

## **Building a Great Student Chapter: Reflections on Workshop Activities Using Entrepreneurial Mindset**

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## **Abstract**

Growing as a student, professor, or engineer commonly involves being part of larger organizations. Many professional engineering organizations, e.g., IEEE, ASME, AIChE, ASCE, NSBE, SHPE, etc., offer opportunities to engage and lead during undergraduate study as well as throughout a person's career. In this contribution, I summarize and examine several iterations of a goal-setting and leadership-development workshop focused on student chapters. The overarching objective of the workshop is to lead participants through exercises to help build great student chapters. Specifically, AIChE students at a regional conference, STEM students and advisors on the author's home campus, and student chapter advisors at the AIChE Annual Conference participated in different activities centered upon the entrepreneurial mindset framework. This entrepreneurial mindset framework is summarized by the 3C's, namely Curiosity, Connections, and Creating value. By applying an entrepreneurial mindset, participants identify characteristics desired in their student chapter, officers, and members. Additional workshop prompts explore actions of student members and leaders and help participants develop an action plan for the coming semester and year. The logistics and delivery of the workshop are detailed in this contribution. In addition, surveying participants at both the beginning and end of the workshops found high engagement, i.e., significant evidence of brainstorming and goal setting.

## **Introduction and background**

Engineers are known as problem solvers, who commonly work in teams. Teamwork involves management and leadership skills that may not be emphasized in the engineering undergraduate curriculum. Student organizations are one avenue for undergraduates to develop professional skills while earning their engineering degree. For example, professional engineering organizations commonly have student chapters on campuses with activities and competitions tailored to this audience. Specifically relevant to this contribution, AIChE is the professional home for chemical engineers with over 400 student chapters across the world, as well as local sections and many divisions, forums, and committees. While discipline-specific examples will be provided throughout this paper, transferrable skills and learnings will be emphasized and apply more generally.

Instituting change is a well-studied topic ranging from academia to industry [1-3]. One facet of change management is goal setting [4-6]. Specifically, the development of short and long-term objectives that align with an organization's mission and values provides a mechanism for productivity and growth. From daily tasks and weekly outputs to quarterly targets and multi-year initiatives, goal setting can help engineers and engineering students solve problems big and small.

Balancing work and life responsibilities is paramount for both students and faculty alike. By setting, working toward, and achieving both personal and professional goals can order both work and life. For engineering faculty, goals related to research usually take precedence with some goals related to teaching and few related to service activities. Thus, participating in professional engineering organizations is normally considered service, a small part of the faculty workload, and less likely to have documented ambitions [7]. For engineering students, finding community, participating in competitions, and traveling are some of the reasons that students participate in these extracurricular groups, which should complement curricular activities and not derail progress toward the goal of earning their degree. Overall, professional organizations, such as AIChE, operate as non-profit entities that leverage large numbers of volunteers to support the larger membership and community. Therefore, engagement and activity in professional organizations leverage members' time to build communities and a stronger engineering profession, and hopefully, include some aspirational goals.

While developing skills outside of the technical area has traditionally been called soft skills in engineering education [8-10], more recently, the term "professional skills" captures traits, such as oral and written communication, teamwork, and empathy. One framework that captures both engineering and professional skills is the entrepreneurial mindset [11-13]. By framing activities and actions using entrepreneurial mindset's three pillars of Curiosity, Connections, and Creating value (commonly called the 3 C's), innovative strategies have been brought to engineering education (Figure 1); hundreds of examples are available on the Engineering Unleashed platform [14]. Specifically related to chemical engineering, a recent article captured seven disparate but connected perspectives applying an entrepreneurial mindset [11].

### Putting the work in workshop

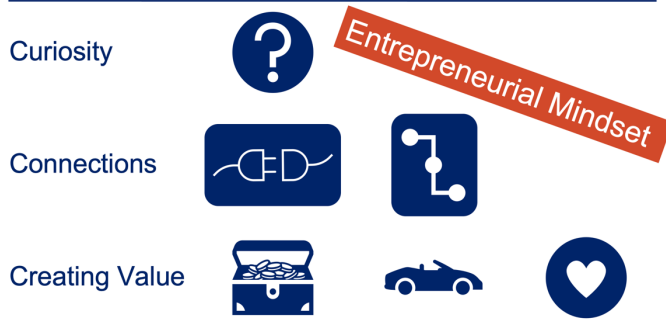


Figure 1. One slide used to introduce entrepreneurial mindset during the workshops.

