

# Pre-Conference Workshop: Unfolding the Layers of the Engineer of 2050 through Faculty Development and Change

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**Abstract**— The Engineer of 2050 requires a multidimensional education that not only incorporates advanced technical knowledge but also emphasizes global competence, growth mindset, and a proactive approach to lifelong learning. This workshop will explore how the DANCE (Designing Adaptations for the Next Changes in Education) model facilitates such development through a structured yet adaptable framework. The model emphasizes the need for faculty to not simply respond to changes but to anticipate and prepare for them, enabling a dynamic and forward-thinking educational environment.

**Keywords**—*faculty development, change model, engineer of 2050*

## I. DESCRIPTION AND RELEVANT LITERATURE

This workshop will equip engineering educators with the tools and strategies necessary to adapt their practices to the rapidly evolving landscape of technology and engineering. This workshop will focus on the DANCE (Designing Adaptations for the Next Changes in Education) model (see Figure 1), a framework developed to help faculty navigate and lead changes in engineering education among the rising frequency of disruptions realizing a complex, non-linear system for change is needed.

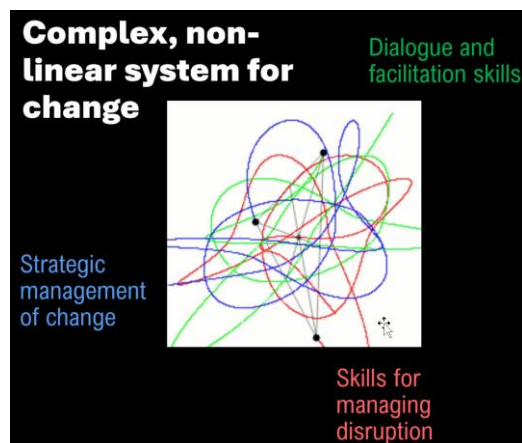


Fig. 1. Groups in DANCE model to focus on adaptations.

The Engineer of 2050 requires a comprehensive education that includes not only advanced technical skills but also global competence, a growth mindset, and a commitment to lifelong learning. This workshop will examine how the DANCE model supports this development with a flexible yet structured framework. The model emphasizes the importance of faculty not simply responding to changes but also anticipating and preparing for them, fostering a dynamic and forward-thinking educational environment.

The model for the workshop is based on three main premises:

- 1) *We have been discussing rapidly evolving landscapes in engineering but have not known how to define them, much less manage them effectively.*
- 2) *Change and the acceleration of change through these disruptions coming faster and faster are motivating factors.*
- 3) *Engineers are uniquely positioned to be able to prepare for this evolving landscape.*

Related to the first premise, the National Academy of Engineering report on "The Engineer of 2020" outlines essential attributes meant to ensure the success and relevance of engineers in a rapidly evolving technological landscape [1]. However, these attributes, including strong analytical skills, practical ingenuity, creativity, effective communication, leadership, and a commitment to ethical standards and professionalism, were not able to be easily classified into traditional engineering categories. Twenty years after the report's publication, we still struggle with defining and synthesizing these different abstract attributes into a meaningful process to educate faculty and staff.

For the second premise, technology and associated tools are advancing at an unprecedented pace, presenting new disruptive challenges. The implications for research, practice, and society are vast [2]. This can be seen with the advancements in technology with the introduction of the World Wide Web in 1989 and it taking until 1996 for 77% of online users to be sending and receiving an e-mail at least once every few weeks. In comparison, ChatGPT had reached 100 million users only two months after its release.

Lastly, in exploring solutions for these disruptions, the authors identified a significant gap in how faculty manage these changes. While organizational development models have existed since the early 1900s and evolved significantly through the mid-20th century with contributions from Lewin, Mayo, and others, contemporary models focus more on agility and continuous learning, emphasizing psychological and social processes. [3-6]. The authors noted the absence of a model specifically tailored for engineering, which could serve as a dynamic system to address organizational disruptions. Their innovative approach assembles existing elements into a novel, systemic framework that addresses the unique complexities of the engineering domain.

As the authors of this work firmly exist in the space of engineering and were trained predominately in engineering, the engineering design process helps frame how challenges brought on by disruption and innovation broadly are examined, along with their impact on engineering education in this faculty development model. The iterative design process with complex emergence allows thinking in a complex three-body world, where a system exhibits properties or behaviors that its individual parts do not possess on their own. The design process assists with choosing potential solution paths through this iterative process, allowing adaptability and complexity.

To achieve the desired changes, we must implement a wide range or fleet of initiatives, not just a single type. This comprehensive approach will involve actions at various levels, including Federal and State levels for higher education, professional and employer levels, accreditation levels, institutional and program levels, and individual levels. Some of these initiatives will require the involvement of large groups and may take years to implement, while others can be piloted by small teams and achieved relatively quickly. Many of these efforts are already underway; we just need to better coordinate them to achieve our goals.

