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From the Editor

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This is our 27th issue, and it marks the beginning of a major change. I will be turning the editor-in-chief duties over to Holly Matusovich. Holly, Professor of Engineering Education at Virginia Tech, will be transitioning into the editor's chair over the next few months, and will assume full duties by January 1, 2021. As editor, Holly brings a new vision to *Advances* and a charge from ASEE's Board to take the *Journal* to the next level.

Issue number 27 contains nine full papers plus one shorter "Looking Ahead" article. Of note is that five of the papers are international from Qatar, Australia (two), Columbia and the United Arab Republic, an indication that we have extended our reach around the world. In addition, four of the papers address societal issues particularly in the less-developed world. The papers also describe a wide range of pedogeological issues including blended learning, challenged based learning, problem based learning, experiential learning, human-centered design, simulations, visualization, and games. The four papers that address societal issues, both domestically and internationally are:

Katie Schneider, Amy Martin, and Terri S. Hogue (Colorado School of Mines) have focused on "Water-Energy Education for The Next Generation (WE²NG)." This Research Experience for Teachers (RET) program immerses K-12 educators in state-of-the-art research at CSM through the highly interdisciplinary water-energy nexus. Their model includes industry field trips, content and pedagogy workshops and a book club focusing on science communication. Pre- and post-program surveys indicated that WE²NG improved teacher confidence and growth at all three levels: elementary, middle and high school, demonstrating that their model represents an effective professional development program for K-12 STEM educators.

Martha Liliana Torres-Barreto, Ginna Paola Castro Castaño, and Mileidy Alvarez Melgarejo all from Columbia present "A Learning Model Proposal Focused on Challenge-Based Learning." They use these challenges to promote professional skills such as oral expression, communication, resource management, leadership and problem solving among engineering students. Their test case involves more than 180 engineering students and four professors who address realistic challenges dealing with problems of the homeless that require both technical and non-technical skills for resolution. The first phase of the project is described in their paper. Results to date support the need to modify engineering education in order to better develop competences that engineers will need to globalized world's problems.

Jenna L. Mueller and colleagues are "Using Human-Centered Design to Connect Engineering Concepts to Sustainable Development Goals" (SDGs). The project originated out of the Ignite program at Duke University's Center for Global Women's Health Technologies (GWHT), which applies the human-centered design framework to address specific issues associated with the SDGs. As part of a BME design course students created and delivered technological solutions to increase access to light at night, a significant challenge in many less developed communities. A subset of the undergraduate students partnered with energy-poor communities in Kenya, India and Guatamala, implementing a curriculum based on the skills they had learned in the course. By integrating human-centered design and the SDGs into engineering curricula and targeting communities that work with women and girls, the authors propose that the Ignite program can impact three of the SDGs – renewable energy, quality education, and gender equality.

Suzan Alaswad and Sinan Salman (Zayed University, Abu Dhabi, UAE) address another societal issue by creating the "Humanitarian Aid and Relief Distribution (HARD) Game" where students are challenged to coordinate supply chains in order to get aid timely to those in need. They propose that humanitarian supply chains focus on delivering what customers *need* rather than *want* within difficult environments rife with uncertainty. Their HARD Game is an experiential learning tool where students must balance operational efficiency with tradeoffs impacting supply chain performance; i.e., beneficiary demand satisfaction, operational costs, and transportation resources utilization. The HARD game is intended for graduate and undergraduate students in courses dealing with supply chain management. Analysis of students' surveys suggest that the game is an effective pedagogical tool that is both engages students and complements the traditional supply chain lecture format.

