Board 196: An 'Inspiration Kit' for Building a Culture that Fosters Engineering Identity

Dr. Yen-Lin Han, Seattle University

Yen-Lin Han is an Associate Professor in the Department of Mechanical Engineering at Seattle University. Dr. Han received her BS degree in Materials Science and Engineering from National Tsing-Hua University in Hsinchu, Taiwan, her Ph.D. degree in Aerospace and Mechanical Engineering and her MS degree in Electrical Engineering from the University of Southern California. Her current research interest focuses on soft robotics in medical devices, for which she recently received the NSF Mid-Career Advancement (MCA) award. She is passionate about Engineering Education and experienced in developing inverted classroom lectures and facilitating students' learning through authentic engineering problems. She was the Co-PI for the NSF Revolutionizing Engineering and Computer Science Departments grant awarded to the Mechanical Engineering department at Seattle University to study how the department culture changes can foster students' engineering identity with the long-term goal of increasing the representation of women and minorities in the field of engineering.

Dr. Kathleen E. Cook, Seattle University

Kathleen Cook, Ph.D. is a Professor in the Psychology Department at Seattle University. Dr. Cook received her doctorate in Social and Personality Psychology from the University of Washington, with a minor in quantitative methods and emphases in cognitive

Dr. Jennifer A Turns, University of Washington

Dr. Jennifer Turns is a full professor in the Human Centered Design & Engineering Department in the College of Engineering at the University of Washington. Engineering education is her primary area of scholarship, and has been throughout her career. In her work, she currently focuses on the role of reflection in engineering student learning and the relationship of research and practice in engineering education. In recent years, she has been the co-director of the Consortium to Promote Reflection in Engineering Education (CPREE, funded by the Helmsley Charitable Trust), a member of the governing board for the International Research in Engineering Education Network, and an Associate Editor for the Journal of Engineering Education. Dr. Turns has published over 175 journal and conference papers on topics related to engineering education.

Dr. Gregory Mason P.E., zyBooks, A Wiley Brand

Gregory S. Mason received the B.S.M.E. degree from Gonzaga University in 1983, the M.S.M.E. degree in manufacturing automation from Georgia Institute of Technology in 1984 and the Ph.D. degree in mechanical engineering, specializing in multi-rate digital

Dr. Teodora Rutar Shuman, Seattle University

Professor Teodora Rutar Shuman is the Chair of the Mechanical Engineering Department at Seattle University. She is the PI on an NSF-RED grant. Her research also includes electro-mechanical systems for the sustainable processing of microalgae. Her work is published in venues including the Journal of Engineering Education, IEEE Transactions on Education, International Journal of Engineering Education, Transactions of ASME, Chemical Engineering Journal, Bioresource Technology, Proceedings of the Combustion Institute, and Combustion and Flame. She is a member of the ASEE, ASME, and the Algae Biomass Organization. Dr. Shuman served as Chair for the ASEE Energy Conversion and Conservation Division.

She received a Dipl. Ing. degree in mechanical engineering from Belgrade University and an M.S.M.E. and a Ph.D. from the University of Washington. She has held the title of Paccar Professor and is an Affiliate Professor at the University of Washington.

An "Inspiration Kit" for Building a Culture that Fosters Engineering Identity

Introduction

The Mechanical Engineering Department at Seattle University was awarded the National Science Foundation (NSF) Revolutionizing Engineering and Computer Science Departments (RED) grant in July 2017 to support the development of a culture that fosters students' engineering identities. This culture of "engineering with engineers" was built through a strong connection to industry and through changes in the four essential areas of *a shared department vision, faculty, curriculum, and supportive policies*.

During the last year of this project, we conducted an audit of our activities taken during the six-year project to identify which were most impactful for the culture building in the department and were relatively easy to implement and adopt by other departments. We shared our audit process and results at the 2023 ASEE conference [1]. This audit process helped us identify ten significant endeavors, each of which included multiple activities. These ten endeavors include *creating a mission statement to drive culture change, fostering the new culture in retreats, improving diversity, equity and inclusion (DEI) in the program, hiring staff to support DEI, teaming to build trust, including students in curriculum design, positioning seniors as professionals, developing innovative teaching, and changing the annual performance review (APR)*.