In this workshop, participants will gain deep insights into the DANCE model, which integrates change management theories and practices within the context of engineering education. This will enable participants to understand and manage the dual strands of change — organizational and individual — and see how these elements interact within educational settings to create a cohesive strategy for adaptation and innovation.

The workshop content will cover the following areas:

- Application of Change Management Strategies: Participants will learn to apply change management strategies tailored to the unique needs of engineering faculties. This includes both planned strategies, which involve deliberate, systematic approaches to implementing change, and emergent strategies, which focus on adapting to potentially unforeseen challenges and opportunities. The workshop will provide tools and frameworks for diagnosing organizational readiness, planning change initiatives, and navigating resistance to change.
- Application of the DANCE Model to Disruptions: The workshop will address how the DANCE model can be effectively applied to manage disruptions within the educational environment. This includes practical examples

such as the incorporation of AI tools, including ChatGPT, into the curriculum and administrative processes. Participants will explore how these technologies can be leveraged to enhance learning, streamline operations, and prepare students for a technologically advanced future.

- Fostering a Dynamic and Adaptive Learning Environment: Methods for creating a dynamic and adaptive learning environment will be a key focus. Participants will learn techniques for anticipating and responding to future technological and educational trends, ensuring that their practices remain relevant and forward-thinking.

By the end of the workshop, participants will have a thorough understanding of the DANCE model and its practical applications. They will be equipped with the knowledge and skills to implement change management strategies effectively, integrate emerging technologies into their teaching practices, and cultivate a proactive, resilient educational environment that can thrive amidst ongoing change and disruption.

## II. GOALS

The goals of the workshop are to:

- Equip participants with effective strategies to adapt and innovate in engineering education amid the increasing frequency of disruptions. This includes providing tools and techniques that enable educators to stay agile and responsive to changes in technology, industry demands, and educational environments.
- Encourage a proactive approach to continuous faculty development in anticipation of future educational needs. This involves fostering a culture of lifelong learning and professional growth among faculty members. The workshop will highlight the importance of staying ahead of educational trends, engaging in ongoing professional development activities, and cultivating a mindset to anticipate future shifts in the educational landscape.

These goals align with FIE's commitment to advancing engineering and computing education through innovative pedagogies, research, and collaborative exchanges across educational domains. FIE aims to create a dynamic community of educators dedicated to pushing the boundaries of traditional education and embracing new methodologies. By focusing on adaptation, innovation, and proactive development, the workshop seeks to empower educators to contribute meaningfully to the evolution of engineering and computing education, ensuring that it remains relevant and impactful in a rapidly changing world.

## III. AGENDA AND WHAT TO EXPECT DURING THE WORKSHOP

The workshop will be highly interactive, incorporating a mix of discussions, case studies, and hands-on activities to ensure an engaging and practical learning experience. The schedule is as follows:

- Introduction to the DANCE Model (30 minutes): This session will provide an overview of the DANCE framework, detailing its components and explaining its significance in the context of engineering education. Participants will learn about the model's theoretical

foundations, its application in educational settings, and how it addresses the challenges faced by engineering educators.

- Case Studies and Group Discussion (60 minutes): In this segment, participants will delve into real-world scenarios where the DANCE model has been applied or could be applied. Through detailed case studies, they will explore the practical implementation of the model, identify key success factors, and discuss potential obstacles. Group discussions will facilitate the exchange of diverse perspectives in various contexts.
- Interactive Session (60 minutes): This hands-on segment will enable participants to actively engage with the DANCE model. Through a series of practical exercises and activities, they will learn how to integrate the model into their practices. The interactive session is designed to be collaborative, encouraging participants to work together and share ideas.
- Q&A and Wrap-up (30 minutes): The final portion of the workshop will be an open discussion period where participants can ask specific questions about the DANCE model and its application. This Q&A session will provide an opportunity to address any uncertainties, clarify concepts, and receive personalized feedback. The workshop will conclude with a summary of the key takeaways, reinforcing the main learning outcomes and ensuring that participants leave with a clear understanding of how to apply the DANCE model in their educational settings.

Overall, the workshop aims to provide a comprehensive and immersive experience that not only introduces the DANCE model but also equips participants with the practical skills and knowledge needed to effectively implement it in their practices.

#### IV. EXPECTED OUTCOMES

This workshop is essential for faculty developers, engineering educators, and educational leaders who are dedicated to shaping the future of engineering education. By participating in this workshop, attendees will gain a comprehensive understanding of how to leverage the DANCE model to address the evolving demands of the engineering profession and prepare students to become capable, well-rounded professionals ready to tackle the challenges of 2050 and beyond. Designed for up to 30 participants, the workshop ensures an engaging and interactive learning environment, promoting in-depth discussions and personalized feedback.