Based on the literature and identified needs, the themes of leadership, professional organizations, and goal setting were brought together as a workshop for student chapter members and advisors. Thus, this contributions summarizes the logistics, content, and evaluation of four recent workshop offerings. The objective is to provide some best practices that can help other students and faculty become better leaders and create more active student chapters.

### Materials and methods

A goal-setting workshop offering multiple perspectives and providing personalized feedback will likely engage the largest fraction of participants. Analogously, this workshop is an active

learning environment with two or more facilitators [15-17]. While some slides are presented, a significant amount of the workshop time is left for activities, idea generation, and finally, goal setting. The author of this contribution served as a facilitator for four previous offerings, and some perspectives are captured later in the article.

Promotion of the workshop was done by targeted email to student chapter officers and advisors for on-campus versions. In addition, the workshop being part of the conference program was sufficient for the AIChE conference settings. In addition, the on-campus workshops provided lunch as another incentive to attend.

The delivery of the workshops involved a combination of presented slides and a worksheet with prompts for each participant to fill out during the workshop. Example slides and worksheets are shared on the Engineering Unleashed platform and are available for adaption and reuse [18].

Both pre- and/or post-workshop surveys were delivered and will be discussed in the results below. Providing a QR code on the presentation slides as well as the worksheet led to high participation rates. Select surveys questions are tabulated here and vary between information about the participants to their familiarity with entrepreneurial mindset. The surveys included various question types, such as multiple choice, multiple answer, typed response, and file upload. The surveys were created in the forms applications available from either Microsoft or Google. Example surveys are also available for reuse [18].

## **Results**

Four recent workshops will be detailed here. A brief history on how the workshop was created begins this section, similarities and differences between the offerings are presented next, and finally initial perspectives complete this contribution.

Communities of practice, usually virtual groups across time zones and locations in recent years, are groups that support change and/or the adoption of best practices in engineering education for many years [19-23], including a significant set of groups in chemical engineering in 2020 and 2021 [24]. The Engineering Unleashed (EU) Ambassador program operates similarly to a community of practice. The Ambassadors create connections between a professional society and both Kern Entrepreneurial Engineering Network (KEEN) and EU. The author of this contribution is the Ambassador to AIChE. The EU Ambassadors group started in 2021 and meets about 3 times per year in person (e.g., as part of KEEN National Conference and ASEE) as well as some small group and individual virtual discussions. The leader of the Ambassadors, Professor Julia Williams from Rose-Hulman Institute of Technology, does not serve as an Ambassador to a specific society but provides leadership, individualized feedback, and opportunities for sharing across Ambassadors.

These goal-setting workshops, detailed below, grew out of discussions amongst the Ambassadors to embed entrepreneurial mindset into student chapters in their respective organizations. While initial discussions focused on integrating Curiosity, Connections, and Creating value into student competitions, e.g., Chem-E-car for AIChE [25], the inconsistency of student chapters from year to year was a common concern. Since Ambassadors were usually faculty who served as chapter

advisors, addressing both advisors and chapter officers/members became a common point-of-interest. The Ambassadors hoped to create engaged and active student groups every year. In addition, after two years of locked down and restricted campuses, Ambassadors were rightfully concerned that disconnected students would participate at much lower rates than before 2020. This concern generally came true for many student chapters based on discussions amongst the Ambassadors in the last two-plus years [26]. Thus, starting with the Ambassadors' ambition to increase student engagement in the student chapters, a goal-setting workshop built upon entrepreneurial mindset's 3 C's (Curiosity, Connections, and Creating value) was proposed and developed.

The connection between the entrepreneurial mindset framework and the goal-setting objective of the workshop merits further elucidation. First, the workshop's activities followed the 3 Cs, which is analogous to and loosely based upon the Integrating Curriculum with Entrepreneurial Mindset (ICE) workshops that has been regularly available for many years [12]. Also, assessment and rubric design related to entrepreneurial mindset in class settings has also been previously studied [27]. For the workshop being detailed here, the surveys were created as a pre/post workshop reflection on familiarity with entrepreneurial mindset as well as if and what type of goals were written by participants. From a student chapter advisors perspective, creating and writing down specific goals for a student chapter is generally an indication of an active and successful student group for the next year. Alternatively, the perspective of embedding an entrepreneurial mindset in students and chapter advisors necessitated survey questions at the remembering and understanding levels (i.e., lowest levels of Bloom's taxonomy) to see if the participants felt the entrepreneurial mindset framework was clear and beneficial. Overall, the surveys addressed the workshop goals, but were not intended as a research tool at this point. While this focus for the surveys may be considered a weakness currently, diving deeper is an opportunity. However, a multi-year research plan and resources was outside of the scope of this initial contribution.