To investigate how to share these endeavors effectively, we invited engineering educators, the potential adopters of our endeavors, to three successive virtual co-design workshops. Each workshop was attended by over 40 participants, representing nearly 70 different educators. During each of these workshops, the participants served as co-designers and engaged with the endeavors through listening, viewing, free-writing, and discussion. The idea of an "inspiration kit" emerged. Based on the co-designers' collective feedback, a dedicated website, SURED.org, was built to share these endeavors.

In this paper, we summarize the ten endeavors in our "inspiration kit" and present key activities and artifacts crucial to each. We share the process of how we co-designed and constructed SURED.org. We hope that sharing our experience and inspiration kit provides transferrable knowledge that other departments may use to improve their programs and change their cultures.

Project Background

The theoretical background guides us throughout the project and remains unchanged; hence, this section combines content from our previous ASEE papers [1] - [6] to summarize our project background.

Identity influences who people think they are, what they think they can do and be, and where and with whom they think they belong [7] - [10]. People's identity shapes the experiences they embrace, and reciprocally, those experiences shape their identities [11] - [13]. People behave consistently with their identities [14], [15], choosing behaviors with meanings that match their

self-conceptions [16], [17]. When people identify with an esteemed group, they feel better about themselves and, in turn, feel better about the group [18], [19]. If people strongly identify with a group, they steadfastly defend the group, stay in it, and support it [20].

In education, identity influences whether people feel they belong in a program and what they believe they can achieve. It has been shown to influence what goals are pursued and the level and type of effort put toward those goals [15]. Research also shows that identity and fit are important factors affecting persistence in STEM fields [11]. When people perceive a fit between themselves and their fields, they persist longer in those fields [21] - [23]. Hence, identity is a determining factor in one pursuing, persisting, and persevering in engineering [14], [24].

The development of identity is a social process. People's thoughts and behaviors are shaped through relationships and reflected appraisals with others [8], [20], [25]. Identities are further derived through associations, affiliations, and identifications with groups [21], [24]. Tonso [27] observes that identity development is an enculturated process where identities are acquired through "community-based interactions," and Beam et al. [24] concur that social contexts affect identity. In engineering education, situated learning is central to identity development [27]. Therefore, this social process of identity development can be realized through the culture of an engineering program. Cultivating a culture of doing engineering can result in graduates who not only are prepared technically and professionally with a practical, realistic understanding of what it is to be an engineer but also who identify with and are committed to the engineering profession.

Culture is shaped, in part, by the identities of those in the culture. It is negotiated, co-created, and reinforced through communication and social interactions [28]. It develops organically from the behaviors of a group through association and shared experiences [29]. The culture of a program plays a significant role in effective, innovative STEM education [30], [31]. It is also important to know that the priorities of the institution and department influence culture in an educational setting.

Our RED project aimed to develop a mechanical engineering program where students and faculty are immersed in a culture of doing engineering with practicing engineers that, in turn, fosters students' engineering identities. This culture of "Engineering with Engineers" is built through interactions of students, faculty, and industry, participation in engineering-related activities, and reinforcement of shared experiences in our program.

Summary of Project Audit

During the six years of the project, we took numerous actions to build this culture of "Engineering with Engineers". Following the best practices recommended by Henderson et al. [32], which came from an extensive review of articles on facilitating change in STEM education, these actions can be characterized in four areas: *shared vision, reflective faculty, relevant curriculum and pedagogy, and supportive policies*. In our previous ASEE papers [2]-[6], we chronicled actions we took in these four areas of change. Last year, an audit was conducted to review all of our activities. In Ref. [1], we shared the audit process and the ten most impactful

endeavors (groups of items or actions) that resulted from the audit. In this section, we briefly review the auditing process and these ten endeavors.