Four of the papers address better conceptual learning:

Mansour Karkoub from Texas A&M University at Qatar, and three colleagues, Chun-Lin Yang, Wael Karkoub and Moutafa Raslan, from the main campus (College Station) describe "Undergraduate Cross-Class Research Projects for Deep Learning" (UCCRP). They have introduced hands-on projects that students can work on throughout their entire undergraduate years, involving mixed team drawn from all four undergraduate levels, and mentored by peers, TAs, and instructors. The UCCRP model was implemented and assessed at Qatar. The goal is to develop particular skills for specific students rather than on solving a particular problem, making it different from most project-based learning models used in engineering education. Each UCCRP task is divided into well-defined skills with intended learning outcomes, teaching and learning activities, and assessment tasks, all designed so that when properly executed will push the students into a "deep learning" experience. The authors have proposed that 60% of the students in their pilot did, in fact, achieve some level of deep learning.

Jianchu Yao (East Carolina University) presents "a Temperature Control Project that Facilitates Learning of Difficult Concepts in Control Theory." This design project requires students to

mathematically model the thermal dynamics of a glass incubator and its heat source, and then use the model to design a system to keeps the incubator temperature in a safe range when the external temperature fluctuates. Results indicated that such simulation-based real-world projects can facilitate student learning, making difficult concepts easier to understand.

Smitesh Bakrania (Rowan University) describes "A Visual Approach To Teaching Properties Of Water In Engineering Thermodynamics." He proposes that steam tables and corresponding digital property charts fail to reinforce how state properties are related to each other. Research has shown that using property charts can improve student's ability to visualize property relationships and facilitate developing mental models of the complicated equation of state for water. Bakrania uses animations and other multimedia resources to leverage the visual nature of property charts in a flipped instructional environment. The result reduces the faculty's instructional load, but with deeper conceptual engagement. The author's assessment found that students who used property charts as their primary reference were significantly better at predicting water property trends compared to students who relied on the more traditional steam tables and property chart sketches. Students felt that the property charts and supplemental videos better enabled them to visualize the underlying complex relationships. Bakrania notes that the results are consistent with current research and support revising thermodynamics pedagogy by embedding an intuitive, evidence-based approach to teach fundamentals.

Two papers are directed at using a blended learning model, both at Australian Universities:

Jung-Hoon Sul, from Central Queensland University, with Zhongxiao Peng and Nicole Kessissoglou, both from the University of New South Wales discus the "Implementation of Blended Learning for a Large Size Engineering Mechanics Course." The paper describes the course's evolution as the blended learning (flipped) pedagogy was introduced. During the process changes were introduced to (a) reduce the administrative burden, (b) maintain student interest and engagement, and (c) achieve the desired learning outcomes. Student participation increased with the integration of additional information and communication technology, and the implementation of online assessments. However, they found no indication that blended learning improved student academic performance.

Sarah Dart, Edmund Pickering, and Les Dawes (Queensland University of Technology) in "Worked Example Videos (WEVs) for Blended Learning in Undergraduate Engineering" investigated the impact of WEVs as an effective, self-directed learning approach for large courses. They used a mixed methods approach incorporating viewership data and surveys to evaluate their "advance," finding that nearly 90% of students actively interacted with the WEVs. Many students used the video controls to tailor and self-pace their learning. Surveys indicated that students felt their content knowledge improved, and, consequently, their grades would also improve.

In addition to the nine full papers, we are featuring one "Looking Ahead" paper. These are projects in progress that have the potential for impact in engineering education. **David Reeping** and

Lisa McNair (Virginia Tech) look ahead with "Thinking in Systems to Uncover Faculty Mental Models Situated in Curricular Change." To do this, they are utilizing a systems modeling technique– Causal Loop Diagrams (CLD) – designed to reveal connections in themes across large projects. Early results have already resulted in changes to graduate education.

This journal, like most academic journals depends on volunteers, starting with the editor, associate editor, and advisory board. We recognize there contributions by listing their names on our website. However, there is one other group that we depend on – the reviewers. Typically reviewers get little recognition, although we try to share reviews with them once a decision has been made. With this issue, we take a small step in thanking our reviewers by listing the names of everyone who served as a reviewer in 2019. Please take a few minutes to look over this list, and, if your name is not on it, consider volunteering as a reviewer – just drop us a note!