical partners and access to

patient populations. That's why a group of prominent researchers from leading rehabilitation centers and research universities across the nation created the Interdisciplinary Rehabilitation Engineering Research Career Development Program (IREK12). Through funding from the National Institutes of Health, IREK12 aims to "recruit and train scholars with engineering and other quantitative backgrounds to become successful rehabilitation scientists in basic, translational and/or clinical research."

Dr. Perry has focused his research career on developing wearable exoskeletons and assistive robotic technologies to help assess, assist, and rehabilitate individuals with arm and hand mobility impairments. He currently leads a 5-year NSF project, BLUE SABINO, aimed at developing a new exoskeleton instrument with the unique capability of quantifying neuromuscular impairment from the full 3D workspace during unilateral and bilateral functional tasks. BLUE SABINO, meaning BiLateral Upper-limb Exoskeleton for Simultaneous Assessment of Biomechanical and Neuromuscular Output, will measure position and force information from the arm and hand as well as neural activation information superficially from arm musculature and the brain.

Other research that will benefit from the award include topics in clinical assessment with real objects, wearable home-based monitoring and assessment, and wearable assistive robotics. Dr. Perry plans to leverage the remote and rural setting of the University of Idaho and its surroundings to address a much larger underserved population of individuals with disabilities. The IREK12 award will allow Dr. Perry not only to dedicate 80% of his time these research objectives, but also provide invaluable learning and networking opportunities.

TEACHING INNOVATIONS

Competition Vehicle Elective

– Zack Lippie

The University of Idaho Clean Snowmobile Challenge team started its year off with a bang with the addition of 22 new members, ranging from freshmen to juniors. This is the largest influx in team growth the team has experienced, so to better meet the needs of the team, our Snowmobile elective class was reorganized. This class serves as both a special topics course for younger members and as a technical elective for older members, while formalizing the learning process and allowing new members to have more of an impact on the team.

The class is taught by several of the senior members and team captains, with topics ranging from engine calibration to project management. This helps increase the base-level knowledge of the newer members, as well as teaching the longer-term members how to properly convey complex ideas. Overall, the team has had a much higher retention rate than previous years and the newer members have been more involved with design and development of components than in the past. With four members graduating in May, it's good to know the team will be left in capable hands for the 2019 competition.



Clean Snowmobile Challenge Team

25 Years of Idaho Engineering Works

– Edwin Odom



If my memory is correct, this is the 25th year of the Idaho Engineering Works (IEW). This graduate student organization was organized around two questions “What can we do to have the best 1½ to 2 years possible” and “How can we leave this place better than we found it” This organization did not have a singular research focus, we have tackled topics such as experimental and analytical mechanics, internal combustion engine testing, GD&T,

FSAE Formula 1 and Hybrid FSAE Formula 1, design pedagogy, solid modeling, provided support to for the Capstone Design course, and implemented new manufacturing capabilities in the ME machine shop. Through all of this, the one constant was to try to get the “people” part right. Now we have a new generation of faculty. It is time for me to erase the blackboard, step aside, and allow these excellent faculty members to look at the present state and find their own way. To all past and present members of the IEW, I want to extend a heartfelt thank you.

Interdisciplinary Capstone Design Project Fair

– Matt Swenson

Each year, faculty from four different engineering departments (mechanical engineering, electrical and computer engineering, biological engineering, and computer science) work together to coordinate the interdisciplinary Capstone design program. Prior to

the beginning of the two-semester capstone sequence, the faculty gather several sponsored project options for students to consider for their capstone project bid. Project sponsors may include: a) industrial partners, b) internal departmental research, or c) on-campus departments outside of engineering. Historically, a representative from each project has been invited to come to class and present a brief overview of the project synopsis to the class. This provides students with broad exposure to many project options, but did not facilitate deep student-sponsor interaction.