The goal of the audit was to identify activities we thought were the most critical to the changes we have seen in our program, and that might be valuable for others seeking to change the culture in their academic unit. The audit began by summarizing all the activities, as shown in Ref. [1]. All five RED PIs reviewed and agreed on the list of activities. Each of the five RED PIs then individually rated these activities, *based on the accumulative efforts in the five years of the project,* using H (high), M (medium), or L (low) to respond to the following three questions:

- *How critical (impactful) was the activity for the culture change to happen in the Department?*
- *How easy was the activity to materialize or use?*
- *How likely would other departments adopt the activity? (Consider limitations on finance, dept size, etc.)*

After collecting responses from all PIs, results were assembled and shared with all PIs. In subsequent PI meetings, results for each item were discussed. Through discussion of how impactful an activity was for the culture change we observed in the department, ten endeavors (groups of activities) were identified. In alphabetical order, these ten endeavors are summarized below.

1. *Annual Performance Review (APR)*: Faculty and staff should be recognized and celebrated for the efforts they put into creating a more inclusive department, changing the curriculum to develop a culture of "Engineering with Engineers," contributing to the creation of the shared vision, improving pedagogy, and many other actions that led to the sweeping culture change. Faculty generally appreciated such recognition of their work, which otherwise would be ignored. APR could be used as a motivator towards initiating and sustaining culture change [4]-[6].

2. *Curriculum*: To prepare students for engineering practice, the main objectives of the new curriculum were to get students more comfortable with uncertainty and help students identify themselves as engineers. Students were included in the new curriculum design when the faculty was stuck. With students' feedback, the resulting curriculum incorporated a new vertical design experience course (Integrated Design Projects, IDP) and a new integrated EE (Electrical Engineering) and DAQ (Data Acquisition) course sequence [3, 4, 33, 34, 35].

3. *Diversity, Equity, and Inclusion (DEI)*: Helping women and underrepresented minorities feel identified and one with the program was at the heart of our RED project. The initial report from the project's external evaluator revealed that some female students (anonymized) felt excluded and diminished, occasionally by faculty and staff and sometimes by classmates. Therefore, the program undertook several actions to address DEI in the four areas of change [2]-[6].

4. *Engineers in Training (EIT)*: The senior capstone sequence, connecting seniors and the industry, was pivoted away from academic language and schedules to language and schedules more indicative of engineering practice, with the goal of better preparing graduates for their engineering careers. Results from the *Senior Growth Survey* indicate significant development in senior's growth as professionals [4, 5].

5. *Industry Connection*: The program used various means to connect with the industry, including hiring a resident industry advisor, strengthening faculty's connection with the industry through summer immersion experiences, and infusing industry practices in IDP and senior design courses [2]-[5].

6. *Innovative Teaching*: The department promoted and encouraged innovative teaching. Teaching innovation was driven by the COVID-19 pandemic, by feedback from constituents, and by funds from the RED grant. Innovations included the adoption of flipped classrooms, industry projects in classes, recognition of the importance of DEI in an engineering curriculum, and lessons learned from remote teaching during the pandemic [4, 5, 6, 36].

7. *Mission Statement*: At the beginning of the RED project, we needed to establish a shared understanding of the department's goals. We crafted a process inspired by co-design to revise the current mission statement. In addition to producing a collaboratively created revised mission statement, the process also resulted in a shared memory of how the mission statement had come about, renewed commitment to the mission statement, an experience of having worked together, and trust that the group can succeed when it works together. Co-designing the mission statement early in the RED project set the stage for other successful endeavors. [3].

8. *Retreats*: Departmental retreats are customary across Seattle University and a tradition in the ME Department. These retreats, which typically occur in the fall before the start of each academic year, are important in connecting faculty and staff and allowing departments to make plans. As part of the RED grant, the department changed how they prepared for and conducted retreats [1]. Instead of focusing on administrative details, the RED PI team spent time establishing retreat goals and activities that involved all faculty and staff. These retreats moved the department's culture change forward and brought faculty and staff together.

