"Our guiding questions were, What are we already doing that helps students to develop EM? What could we do better? What else can we do? And finally, Which if any barriers/challenges do we face? Then we used the KEEN framework as an organizational and measurement tool to help faculty and lecturers identify ways to adapt current and/or create new course materials."

- FSE Entrepreneurial Mindset Team

**Case at a glance**

**Integration goals:** Train faculty and lecturers on the importance of entrepreneurial mindset (EM) and modify or create curricula to integrate EM

**Materials affected:** Training materials created, course materials modified or created

**Lessons learned:** We learned at least a few key lessons:

- Train-the-trainer model is an effective way of teaching EML to a large number of faculty and lecturers across different schools of engineering within the same institution.

- Some engineering courses are easier to adapt and incorporate EML than others. Design courses that require generating an idea, designing a prototype and marketing the device are much easier to adapt than courses involving learning mathematical modeling or using specific software.

- When faculty are first attempting to incorporate EML into their courses, it is important that the course changes be reviewed by someone with EML expertise.
Context

Entrepreneurial mindset (EM) workshops for faculty and lecturers were, along with workshops for staff and student leaders/employees (and other interested parties), the starting point for implementing phase one of our EM integration initiative, which focused on integrating EM into both core and elective courses up and down ASU’s engineering curriculum. Multiple workshops, delivered by engineering school (ASU has six schools of engineering) and course clusters, were held, beginning with the School of Biological and Health Systems Engineering (SBHSE) and the Polytechnic School. Those early workshops employed mixed approaches and produced equally mixed results. From the first workshop, however, we quickly recognized the need to modify the workshops’ content and approach, and with each iteration the messages were clearer and their reception more enthusiastic.

While the particulars of the agendas, presentations, and activities for faculty and lecturer workshops evolved, the core learning objectives remained quite consistent and were usually a variation on the following:

As a result of the workshop, faculty/lecturer attendees will be able to

- Explain what KEEN is
- Describe the entrepreneurial mindset and why it is important/valuable
- Participate in sample EML activities and/or observe examples
- Review current course structure/content to identify opportunities to create added value for students
- Connect personal experiences (from oneself and others, including students) and examples of implementing EM curriculum (at ASU or other institutions) to develop ideas for revising/creating EM-related course materials
- Discuss assessment strategies for EM (e.g., key features to look for in student work)
- Develop strategies for helping FSE students to develop the entrepreneurial mindset

In one way or another, then as now, these workshops focus on how EML is different from what we’ve been doing and how to adapt current and/or create new course materials to ensure that FSE students are exposed to and have the opportunity to benefit from EML.

Our goal was to train about 70 ASU faculty and lecturers within the first year of our EM integration effort. The early workshops took place before the first KEEN Professorships, which provide additional incentives for integrating EM into courses, were awarded.

Integration details
A timeline view of our activities during 2016 and 2017 will best provide insight into the details of advancing FSE’s EM integration initiative through faculty and lecturer workshops.

2016

May:
The EM team, led by Amy Trowbridge, held its first Entrepreneurial Mindset Workshop in May 2016. It was for FSE 100 lecturers, and we requested that attendees complete the following pre-work prior to the half-day workshop:

Watch: [https://www.youtube.com/watch?v=ufdgKZ_3Zco](https://www.youtube.com/watch?v=ufdgKZ_3Zco)

Think about: What are the hallmarks of traditional vs. entrepreneurial engineering?

Read: Doug Melton’s article “Stacking Entrepreneurially Minded Learning Alongside Other Pedagogies”

Think about: How is EML different from other techniques you may currently be using (i.e., problem-based learning, subject-based learning, etc.)?

Watch: [https://www.youtube.com/watch?v=WZHvRpuemgk](https://www.youtube.com/watch?v=WZHvRpuemgk)

The pre-work prepared attendees for the workshop’s four-hour agenda:

9:00 - Breakfast
9:15 - Introduction to Workshop
9:20 - Kern/KEEN Context
9:30 - Characteristics of EM
9:50 - ASU Frameworks and Outcomes
10:05 - EM in Action: Taking an EM approach to our courses
10:10 - Discussion: Identify opportunities (who is our customer? Opportunities to create value?)
10:25 - Discussion: Connect current experience to EM (what do we already do that is EM? What can we do differently? Barriers/challenges?)
10:45 - Break
11:00 - Creating Value: Example EM Activity - House of Cards
11:45 - EM Examples of student-led learning (FSE 100 Grand Challenge Project example, Uncle Mort, Earth Day Cups)
12:00 - Lunch
12:30 - Assessing EM
12:55 - Closeout

Also in May, members of the BME Design Spine faculty and one lecturer attended an initial EM training workshop to lay the foundation for a school-wide workshop that Dr.
Jeffrey Kleim and the EM team were designing specifically for the SBHSE to be held in July.

**June:**
We reviewed workshop participant feedback and other assessment data from the previous month’s FSE 100 lecturer EM training and began planning the workshop’s next iteration.