For the 2017-2018 capstone sequence, faculty decided to host the first annual Interdisciplinary Capstone Project Fair on August 29, 2017. At this one day event, each project had a 90 minute booth display in the Vandal Ballroom of the Pitman Center (a format similar to a traditional career fair). A representative for each project was available to present, discuss, and answer questions about their respective project using visual aids such as posters, videos, or physical hardware. Students were required to attend the Fair with the goal of visiting at least a half-dozen project booths that aligned with personal interest and expertise. Following the Project Fair, each student submitted their personal Project Bid Portfolio, outlining their ranked top four project preferences. Upon completion of the project team assignments, every student was awarded a project from among their top four selections.

The interactive nature of the Project Fair offered many positive attributes. Fundamentally, it flips the student experience from passive listening to multiple short-duration presentations in a large class environment to active face-to-face dialogue between students and project sponsors. From the sponsor side, our presenters were engaged non-stop during the 90 minutes as waves of students came by their booths. Sponsors provided helpful instructor feedback on students whose skills and interests would mesh well with their projects. Similar to a Career Fair, the event provided an opportunity for visibility of sponsoring organizations across the senior class and an initial touch point for new-hire recruiting. If your organization has capacity to support a capstone project and if you would like to be a capstone client, don't hesitate to contact Matt Swenson so we can begin project scoping discussions.



ABET Design Assessment

– John Crepeau

At universities across the country, departments are becoming required to assess how well students are meeting various educational outcomes. This is part of a nationwide effort to help leaders and policy makers better understand how students are achieving their educational goals. Fortunately, in the mechanical engineering department, we have built a culture of assessment for our students and our courses. This is due, in large part, to the requirements of our accreditation body, ABET (formerly the Accreditation Board for Engineering and Technology), which requires all programs to perform assessments, analyze the results and implement improvement plans for the programs that wish to be accredited. The mechanical engineering program at the University of Idaho has been accredited since 1936.

The accreditation efforts are aimed at measuring student outcomes, and the focus of these efforts has been students towards the end of their studies, usually juniors and especially seniors. While assembling this information for the department, a thought came to mind to a group of faculty members. Wouldn't it be of interest to see how students' skills progress from the freshman to senior years? Design is a major strength of the department, and we offer hands-on design courses during the freshman, sophomore and senior years. The College of Engineering is well-known for their annual Engineering Expo, but students have been working on design projects since their freshman year. Why not figure out a way to track those design skills?

To tackle this problem, four faculty members sat down and hashed out a single rubric which could be used to assess various design skills, including System Design, Implementation, Project Management and Documentation. The rubric was scaled to assess these skills based on an increasing level of sophistication, starting at a pre-engineer level and progressing through Trainee, Intern, Entry-Level and Professional categories. A good freshman design project might rank well in the class, but would likely rank low on the scale above, since the project would be compared to how a professional engineer would carry out and realize the design. The rubric was developed, refined and used during the fall 2016/Spring 2017 semesters. Three more faculty members joined the team and the rubric was applied to the fall 2017 projects.

The results showed a steady improvement in each of the four design competencies beginning at the freshman year. The faculty were quite impressed to see the improvement in quality among the projects. Freshman students used cardboard, Popsicle sticks and other common materials to build their designs, and just one year later, they used Arduino control systems and three dimensional parts in projects of their own choosing. By the time they were seniors, students were able to incorporate parts they machined in the shop. It has been a great exercise to have a global view of the design work our students complete. They graduate as engineers with significant design experiences, working in multi-disciplinary teams and reporting to a client. It is no wonder that our graduates are so highly sought after. We will present our preliminary findings at the 2018 American Society of Engineering Education conference held in Salt Lake City.