9. *Staff*: Staff play an important role in student experience. This fact was supported by both the ME Student Advisory Council and by student interviews conducted by our external evaluator. Armed with a new appreciation for student-staff interactions, the department assigned new expectations during the hiring process and placed a greater emphasis on the lab manager and senior administrative assistant staff positions during conversations regarding curriculum change, retention of students, and other matters [1].

10. *Teaming*: As our RED project transitioned into its fifth and final year, we recognized that the dynamic discussion that had come with the creation of the RED initiatives might fade away. Hence, "teaming" was created as a way to continue discussions. *Teaming*, as

defined by us, is a form of group discussion that requires no preparation for the participants, starts with a simple prompt that can be answered by everyone present, and helps the group build trust through dialogues [6, 37, 38].

These ten endeavors offer a glimpse of the efforts put into our RED project and highlight key outcomes that led to our culture change. Many actions were not limited to our unique setting (i.e., a small, teaching-focused mechanical engineering program) and could be adopted in different settings. We also realized that sharing these actions (or results) alone would not tell the whole story and that sharing the nuances of our experiences would be more meaningful to others seeking change. Thus, we wanted to disseminate our work beyond traditional academic publications to tell our stories better.

Co-Design Workshops

Inspired by the work of Arif and his colleagues [39], we pursued the concept of building a "toolkit" that would address our dissemination goal while also respecting the agency of those for whom this toolkit is intended [40]. A toolkit, as defined in the dictionary, is "a collection of expert skills, knowledge, procedures, or information for a particular topic or activity" [41]. Although the description of a toolkit is clear, there is limited academic literature on how to build one. While we had established the basic items that would form the toolkit, we had not established how each item would be shared, the appropriate level of detail, or the amount of context needed for each item. Through exploring how to build this toolkit, we found that the toolkit designers often co-construct their toolkit with the intended users through methods like co-design [40], a collaborative design approach that involves multiple stakeholders, such as end-users, working together to develop a solution [42].

A co-designed toolkit involves the eventual users of the toolkit in the design and development of the toolkit. We aimed to solidify the toolkit's content through three co-design workshops. Rather than engaging in speculative co-design (an inspiring use of co-design in which participants speculate on possible and desirable futures), our co-design workshops were instrumental [43]. We wanted these workshops to help us understand our toolkit users' needs and to help us design the items' presentation in the way most beneficial for our users. The goal was to solidify the contents of a toolkit at the end of these co-design workshops.

We conducted three co-design sessions via Zoom. Around 40 educators attended each session, with significant overlap between sessions. Details on the design and observations of the co-design workshops can be found in Ref. [40], and below is a brief summary of these workshops.

In the first session, we shared our overall story and focused attendees' attention on four of our endeavors, one each of Henderson et al.'s areas of change [32] that we had selected for inclusion in the toolkit. We invited attendees to think individually about one of these endeavors and then work with a few others in a breakout room to create a scenario featuring someone coming to the toolkit to learn more about the endeavor. These scenarios gave us insight into who might use the toolkit and what should be in the toolkit. Lessons learned from the first co-design session made us realize that participants needed rich context and sufficient background on each item presented in order to contribute to the co-design work. In the second co-design session, we shared those

observations, presented a low-fidelity prototype of the toolkit, and invited reactions to the content of two additional endeavors. Through the reactions and comments from participants, we realized that participants' hope for 'silver bullet' solutions meant that our toolkit needed to manage expectations. During the third and final co-design session, in addition to sharing the content of the final four endeavors, we asked the participants to respond to the questions, "How can these stories make you think about things to do differently? Do they inspire such thinking?" Based on responses and reactions from participants, the eventual audience of our dissemination, a significant framing change occurred: we turned to describing our kit as an *inspiration kit* rather than a toolkit.

The "Inspiration" Kit

The final stage of this dissemination effort was to bring the inspiration kit to life. First, we iterated on the content based on detailed analyses of what was learned in the co-design workshops. We then considered resources and ease of access to choose a development platform; *durable.co* was selected to host our inspiration kit for these reasons. The first author then assumed the responsibility of visual design to match the content appropriately in presenting the kit. The kit was populated with related artifacts and links for each item with the intention of sharing more details of our experiences and providing users with additional resources. We integrated the story of the grant into the kit to provide context, as well as the story of building the kit.