Audience, location, and length varied during the first four offerings of this workshop with some similarities and differences (Table 1). Two offerings occurred at AIChE meetings, and two more workshops took place on the author's campus. The first workshop was delivered at the AIChE North Central Regional Conference in a classroom-style room setup with rows of chairs at the University of Illinois Chicago (UIC). The on-campus workshops at the University of Toledo (UToledo) used a multi-purpose room with tables to facilitate more collaboration. Finally, the advisors' workshop took place in room with small tables for sitting or standing and interacting with groups of 3 to 6. Having a room where participants interacted and shared ideas with each other was more important than the physical layout, which paralleled previous work on active learning in large lecture halls as well as custom-design collaborative classrooms [28].

Table 1. Logistics of four recent workshops.

Date	Location	Length (min)	Audience
April 2023	AICHe North Central Regional Meeting (UIC)	90	Students and advisors
September 2023	College of Engineering (UToledo)	90	Students and advisors
November 2023	AICHe Annual Meeting (Orlando)	30	Advisors
January 2024	College of Engineering (UToledo)	120	Students and advisors

The three longer workshops included three activities to guide participants through the three pillars of the entrepreneurial mindset. The advisors' workshop only had time for the Curiosity activity. The Curiosity activity used a question formulation technique [29, 30]. This activity generally included three phases: 1. Generating questions; 2. Refining, rewriting, and researching solutions/answers to the questions; and 3. Prioritizing the most important questions. The overarching prompt was "How do I build a great student chapter this year?" or variations of this question specific to the audience. While using a question to prompt additional questions is discouraged in the question formulation technique [30], this central idea or focus will be examined in future iterations. After about 5 minutes for writing down as many questions/ideas, usually done individually with some sharing with neighbors, participants were shifted to altering the questions to be open-ended. The open-ended questions were further prioritized in small group discussions. Finally, time and group size permitting, 1–2-minute informal presentations of the top question or questions were given (Figure 2). In general, some students readily volunteered to give these oral presentations. The workshop leaders encouraged different points of view as well as pointing out similarities in the questions presented.

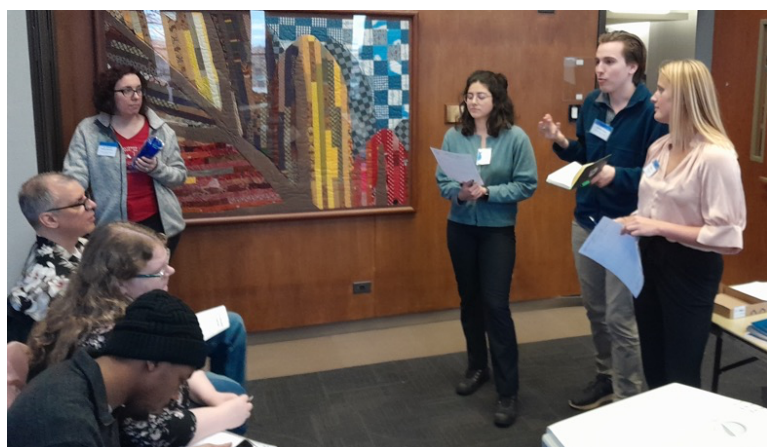


Figure 2. Students presenting after question formulation (Curiosity) activity.

The Connections activity centered around the characteristics of success. First, a list of characteristics of a student member, officer, or leader was compiled. Then, characteristics of a successful chapter were listed. After these short, individual activities (about 2 minutes each), common themes were found by discussing in small groups. While each participant compiled their lists on the provided worksheet in this cases, this activity can be done using small post-it

notes that can be easily rearranged and grouped. The objective of the Connections activity was for participants to see the similarities between a successful group and the actions of individuals.