ASSESSING THE PROGRESS OF STUDENT DESIGN SKILLS RUBRIC FINAL DESIGN REVIEW

Team: _____ Course: _____ Date: _____ Evaluator's Name: _____

Competency	PRE-ENGINEER 1	TRAINEE 2	INTERN 3	ENTRY-LEVEL 4	PROFESSIONAL 5	SUB-SCORE
System Design	No overall system architecture and lack of system integration. Minimal consideration of design constraints.	Partial consideration given to system-architecture and integration. Some consideration of design constraints.	Broad concept of a design with an adequate consideration of system integration while meeting many design constraints.	Refined and thoughtful integration of subsystems and meets most design constraints.	Well-integrated system which meets all design constraints.	
Implementation	Inappropriate selection of materials; undisciplined fabrication; no manufacturing plan; rarely functioning system.	Arbitrary selection of materials; minimal consideration of manufacturing; intermittent system functionality.	Suitable materials identified; some consideration given to manufacturability; system usually functions.	Standard selection of materials; complete manufacturing plan; system functions reliably.	Purposeful selection of materials; optimization of manufacturing and system functionality; high system reliability.	
Project Management	Unorganized and lacks direction; team members unaware of responsibilities; no accountability.	Minimally organized and planned; team members somewhat aware or responsible; some accountability.	Moderate organization and planning; team members aware of responsibilities and held accountable.	Well organized and planned; team members are responsible and willingly accountable.	Thoroughly organized; team members are highly responsible and hold each other accountable.	
Documentation	Little to no documentation; haphazard organization.	Some documentation included; minimal organization.	Many documents available and largely complete; somewhat organized.	All important documents included and ready for external review; clearly organized.	All important documents included, referenceable by third parties; highly organized.	

FACULTY AND STAFF

Introducing Debbie Edwards



Debbie Edwards

Originally from the northeast, I was born and raised in the Rochester area of upstate New York. I graduated with a B.S. degree in Psychology, with a Minor in Sociology from SUNY Brockport. My M.S. degree is in Education, with an emphasis in Counseling Psychology from Washington State University (WSU). My area of expertise is Career Counseling.

I always knew I wanted to work in a helping profession. After finishing my Master's degree, I began my professional career as a Career Counselor at WSU Career Services, where I enjoyed many wonderful years counseling students on career and life issues, as well as internship and job search strategies. Over the years I was asked to take on additional administrative responsibilities and finished my career at WSU as the Director of Career Services.

After leaving WSU, I was fortunate to be hired as the Manager of the Pullman Campus of Spokane Falls Community College. After a few years I left this position to spend more time at home. I soon realized that I was not ready to retire and was excited to see a half-time, 10-month, Administrative Assistant position advertised at the University of Idaho. I am thoroughly enjoying my time working with the Mechanical Engineering faculty, staff and students.

My husband is a Professor at WSU. Our son, Trevor, graduated from MTech in Butte, MT and is employed as an Engineer for John Deere Co. in Iowa. Our remaining "children" are Bear (Anatolian Shepherd) and Moose (Lab Mix).

MANUFACTURING INFRASTRUCTURE

Bridgeport V2XT CNC Upgrade

– Bill Magnie

The Bridgeport V2XT CNC milling machine was originally installed in 1994. This was the first Computer Numerical Control (CNC) machine installed in the ME Shop. At the time of its installation, the operating system was the latest and greatest from Bridgeport Machine Tools. Nevertheless, like most computer based systems modern technology was soon outdated. The machine performed well and provided years of service. Over the last couple of years, the machine control had become unreliable, occasionally requiring circuit boards and cables to be jiggled in hope that it would perform as required. Eventually that failed to work and the machine became unusable.

The machine is still in great condition so it was decided to retrofit it with a modern CNC control, essentially giving it a brain transplant. A Centroid CNC retrofit package was chosen for its relatively straightforward installation and the ability to choose options to keep

the cost down. Members of IEW assisted with the conversion by removing the old control box and installing the new one. The existing servomotors were retained but required new encoders to be adapted. The new encoders have a 4x increase in resolution providing better feedback and increased performance over the old encoders. After a few minor hiccups with the installation, the machine is up and running again. No more floppy discs or DOS based programming...