The Seattle U (SU)-RED inspiration kit is implemented as an independent website, which can be accessed at https://SURED.org/. The core content of the kit is a set of 10 key stories from our practice (*Our Endeavors*), background on the overall project in which these endeavors were situated (*Our Project*), and information on the process we used to create the final inspiration kit, including details of the co-design workshops (*Our Journey*).

Conclusion

Our RED project aimed to build a culture that fosters engineering identity. To build this culture, we took action in the four essential areas of shared vision, reflective faculty, relevant curriculum and pedagogy, and supportive policies over the five years of our project. In the project's final year, we conducted an audit to identify the most impactful actions we took that contributed to the culture change we observed in our program. We summarized those actions into ten endeavors for dissemination.

To disseminate these endeavors, we collaborated with our target audience through the co-design workshop to determine their interests, questions, and paths for adaptation of our experiences for culture change, and to identify content that would be meaningful to them. Through feedback collected from the co-design workshop participants, we built an inspiration kit with the core content of 10 key stories that we called Endeavors. These endeavors highlight how the story starts, show solutions, and include links to reference information and artifacts (documents, processes, measures, images, etc.). We hope that through the stories we shared and tools we have developed this kit will inspire those who embark on the journey of culture change.

Acknowledgment

This project was funded by the Division of Undergraduate Education (DUE) IUSE/PFE: RED grant #1730354 through NSF. The authors also thank the participants of our co-design workshops for their valuable comments and suggestions on building our inspiration kit.

References

[1] Han, Y.-L., Turns, J., Cook, K., Mason, G., & Shuman, T.R., "Building a culture of "Engineering with Engineers". *Proceedings of American Society for Engineering Education Annual Conference*, Baltimore, MD: ASEE 2023.

[2] Y.-L. Han, K. E. Cook, T. R. Shuman, G. Mason, and J. Turns, "Engineering with Engineers: Revolutionizing Engineering Education through Industry Immersion and a Focus on Identity," *Proceedings of American Society for Engineering Education Annual Conferenc*e, Salt Lake City, UT: ASEE 2018.

[3] Y.-L. Han, K. E. Cook, G. Mason, T. R. Shuman, and J. Turns, "Engineering with Engineers: Revolutionizing a Mechanical Engineering Department through Industry Immersion and a Focus on Identity," *Proceedings of American Society for Engineering Education Annual Conference,* Tampa, FL: ASEE 2019.

[4] Y.-L. Han, K. Cook, G. Mason, T. R. Shuman, and J. Turns, "Engineering with Engineers: Fostering Engineering Identity through Industry Immersion," *2020 ASEE Annual Conference and Exposition*, Montreal, Québec, Canada: ASEE 2020.

[5] Y.-L. Han, K. Cook, G. Mason, T. R. Shuman, and J. Turns, "Engineering with Engineers: Fostering Engineering Identity," *2021 ASEE Annual Conference and Exposition*, Virtual: ASEE 2021.

[6] Han, Y.-L., Cook, K., Mason, G., Shuman, T.R., and Turns, J., 'Cultivating a Culture to Foster Engineering Identity," *2022 ASEE Annual Conference and Exposition*, Minneapolis, MN: ASEE 2022.

[7] K. Deaux, "Reconstructing social identity," *Personality and Social Psychology Bulletin,* vol. 19, pp. 4-12, 1993.

[8] S. Stryker, and P. J. Burke, "The past, present, and future of an identity theory," *Social Psychological Quarterly*, vol. 63(4), pp. 284-297, 2000.

[9] E. H. Erikson, *Identity and the life cycle*. New York: International Universities Press, 1959.

[10] M. B. Brewer, "The social self: On being the same and different at the same time," *Personality and Social Psychology Bulletin*, vol. 17, pp. 475-482, 1991.