Finally, value creation was introduced. A short brainstorming asked the question: what is valuable to you? Participants then recognized that value can be related to money or many other areas. For example, faculty generally talked about Creating value in the three primary pillars of their job, namely teaching, research, and service. More specifically, creating a rubric or using a technology tool that provided timely, constructive feedback to students was valuable in teaching engineering courses. Research success was related to the amount of funding, publications, or commercializing a technology. Service created value through mentorship or organizing a conference for a specific community. Overall, value Creating seemed to group into the categories of money, time, and people.

After discussing a few places where students have experience with value creation, e.g., design projects and student competitions, a summative activity can go in different directions depending on the goal and audience of the workshop. One activity was to create an elevator pitch about the student chapter. Orally presenting the mission and goals of the student group helped students focus on the most important items. Having an elevator pitch for the student group can empower the faculty advisor when talking with chairs and deans as well as alumni (that are potential donors). While orally summarizing a student chapter’s value was a great exercise, documenting goals is another summative activity.

Goal setting is a widely studied topic in business. For example, setting a small number of “stretch” goals was a common area for the good to great and other growing companies [6, 31]. These larger and more long-term goals may not be the best place to have student chapter members and advisors focusing since many student groups have significant annual turnover. Therefore, the SMART goals framework helped students write appropriate goals for themselves and the student chapter as a whole. SMART challenges the goal setter to be **Specific Measurable Achievable Relevant and Time-Bound** [32]. Providing a few examples (Table 2) demonstrated how to revise a good idea and goal into a focused objective.


Table 2. Example goals and comparison with the SMART framework.

<b>Goal</b>	<b>Analysis</b>
Host industrial speakers	Specific and relevant but not measurable or time-bound
Host 30 industrial speakers	Specific, relevant, and measurable but likely not achievable in a reasonable amount of time
Host a wine tasting	Specific but not relevant or appropriate for underage students
Host 3 industrial speakers during Fall semester	Specific, measurable, achievable, relevant, and time-bound

Gathering feedback and information on the usefulness of the workshop helped tune and improve future offerings. Two mechanisms collected feedback beyond questions and discussions at the individual and small group levels during the workshops. First, worksheets were provided with both guided and open-ended questions. Second, pre- and post-workshop surveys complimented the worksheets.

A worksheet used at the AIChE Student Regional Conference (Figure 3) provides an example. The two pages were printed on a single piece of paper with a QR code at the top of the front for the pre-workshop survey and a second code at the bottom of the second page for the post-workshop survey. Thus, QR codes were available on the worksheet and the slides in the room to make participation as easy as possible. Many completed worksheets were collected as part of the post-workshop survey. During all offerings, participants actively wrote their ideas on the worksheets. Due to time restraints with the first three workshops, few SMART goals were recorded on submitted worksheets. These nascent goals were commonly vague statements, such as recruit new members. Therefore, a longer workshop time was offered for the most recent offering. More SMART goals were written during the 2-hour workshop, but many participants could not stay for the entire session. Thus, future offerings will likely be 90-minutes with encouragement for students and advisors to meet later for further refinement.

**How to Build a Great AIChE Student Chapter**

Welcome Survey: 

**Activity 1: Question storming**


1.  
2.  
3.

**Activity 2: Connections – Chapter or Leader**

1.  
2.  
3.

**Action Plan** for: My chapter Me Both (circle one)

Phase 1	Phase 2	Phase 3
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>

Thank you for attending. Feedback Survey: 

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Figure 3. Left. Page 1 of worksheet with prompts for the Curiosity and Connections activities. Right: Page 2 of the worksheet for recording goals over 3 time periods.

On both pre- and post-surveys, three questions asked about entrepreneurial mindset (Table 3). The term “engineer” in the second and third questions was more specifically stated as chemical engineer at the AIChE conferences and more generally in the on-campus offerings. In general, about a quarter to one-third of the participants would not be familiar with entrepreneurial mindset before the workshop. After the workshop, all participants were familiar or very familiar with entrepreneurial mindset, so participants acknowledged that the entrepreneurial mindset concept and framework played a role in their student chapter activities. Exhibiting and applying entrepreneurial mindset saw similar shifts to sometimes and always encompassing nearly all of the responses after the three student-centered workshops.



Table 3. Survey questions related to entrepreneurial mindset.