Bridgeport V2XT CNC Retrofit

ALUMNI

Advisory Board Report



Todd Swanstrom

– Todd Swanstrom

The department held an evening Advisory Board meeting on October 2nd, prior to the Career Expo. Eight ME Advisory Board members, six ME faculty/staff, and twenty undergraduate/graduate students participated in our fall meeting. The meeting began with informal discussions involving second semester capstone projects, a dinner in the design suite meeting area, and round robin introductions by Advisory Board

members, faculty/staff, and students. Steve Beyerlein gave an overview of undergraduate as well graduate student feedback from exit surveys. He also shared results from the year-long Program Prioritization Process (PPP) where the ME program was ranked 1st in its U of I Mission Fulfillment statement and 8th overall across all the academic/research areas measured (out of 48 participating academic departments). Steve Beyerlein and Stacy Rauch then inventoried updates on the ME Department infrastructure (focus of walking tour that followed) and its funding. Stacy also emphasized the benefit of Advisory Board gifting to our scholarship and its importance to our two recipients.

The major thrust of the meeting was a review of ME laboratory & fabrication infrastructure, continuing to build on themes shared in our spring and fall 2016 newsletters, www.uidaho.edu/engr/departments/me/news/newsletters, (esp. Our Vision for Hands-On Engineering Education and Our Distinctive Learning Environment).

Advisory Board Member Profiles

Gene Hamacher

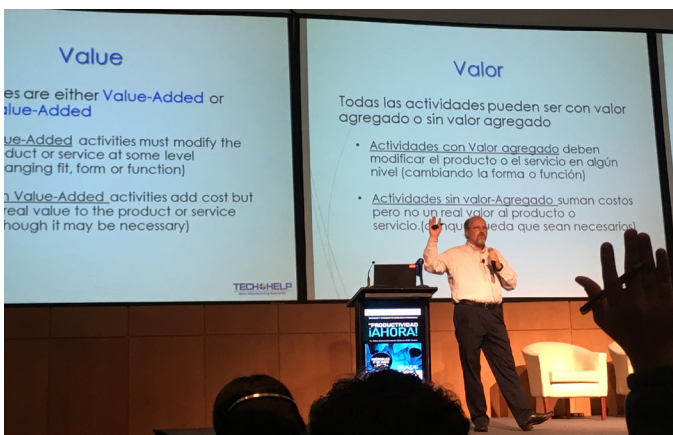
Gene Hamacher is the TechHelp Manufacturing Specialist for North and North-Central Idaho, and is a member of TechHelp's Operational Excellence Team. In this role, he provides training, coaching, and advising for manufacturing companies located throughout Idaho and the Inland Northwest.

Gene has studied and implemented Lean Manufacturing and Total Quality Management (e.g. 6 Sigma) in both manufacturing and academic settings. He has lead benchmarking studies across the United States and Japan, and his efforts have produced significant gains in productivity, safety, quality, and lead-time. Gene is a certified Team Leader and Trainer for Boeing's Hardware Variability Control and their Lean Manufacturing programs. He is also holds a Lean Certification from the Society of Manufacturing Engineers (SME).

Gene has 19 years of process improvement experience working as a manufacturing process engineer, an operations manager, and as a business advisor. During this time he improved product and process performance by using Lean Manufacturing and Six Sigma tools and techniques, as well as other process improvement methods. Gene also has experience developing the organizational structure and culture needed to introduce process improvement techniques.

In addition to his industry experience, Gene spent 9 years teaching at technical colleges. He taught courses on numerous subjects; including Business Management, Production Control, Project Management, Mathematics and Statistics. He is on the executive committee for the Inland Northwest Chapter of SME, and the Inland Northwest Coalition for Operational Excellence; and is on the Advisory Boards for U of I's Mechanical Engineer Program, NIC's Workforce Training Center, and Clearwater EDA's Manufacturing Association.

Gene's education includes both Business Management and Engineering. He holds a Bachelor's in Electronics Engineering Technology from DeVry University; and he has 2 Master's degrees from M.I.T., one is in Management and the other is in Engineering.



Gene Hamacher

Daniel Schneider



Daniel Schneider

Daniel Schneider is a mechanical engineer at Schweitzer Engineering Laboratories in Pullman, Washington, overseeing mechanical development of industrial computing and automation controller products. Employed in 2014, Daniel has already left his mark on the company, improving a number of SEL processes and kick starting educational outreach within just a few years. As SEL continues to push the limits of industrial electronics

in both speed and longevity, each new generation of product poses unique design challenges in thermal management and reliability. Daniel works to ensure that SEL mechanical analysis utilizes the most current technology and methods, specializing in thermal and structural analysis of integrated circuits and printed circuit boards.