[11] J. E. Dutton, J. M. Dukerich, and C. V. Harquail, "Organizational Images and Member Identification," *Administrative Science Quarterly*, vol. 39(2), pp. 239-263, 1994.

[12] G. H. Mead, *Mind, Self, and Society*. Chicago: University of Chicago Press, 1934.

[13] S. Stryker, *Symbolic Interactionism: A Social Structural Version*. Menlo Park, CA: Benjamin/Cummings, 1980.

[14] J. D. Lee, "More Than Ability: Gender and Personal Relationships Influence Science and Technology Involvement," *Sociology of Education*, vol. 75(4), pp. 349-37, 2002.

[15] B. R. Schlenker, "Identity and self-identification.," in *The Self in Social Life*, B. Schlenker, Ed. New York: McGraw-Hill, 1985.

[16] J. D. Lee, "Which Kids Can "Become" Scientists? Effects of Gender, Self-Concepts, and Perceptions of Scientists," *Social Psychology Quarterly*, vol. 61(3), pp. 199-219, 1998.

[17] O. Pierrakos, T. K. Beam, J. Constantz, A. Johri, and R. Anderson, "On the development of a professional identity: Engineering persisters vs. engineering switchers," *Proceedings of Annual Frontiers in Education Conference*, San Antonio, TX: FIE, 2009.

[18] R. B. Cialdini, R. J. Borden, A. Thorne, M. R. Walker, S. Freeman, and L. R. Sloan, "Basking in reflected glory: Three (football) field studies," *Journal of Personality and Social Psychology,* vol. 34, pp. 366-375, 1976.

[19] H. Tajfel, and J. C. Turner, "The social identity theory of inter-group behavior," in *Psychology of Intergroup Relations*, S. Worchel, & W. G. Austin, Eds. Chicago, IL: Nelson-Hall, 1986, pp. 33-48.

[20] R. Spears, B. Doosje, and N. Ellemers, "Self-stereotyping in the face of threats to group status and distinctiveness: The role of group identification," *Personality and Social Psychology Bulletin,* vol. 23, pp. 538–553, 1997.

[21] S. E. Cross and N. V. Vick, "The Interdependent Self-Construal and Social Support: The Case of Persistence," *Personality and Social Psychology Bulletin*, vol. 27(7), pp.820-832, 2001.

[22] A.L. Kristof, "Person-Organization Fit: An Integrative Review of its Conceptualizations, Measurement, and Implications," *Personnel Psychology*, vol. 49(1), pp.1-49, 1996.

[23] O. Pierrakos, N. A. Curtis, R. D. Anderson, "How salient is the identity of engineering students? On the use of the Engineering Student Identity Survey," *Proceedings of Frontiers in Education Conference*, Erie, PA: FIE, 2016.

[24] T. K. Beam, O. Pierrakos, J. Constanz, A. Johri, and R. Anderson, "Preliminary findings on freshmen engineering students' professional identity: Implications for recruitment and retention," *Proceedings of American Society for Engineering Education Annual Conference*. Washington, DC: ASEE, 2009.

[25] C. H. Cooley, *Human nature and the social order*. New York, NY: Scribners, 1902.

[26] K. E. Scheibe, "Historical perspectives on the presented self," in *The Self in Social Life*, B. Schlenker, Ed. New York: McGraw-Hill, 1985.

[27] K. Tonso, "Enacting practices: Engineer identities in engineering education," in *Engineering Professionalism: Engineering Practices in Work and Education*, U. Jørgensen and S. Brodersen Eds. Rotterdam, The Netherlands: Sense Publishers, 2016, pp. 85-104.

[28] J. N. Martin and T. K. Nakayama, *Intercultural Communication in Contexts*, New York: McGraw-Hill, 2010.

[29] J. Lave and E. Wenger, *Situated learning: Legitimate peripheral participation*, Cambridge

UK: Cambridge University Press, 1991.