Question	Choices
How familiar are you with the concept of entrepreneurial mindset?	Very Familiar, Familiar, Not Familiar
I feel engineers exhibit an entrepreneurial mindset.	Always, Sometimes, Rarely
I apply an entrepreneurial mindset as an engineer or engineering student.	Always, Sometimes, Rarely

The post-workshop survey also asked for images of the participant’s worksheet. Since taking photos on a smartphone is quicker than typing in or translating work into a form, many participants readily provided their responses to the organizers. In the future, this type of information could be coded to address specific research questions. Here, the general utility of the workshop was assessed. Overall, participants wrote a significant amount on the front side of the worksheet related to the Curiosity and Connections activities. After the initial offering, the action plans and goals were generally vague, which led to the additional discussion of SMART goals framework.

A number of lessons learned provide guidance to other faculty wanting to adopt this type of workshop with a student group that they advise, many student groups or advisors on their campus, or at a regional or national conference (Table 4). First, active learning activities are very successful for brainstorming and idea generation. Thus, alternating short, prepared remarks and slides with participant activities keeps everyone’s attention. A worksheet with prompts provides participants a canvas to generate and share ideas. While verbal exchanges of ideas are important, writing down responses on the worksheet formalizes the process. Research has shown the importance of hand writing notes and related work in a classroom setting, which is analogous to the workshop setting [33]. About 90 minutes provides enough time think broadly about student chapter’s from multiple perspectives and leave with a small number of focused goals.

Table 4. Lessons learned to date for the How to Build a Great Student Chapter workshop.

<b>Lessons learned</b>
Frequent activities keep participants on task
Guided worksheet captures ideas and goals
A lot can be accomplished in 90 minutes

Beyond the positive take aways summarized above, some limitations and opportunities should be noted to improve future offerings. First, neither the robustness of the goals set nor the success in accomplishing some or all of the goals can be determined at this point, which may be considered a limitation. Some potential avenues to shift from a single workshop to a more complete mentoring/advising program could be explored in the future. Second, the expansion of the workshop to two hours for the most recent offering was more than sufficient time for students to complete as much work as they felt was needed. With some participants not able to commit two full hours, one 90-minute workshop or possible two 45 to 50-minute workshops may be optimal. Third, revising the goals after having a chance to “sleep on it” would be more productive and supported by learning science [34-36]. While the workshop facilitators circulated and provided

prompting and feedback throughout the workshop, receiving more detailed, individual feedback could improve the process. The hope is that that local student chapter advisors will engage in a goal-setting process with their officers on a regular basis. A more formal suggestion to seek additional feedback on their individual and chapter's goals was added to the most recent on-campus offering.

## **Concluding Remarks**

Entrepreneurial mindset provided a valuable framework for helping students set goals related to their student chapters. Curiosity, Connections, and Creating value provided themes for activities within four similar workshops. Workshop attendees filled out worksheets as well as pre- and post-workshop surveys, which demonstrated strong engagement during the events. Overall, the workshop slides and other materials are freely available to other faculty wanting to deliver similar workshops on campus or at conferences [18]. I hope a robust discussion of the workshop occurs on Engineering Unleashed to improve the slides, activities, and outcomes for other faculty advisors and students in the future.

Reiterating the lessons learned from the initial workshop offerings: 1. Use active learning activities to maintain focus and engagement, 2. Provide a physical worksheet for participants to write, doodle, sketch, etc. on. 3. Reserve about 90 minutes to explore different perspectives on student chapters and the roles of officers and advisors. Finally, providing food and swag or other prizes keep the sessions from feeling like another engineering class.

Finally, the on-campus workshops allowed for students to interact outside of their disciplinary silo and even outside of engineering. To date, participants from chemistry, pharmacy, and student life brought outside perspectives to these on-campus events (hosted by engineering). One success after the September 2023 workshop was a co-hosted event between pharmacy and engineering students centered on the formulation of cosmetics. This hands-on event was well received and may become a regular collaboration. Therefore, the entrepreneurial mindset provided the framework for both students and advisors to generate goals and create great student chapters.