In his independent professional pursuits, Daniel develops low-cost, open-source wearable assistive technologies aimed to enable independence among persons living with disability. Along this vein are the Sightless Navigation and Perception (SNaP) and Open Source Prosthesis (OSP) projects. The former is currently undergoing software development by computer science students in the Capstone Senior Design program, and the latter is soon to follow.

Daniel earned his BSME at the University of Idaho, where he worked as a designer and researcher for the Idaho Space Grant Consortium (ISGC). He maintains close ties with the university through both the Department of Physics and Department of Mechanical Engineering, engaging with students through both ISGC and Capstone Senior Design, sponsoring two senior design teams and participating as an expo judge for three years running. He was invited to join the Mechanical Engineering Advisory Board in fall of 2017, and is eager to work with the university to keep the learning environment in lock step with emerging technologies, providing students with the experiences needed to be competitive outside the classroom.

Alumni Advice from ASME Portland Student-Alumni Mixer Attendees

Matthew Cunningham

ME Degrees: BS and MS degrees in Mechanical Engineering

First Job after Graduation: Engineer; Bechtel River Protection Project Waste Treatment Plant

Current Job: Sr. Product Design Engineer; Blount International



What does it mean to “Engineer like a Vandal?”

Elegant simplicity. When others are happy with the status quo and complicated designs, Vandals keep working to understand and solve the core challenges. From experience, simple designs that seem obvious once they’re realized were not simple or easy to develop, but the extra effort is worth it when your design delights customers.

What advice would you like to share with current ME students?

Try new experiences and attempt challenging problems without fear of failure. If you find something that interests you, try it out. As long as you learn from the experience, it was a success. Whether it’s grad school, taking a semester off for an internship, or classes in another department, more experiences across a broad array of fields will help prepare you for industry. Engineers are often asked to perform many roles in different engineering fields and to serve in roles outside of engineering, so broad experience early in your career will prepare you to take opportunities that interest you.

Heather Dillon

ME Degrees: MS and PhD degrees in Mechanical Engineering

First Job after

Graduation: Research Engineer, Pacific Northwest National Laboratory

Current Job: Associate Dean of Graduate Education and Faculty Support, University of Portland Shiley School of Engineering



What does it mean to “Engineer like a Vandal?”

I believe that the University of Idaho taught us to engineer with integrity. There were many small lessons from my excellent professors about how to take responsibility for failure, but also how to share every success with the whole team. They taught us to care a great deal about every engineering job or calculation, no matter how small.

What advice would you like to share with current ME students?

I would encourage students to be patient with an engineering career. I think many students hope to start work and immediately find the perfect fit, but careers are long adventures and each opportunity helps you prepare for your next role. Don’t forget to absorb all the important lessons you can from different people on your journey.

Andrew DuBuisson

ME Degrees: BS and MEngr degrees in Mechanical Engineering

First Job after Graduation: Designer. Freeman Marine Equipment. Gold Beach, OR, and then Mechanical Engineer. Unifield Engineering (now WorleyParsons)

Current Job: Mechanical Engineer. Kestrel Engineering Group, Inc.



What does it mean to “Engineer like a Vandal?”

University of Idaho brought together fundamentals, work ethic, curiosity, innovation, and fun. U of I offered a tremendous opportunity and I utilized it. While most learning occurs on the job, U of I provides an excellent foundation from which to build a career. For me, “Engineer like a Vandal” means working well with others (teamwork), including coworkers, clients, manufacturers, and the public. Clear communication, sharing responsibility, and focusing on quality are all principles I picked up at U of I. Go Vandals!

What advice would you like to share with current ME students?