During the workshop, participants will acquire:

- A Deep Understanding of the DANCE Model: Attendees will gain a thorough understanding of the DANCE model and its application to engineering education. They will learn about the model's theoretical foundations, practical implementations, and how it can be used to enhance the educational system.
- Strategies for Managing and Integrating Changes: Participants will be equipped with effective strategies to manage and integrate both technological and pedagogical changes within their courses, curricula, and programs.

- Enhanced Skills in Developing Forward-Thinking Educational Practices: Participants will enhance their skills in developing adaptable and forward-thinking educational practices. They will learn how to create learning environments that are dynamic and responsive to future trends, ensuring that students are well-prepared to meet the challenges of the future.
- Tools for Handling Disruptions: Attendees will gain tools and techniques to effectively handle disruptions in various educational settings. Whether dealing with unexpected technological advancements, shifts in educational standards, or other unforeseen challenges, participants will be better equipped to maintain stability and continuity in their practices.

Overall, this workshop provides an opportunity for those committed to advancing engineering education to deepen their knowledge, enhance their skills, and develop practical strategies for preparing students for the future. By participating, faculty developers, educators, and leaders will be better positioned to support a generation of engineers who are ready to innovate and excel in a rapidly changing world.

#### V. ABOUT THE FACILITATORS

Dr. Kristi Shryock and Dr. Karan Watson bring a wealth of expertise and experience to the field of engineering education. With extensive backgrounds in both engineering and teaching engineering courses, they are well-versed in the nuances and demands of engineering education. Their active involvement in engineering education research further highlights their commitment to advancing the field and enhancing the quality of teaching and learning in engineering disciplines.

Combined, Dr. Shryock and Dr. Watson have over 65 cumulative years of experience in the engineering education space. Throughout their careers, they have made significant contributions to the development and implementation of innovative teaching methodologies, curriculum design, and educational technologies. Their research efforts have focused on improving student outcomes, fostering inclusive and engaging learning environments, and preparing the next generation of engineers to meet the challenges of an ever-evolving technological landscape. They have also been instrumental in mentoring and supporting faculty and students alike, sharing their insights and best practices to help others succeed in engineering education.

##### A. Kristi Shryock

Kristi Shryock, Ph.D., is the Frank and Jean Raymond Foundation Inc. Endowed Associate Professor in Multidisciplinary Engineering and Affiliated Faculty in Aerospace Engineering at Texas A&M University. She also serves as the Director of the Craig and Galen Brown Engineering Honors program. Dr. Shryock is a fellow of the American Society for Engineering Education. She is an experienced educator with expertise in student engagement and the development of innovative educational practices. Her research encompasses helping educators understand relationships between and how best to integrate strategies for student success to prepare the engineer of 2050. One area, in

particular, includes the development of teaching processes and skills that assist faculty with taming disruptions to the educational system that are occurring faster and faster (e.g., generative AI on education).

#### *B. Karan Watson*

Karan Watson, Ph.D., P.E., is currently Provost Emeritus and a Regents Senior Professor of Electrical and Computer Engineering, having joined the faculty at Texas A&M University in 1983 as an Assistant Professor. She served as the Co-Director of the Institute for Engineering Education and Innovation and is currently a distinguished fellow of this Institute. She has served in numerous administrative roles at Texas A&M University, including: provost and executive vice president, vice provost, dean of faculties and associate provost, interim VP for diversity, associate dean of Engineering, and program chair for interdisciplinary engineering. Dr. Watson is a fellow of three organizations: Institute of Electrical and Electronic Engineers (IEEE), American Society for Engineering Education, and Accreditation Board for Engineering and Technology (ABET). Her awards and recognitions include the U.S. President's Award for Mentoring Minorities and Women in Science and Technology, the

American Association for the Advancement of Science mentoring award, the IEEE International Undergraduate Teaching Medal, the American Society for Engineering Education Lifetime Achievement Award, and numerous faculty awards at Texas A&M University. She has served as President of the Accreditation Board for Engineering and Technology (ABET) and the President of the Education Society of IEEE.

#### REFERENCES

- [1] "Front Matter." National Academy of Engineering. 2004. *The Engineer of 2020: Visions of engineering in the new century*. Washington, DC: The National Academies Press. doi: 10.17226/10999.
- [2] Kurzweil, R. (2015). Exponential Technology Trends: Implications for Research and Practice. *Journal of Future Studies*, 19(4), 23-36.
- [3] Adelman, C. (1993). Kurt Lewin and the origins of action research. *Educational action research*, 1(1), 7-24.
- [4] Burnes, B. (2007). Kurt Lewin and the Harwood studies: The foundations of OD. *The Journal of Applied Behavioral Science*, 43(2), 213-231.
- [5] Burnes, B., & Cooke, B. (2012). The past, present and future of organization development: Taking the long view. *Human relations*, 65(11), 1395-1429.
- [6] Lewin, K. (1947). Frontiers in group dynamics: Concept, method and reality in social science; social equilibria and social change. *Human relations*, 1(1), 5-41.