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## **References**

1. Herman, G.L. and J. Loewenstein, *Evidence-Based Change Practices*. Journal of Engineering Education, 2017. **106**(1): p. 4-13. DOI: <https://doi.org/10.1002/jee.20152>
2. Cummings, T.G. and C.G. Worley, *Organization Development and Change*. 10th ed. 2015, Stamford, CT: Cengage Learning

3. Williams, J.M., *Making Changes in STEM Education: The Change Maker's Toolkit*. 2023: CRC Press
4. Saari, L.M., *Goal setting and organizational transformation*, in *New Developments in Goal Setting and Task Performance*, E.A. Locke and G.P. Latham, Editors. 2013, Routledge/Taylor and Francis. p. 262-269.
5. Locke, E.A. and G.P. Latham, *A theory of goal setting and task performance*. 1990, Englewood Cliffs, NJ: Prentice Hall
6. Doerr, J., *Measure What Matters: How Google, Bono, and the Gates Foundation Rock the World with OKRs*. 2018: Penguin
7. Grose, T.K., *21st century prof*. ASEE Prism, 2007(January): p. 26-31. DOI:
8. Frangenberg, E., *Skills They Don't Teach You in School*. Chemical Engineering Progress, 2017. **113**(5): p. 19-19. DOI: <https://www.aiche.org/chenected/2017/05/skills-they-dont-teach-you-school>
9. Liddle, D. *Why it's time to take a hard look at soft skills*. 2015 [cited 2016 July]; Available from: <https://www.linkedin.com/pulse/why-its-time-take-hard-look-soft-skills-david-liddle>.
10. Nguyen, D.Q., *The Essential Skills and Attributes of an Engineer: A Comparative Study of Academics, Industry Personnel and Engineering Students*. Global Journal of Engineering Education, 1998. DOI:
11. Liberatore, M.W., C.A. Bodnar, K. Fruth, K. Horvat, C. Monty-Bromer, E.S. Vasquez, and M.A. Vigeant, *Encouraging the Entrepreneurial Mindset of Chemical Engineers*. Chemical Engineering Progress, 2023. **119**(May): p. 49-55. DOI: [https://www.aiche-cep.com/cepMagazine/may\\_2023/MobilePagedArticle.action?articleId=1876571&app=false#articleId1876571](https://www.aiche-cep.com/cepMagazine/may_2023/MobilePagedArticle.action?articleId=1876571&app=false#articleId1876571)
12. Jackson, A., C. Mawson, and C.A. Bodnar, *Faculty motivation for pursuit of entrepreneurial mindset professional development*. Entrepreneurship Education and Pedagogy, 2022. **5**(3): p. 320-346. DOI: <https://doi.org/10.1177/2515127420988516>
13. Bosman, L. and S. Fernhaber, *Teaching the entrepreneurial mindset to engineers*. 2018, Switzerland: Springer International Publishing
14. Kern Entrepreneurship Engineering Network. *Engineering Unleashed powered by KEEN*. 2024 [cited 2024 January]; Available from: <https://engineeringunleashed.com/>.
15. Smith, K.A., S.D. Sheppard, D.W. Johnson, and R.T. Johnson, *Pedagogies of engagement: Classroom-based practices*. Journal of Engineering Education, 2005. **94**(1): p. 87-101. DOI: <https://doi.org/10.1002/j.2168-9830.2005.tb00831.x>
16. Prather, E., A. Rudolph, and G. Brissenden, *Using research to bring interactive learning strategies into general education mega-courses*. Peer Review, 2011. **13**(3): p. 27-30. DOI:
17. Bullard, L.G. and R.M. Felder, *All roads start with MEB: A team-teaching approach for mentoring new faculty*. Chemical Engineering Education, 2019. **53**(1): p. 18-21. DOI: <https://journals.flvc.org/cee/article/view/107767>
18. Liberatore, M.W. *Building a Great Student Chapter: A Goal-Setting Workshop using Entrepreneurial Mindset*. 2024 [cited 2024 January]; Available from: <https://engineeringunleashed.com/card/3939>.
19. Faber, C., C. Smith-Orr, C. Bodnar, A. Coso Strong, W. Lee, and E. McCave. *Best Practices for Developing a Virtual Peer Mentoring Community*. in *ASEE Annual Conference proceedings*. 2017. DOI: <https://peer.asee.org/27655>