- Learn the general structure of various standards including ASME. Here is a great intro course: www.asme.org/products/courses/asmestandards
- Find a job working with a licensed Professional Engineer.
- Take the FE exam. Then, pick up a new or used copy of the Mechanical Engineering Reference Manual (or similar) ... SKU: MERM13, ISBN: 978-1-59126-414-9, Copyright: 2013, Author(s): Michael R. Lindeburg, PE ... and start studying for the PE exam.
- Your company may not drive you to continue your education, so keep up on that for yourself.
- Enroll and stay enrolled as an ASME member.

Joe Frankel

ME Degrees: BS and MS degrees in Mechanical Engineering

First Job after Graduation: Motion Control Engineer, Electro-Scientific Industries, Inc. (ESI)

Current Job: Systems Engineer, FormFactor, Inc. (formerly Cascade Microtech)

What does it mean to “Engineer like a Vandal?”

To me “Engineer like a Vandal” means two things: 1) that you apply the principles of math and science wherever possible to make “data driven” design decisions, and 2) that you possess an innate passion for solving technical problems.

When approaching an engineering problem, it is best to identify risks and unknowns first, and then build prototypes to capture and analyze relevant data before making key design decisions. If you analyze, understand, and then control the key variables, you will always win out over the “design and try” approach. The latter may lead to a physical product faster, but will be likely to fail because of some key factor that was not understood during the design. When conducting experiments on early prototypes well ahead of crunch time—and there is always a crunch time—“failure” is educational and will lead to

the right answer. On the other hand, proceeding to go to print with a design that contains unexplored unknowns lurking within will simply result in wasted time, money and real failure. Don’t let unknown, unexplored risks slip into your design.

Also, you’ve got to love what you do. It’s a character trait I’ve seen in all of the best engineers I’ve worked with, and if you delight in solving technical problems and seeing your visions become reality, you will naturally succeed.

What advice would you like to share with current ME students?

Overall I believe the ME program at U of I is well suited to prepare you for an engineering career, and it certainly prepared me well for graduate school at Georgia Tech and then for a career in high tech electronics manufacturing later on. However regardless of your academic preparation, you are going to feel foolish, lost, and unqualified when you start working with senior engineers at that first engineering job. But have faith in yourself and gather mentors whenever you can. Over time you will gain the experience and become a technical expert just like they are.

For me specifically, some of the subjects I’ve had to self-learn after college that I skipped during college include 1) machine vision, 2)



vibrations, 3) calibrations, and 4) systems engineering. However unless you know the exact description of your first job while you are still in school, it is difficult to predict what you will need to go learn on the job later. The best mindset is to always just go do the research and teach yourself whatever you need to know to solve the problem at hand. Never stop learning!

LETTER from the CHAIR



Steve Beyerlein

Two words that are often used interchangeably in education are assessment and evaluation. Similarities and differences between these two processes are illustrated in this linked article <http://www.ijpe.online/25/image/sections/AE.pdf>.

Both are anchored in sound measurement of performance, and both are valuable processes, but each has a different purpose. This column is good place to share my operational understanding of assessment and evaluation in the context of engineering education. I invite you to share thoughts and experiences with assessment and evaluation in your workplace as this could be great material for feature in a future newsletter.

ROLE OF ASSESSMENT

The focus of assessment is continuous improvement, providing feedback about current performance so that future performance can be enhanced. It is ideally a dynamic interaction between the performer being assessed and the party serving as the assessor. This begins with shared understanding of the criteria that define high quality performance, includes relevant data collection/analysis, a timely report of findings, and action planning that leverages time spent on assessment for growth in knowledge/professional skills/accomplishments. Here are several best practices for assessment that are active within our program.

Mid-Term Assessment: A number of faculty conduct mid-semester surveys, typically after the first exam. These survey's query student preparation/success, analyze aspects of the exam that were easy as well as particularly challenging, identify what class activities have been most beneficial in promoting learning, suggest changes in class activities would promote more robust learning, and explore what personal changes students need to make to get the most out of the course. Results of these surveys are summarized and played back to students along with intentions to sustain value-added practices and begin experimentation with alternative instructional strategies. This assessment exercise builds trust as well as shared commitment between faculty and students.