[30] C. Henderson and M. H. Dancy, "Increasing the Impact and Diffusion of STEM Education Innovations", *Increasing the impact and diffusion of STEM education innovations,* Washington, DC: National Academy of Engineering, 2011. [Online]. Available: https://www.nae.edu/File.aspx?id=36304. [Accessed: 15- Nov- 2016].

[31] M. Besterfield-Sacre, M. F. Cox, M. Borrego, K. Beddoes and J. Zhu, "Changing Engineering Education: Views of U.S. Faculty, Chairs, and Deans," *Journal of Engineering Education*, vol. 103(2), pp. 193–219, 2014.

[32] C. Henderson, A. Beach, and N. Finkelstein, "Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature," *Journal of Research in Science Teaching,* vol. 48(8), pp. 952-984, 2011.

[33] Hammel, J., Strebinger, C., Gilbertson, Han, Y.-L., Mason, G., Cook, K., and Shuman, T.R., "WIP: Building Design Experience and a Greater Sense of Community through an Integrated Design Project.," 2021 Frontier in Education (FIE) Conference, Lincoln, Nebraska: IEEE, 2021.

[34] Y.-L. Han, G. Mason, K. Cook, K., T. R. Shuman, and J. Turns, "WIP: Integrating Electrical Engineering Fundamentals with Instrumentation and Data Acquisition in an Undergraduate Mechanical Engineering Curriculum," 2020 Frontier in Education (FIE) Conference, Uppsala, Sweden: IEEE, 2020.

[35] Y.-L. Han, K. Cook, J. Turns, G. Mason, and T. R. Shuman, "Students' Experience of an Integrated Electrical Engineering and Data Acquisition Course in an Undergraduate Mechanical Engineering Curriculum" IEEE Transactions on Education, Vol. 65, Issue 3, August 2022, Pages 331-343, 10.1109/TE.2022.3178666.

[36] Y.-L. Han, J. Hammel, C. Strebinger, E. Gilbertson, G. Mason, K. Cook, K., T. R. Shuman, and J. Turns, "Making the "New Reality" More Real: Adjusting a Hands-On Curriculum for Remote Learning", *2021 ASEE Annual Conference and Exposition*, Long Beach, California: ASEE 2021.

[37] J. Turns, Y.-L Han, K. E. Cook, T.R. Shuman & G. Mason, "Work in progress: Creating effective prompts for "Teaming" sessions. 2023 ASEE Annual Conference and Exposition, June 25-28, 2023, Baltimore, MD: ASEE. 2023. https://peer.asee.org/44197.

[38] J. Turns, Y.-L Han, K. E. Cook, T.R. Shuman & G. Mason, Work in progress: Designing a sustainable mechanism for discursively navigating change. 2022 ASEE Annual Conference and Exposition, Minneapolis, MN: ASEE. 2022. https://peer.asee.org/41516.

[39] T. Wilner, A. Kumar, S. Mandava, A. Bhimdiwala, H. Frluckaj, and A. Arif. "The work of making toolkits work: Perspectives and considerations from toolkit designers," Paper submitted to the Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems, Honolulu, Hawai'i: CHI 2024.

[40] J. Turns, K. E. Cook, T.R. Shuman, Y.-L Han & G. Mason, "Designing a Toolkit for Dissemination", 2023 Frontier in Education (FIE) Conference, Oct. 18-21, College Station, Texas: IEEE. 2023. DOI: 10.1109/FIE58773.2023.10342984.

[41] Dictionary.com. “Toolkit.” https://www.dictionary.com/ (accessed January 12, 2024).

[42] L. Sanders, and P. J. Strappers, “From designing to co-designing to collective dreaming: Three slices in time,” Interactions, vol. 21, no. 6, pp. 24-33, Nov. 2014. doi: 10.1145/2670616.

[43] L. K. Johannessen, “The young designer’s guide to speculative and critical design,” Accessed January 12, 2024. Available: https://www.ntnu.edu/documents/139799/1279149990/16+TPD4505.leon.johannessen.pdf/1c9221a2-2f1b-42fe-ba1f-24bb681be0cd.