20. McKenna, A., A.M. Johnson, B. Yoder, R.C. Chavela Guerra, and R. Pimmel, *Evaluating virtual communities of practice for faculty development*. The Journal of Faculty Development, 2016. **30**(1): p. 31-40. DOI: <https://www.ingentaconnect.com/content/magna/jfd/2016/00000030/00000001/art00005>
21. Farrell, S., S.J. Krause, N. Ruzycski, A.L. Genau, B. Nelson-Cheeseman, C.A. Bodnar, J.D. Shih, D. Lepek, L. Corneal, S. Ciston, and R.E. Eitel. *A Virtual Community of Practice to Introduce Evidence-based Pedagogy in Chemical, Materials, and Biological Engineering Courses*. in *ASEE Annual Conference & Exposition*. 2015. Seattle, Washington. DOI: <https://doi.org/10.18260/p.23473>
22. Self, B.P. and E.J. Berger. *Promoting Research-based Instruction in Statics and Dynamics: A Virtual Community of Practice*. in *ASEE Annual Conference & Exposition*. 2014. DOI: <https://doi.org/10.18260/1-2--22953>
23. Pimmel, R., A.F. McKenna, N.L. Fortenberry, B. Yoder, and R.C. Chavela Guerra. *Faculty development using virtual communities of practice*. in *ASEE Annual Conference & Exposition*. 2013. Atlanta, Georgia. DOI: <https://doi.org/10.18260/1-2--19608>
24. Liberatore, M.W., D. Lepek, L.P. Ford, T. Carter, J. Pascal, M. Lamm, C.L. Patton Luks, D.L. Silverstein, A.N. Ford Versypt, S. Butler Velegol, T. Vogel, N. Raikar, M. Kipper, and C. Wheeler West, *AICHE Virtual Communities of Practice – Supporting Faculty During the COVID-19 Pandemic*. Chemical Engineering Education, 2022. **56**(1): p. 68-78. DOI: <https://doi.org/10.18260/2-1-370.660-125282>
25. AIChE. *Chem-E-Car Competition 2023* [cited 2023 February]; Available from: <https://www.aiche.org/students/chem-e-car-competition>.
26. Gretzinger, E. and M. Hicks. *Why Campus Life Fell Apart*. 2024 [cited 2024 January]; Available from: <https://www.chronicle.com/article/why-campus-life-fell-apart>.
27. Hylton, J.B. and B.A. Hays. *Modifying the value rubrics to assess the entrepreneurial mind-set*. in *2019 ASEE Annual Conference*. 2019. Tampa, FL. DOI:
28. Beichner, R.J., J.M. Saul, D.S. Abbott, J.J. Morse, D. Deardorff, R.J. Allain, S.W. Bonham, M.H. Dancy, and J.S. Risley, *The student-centered activities for large enrollment undergraduate programs (SCALE-UP) project*. Research-based reform of university physics, 2007. **1**(1): p. 2-39. DOI: <https://www.academia.edu/download/32837058/Chapter.pdf>
29. Hylton, B.J., D. Mikesell, J.-D. Yoder, and H. LeBlanc, *Working to Instill the Entrepreneurial Mindset Across the Curriculum*. Entrepreneurship Education and Pedagogy, 2019. **3**(1): p. 86-106. DOI: <https://doi.org/10.1177/2515127419870266>
30. Rothstein, D., L. Santana, and W.D. Puriefoy, *Make Just One Change: Teach Students to Ask Their Own Questions*. 2011: Harvard Education Press
31. Collins, J.C., *Good to Great: Why Some Companies Make the Leap -- and Others Don't*. 2001: Random House Business
32. Bjerke, M.B. and R. Renger, *Being smart about writing SMART objectives*. Eval Program Plann, 2017. **61**: p. 125-127. DOI: <https://doi.org/10.1016/j.evalprogplan.2016.12.009>
33. Mangen, A. and J.-L. Velay, *Digitizing Literacy: Reflections on the Haptics of Writing*. Advances in Haptics, 2010: p. 385-401. DOI: 10.5772/8710
34. National Academies of Sciences, *How People Learn II: Learners, Contexts, and Cultures*. 2018: National Academies Press
35. Walker, M., *Why We Sleep: Unlocking the Power of Sleep and Dreams*. 2017: Scribner.

36. Yang, G., C.S. Lai, J. Cichon, L. Ma, W. Li, and W.B. Gan, *Sleep promotes branch-specific formation of dendritic spines after learning*. *Science*, 2014. **344**(6188): p. 1173-8. DOI: <https://doi.org/10.1126/science.1249098>