Peer Mentoring: Supplemental instruction and advisement is a distinctive feature within our design stem from the freshman to the senior level (ME 123, ME 223, ME 301, and ME 424 & 426). Undergraduate and graduate student peers who have excelled in course content/tools but who are also interested in helping other students elevate their knowledge/skills are involved in this enterprise. Significant personal growth of both mentors and mentees results from our unique learning environment.

Student Outcome Monitoring: Specific courses within our program are used to gather data about development of explicit student outcomes about knowledge, skills, and professional perspectives prescribed by our accreditation organization (ABET). Intentionally, these are integrated in normal class activities and designed to

add value to particular classes. All findings are reviewed by the department ABET committee and key discussion points are forwarded to the general faculty for deliberation.

ROLE OF EVALUATION

The focus of evaluation is making judgments whether standards have been met in key performances. Care needs to be taken in defining standards to make sure that the desired level of performance is shared by key stakeholders and meaningfully aligned with performance measures. Evaluation involves clear articulation of intended outcomes, thoughtful selection of methods for data collection, identification of specific target levels for the performance, analysis of findings, and communication of results to appropriate decision-makers. Evaluation is important in documenting student achievement, making decisions about resource allocation, and accrediting programs as well as institutions. Here are three areas where evaluation is being applied in Mechanical Engineering program design/delivery.

1st Year Retention: While U of I has the highest first-year retention rate among public institutions in the state (82%, up 5% from the previous year) and students entering the College of Engineering are among the most likely to obtain a U of I degree, there is a strong on-campus push for greater levels of academic success. Last year, first-year professional advisors were hired across campus to ensure smoother transition from high school to college and to provide quicker intervention in response to early warning/midterm grades as well as probation/disqualification interventions. The full-time job of these advisors is supporting the whole student in their college experience. In addition to higher levels of freshman engagement in advising as well as college-based activities, our D/F/W rate for freshman students has declined significantly. First-year retention for the College Engineering rose to 83%.

All U of I programs have a mandate to improve their 1st year retention as well as their 6-year graduation rate. This will continue to be an important element of U of I program evaluation.

Program Prioritization: Last year all academic and non-academic programs were required to submit documentation to go along with data from the office of institutional research in ranking program effectiveness. We prepared a narrative about our program contribution to the U of I strategic plan along with multi-year data on enrollment, awarding of degrees, research expenditures, measures of diversity, and expenditures against general education budgets, see <http://www.uidaho.edu/engr/departments/me/about>. Our statement of mission fulfillment as reviewed by department chairs and administrators across campus was rated 1st among 48 programs. As a result we will be receiving funding for two more graduate teaching assistants and a full complement of in-state tuition waivers for all of our TAs.

Accreditation: Our next ABET visit will be in 2019 and we will be putting together a self-study report over the next year where we will be mining data from our archive of ABET Student Outcome Reports. One ingredient in the self-study is our updated Program Educational Objectives which many of you contributed to via previous newsletter surveys. In addition to disciplinary accreditation, all programs need to contribute to a university-wide effort to proactively respond to expectations of the Northwest Commission on Colleges and University (NWCCU) surrounding institutional accreditation. Our departmental curriculum committee has done an artful job synergizing NWCCU requirements with those of ABET. Our ME program materials were recently featured as one of three exemplars across campus in an interim NWCCU visit.

25TH ANNUAL ENGINEERING DESIGN EXPO 2018

April 27, 2018 | Pitman Center



MECHANICAL ENGINEERING NEWS

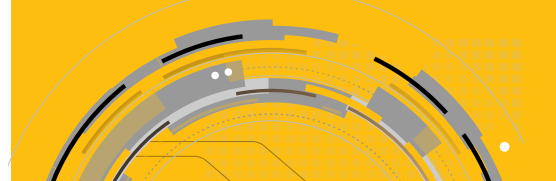
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Any opinions expressed herein are those of the writers and do not necessarily represent the official position(s) of the university or its Board of Regents.

Editor: Debbie Edwards



KEEP IN TOUCH! We want to hear from you!

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