**July:**
SBHSE Design Spine faculty were then charged with the task of adapting their courses by developing assignments or activities that incorporated EML to be presented at a workshop that July. The goal of the workshop was to have members of FSE with EML expertise (Brent Sebold, Scott Shramek, and Amy Trowbridge) as well as industry partners and Doug Melton of the Kern Family Foundation review the proposed activities discuss so that the faculty could then work to implement the changes to their courses for the upcoming 2016 - 2017 academic year.

When Jeff Kleim announced the meeting, he presented it as an opportunity for Design Spine teachers to come to get a feel for EM and what FSE was trying to do with it. They were told they would be presenting during the event. After the EM leads provided an overview of EM, including the KEEN framework to illustrate KEEN’s specific standards, Drs. Jeffrey Kleim and Casey Ankeny presented their course proposal as a model. It was clear from the faculty presentations that the proposed activities did not sufficiently incorporate EML. In fact, most faculty presented what they were already doing and attempted to explain why it was indeed EML. This is the key problem with trying to incorporate EML into existing courses. There were to lessons learned here. The first is that most faculty did not fully understand the 3C’s and the difference between entrepreneurship and EML. The second is that not all courses are easily adapted simply because of the course material and faculty were unwilling to “sacrifice content” for EML.

Based on feedback from the workshop and a follow up meeting, BME 100 and BME 382 were identified as courses where EML could be readily implemented and these courses were adapted for that fall and spring. For example, BME 100 developed a lab series comprising four assignments: 1) students identify a specific need, then 2) assess the fundability of the device or technology and examine existing technologies, then 3) design and create a prototype, and finally 4) pitch the idea to the class and ultimately local entrepreneurs in an event now named “Spark Tank.” This lab series proved effective that fall and is one we continue to use.

It was around this time that we formalized our intention of getting together again the following May (2017) to debrief and reflect on what worked during the academic year and plan what to do the next time we offered the EM workshop for BME Design Spine faculty and lectures. We assumed the next offering’s focus might be a bit better since everyone would have been through the initial training. We also decided to invite KEEN experts to the next workshop so that they could respond to the faculty and lecturers’ presentations.
August:
At this point, in preparation for the start of Fall 2016 classes, we conducted a follow-up to the EM Workshop for the FSE 100 lecturer team that took place in May. During this refresher, which was part of the FSE Lecturer Fall Retreat, we delivered a 1.5-hour training session for the 15 FSE 100 lecturer team members. This session reinforced the genesis of entrepreneurial mindset, the development and utilization of the EM framework, and several best practice examples of how to incorporate EM into FSE 100 (and some upper division coursework).

The participants shared new materials and discussed revised materials, assessment strategies for projects, etc. The participants who created new EM lecture/lab/modules over the summer were expected to briefly present their new material to the lecturer team. They also shared their materials for others to see and subsequently use in the “2016 Retreat” area on the FSE 100 Development site, which lives in a Blackboard shell. After the brief presentations, the participants worked in groups to share, discuss, and collaborate on EM modifications and other course material updates.

Graduate students connected to FSE 100 and other classes that are involved with EM also received formal EM training during August 2016. It was delivered as part of the Engineering Projects in Community Service (EPICS) Retreat for project mentors (industry professionals), graduate assistants, and undergraduate teaching assistants affiliated with EPICS.

2017

March:
In collaboration with Michael Rust at Western New England University, we delivered a workshop titled “EM and Disruptive Technologies” that was designed to expose engineering educators to the concept of disruptive technologies and how they can be used with engineering students to encourage entrepreneurially minded approaches.

March/April:
Also in the spring of 2017, we presented “Encouraging the 3C’s through Hands on Workshops,” a series of workshops that were offered two days a week for several weeks. These sessions promoted an understanding of the 3C’s through learning basic wood and metal working skills. They were open to all undergraduate engineering students and led by Dr. Jeff LaBelle, who had been trained in EM the previous year.

June:
We held a follow-up workshop with the goal of reviewing the projects implemented during the year in the BME Design Spine to assess how well they worked and to suggest any changes for the next academic year. In addition, new projects to be implemented in BME 300 and BME 182 were discussed.

July:
FSE faculty delivered two workshops that focused on promoting EML through the design of robotic devices to enhance rehabilitation of neurological impairments. Initially
developed for high school students, these workshops were subsequently adapted to include undergraduates in a one-credit hour course that was delivered during the upcoming fall term.

NOTE: Supporting resources for this case study can be found within its companion KEEN card (link below), which is also where the community can discuss the case and its broader topic.

Integration outcomes

We have achieved the key milestone of integrating EML into several classes sufficiently that we are able to assess the impact of the assignments and student engagement, and we have had successes, as noted above (e.g., BME 100’s four-part EM project). In addition, as a result of these workshops, a new faculty member designed and is now teaching a graduate course focused on designing instruments for further assessing student outcomes. However, our approach is still evolving to achieve greater outcomes and address what we see as additional potential.

Future plans

We have already refined our approach to training faculty and lecturers quite a bit, but we expect to continue making refinements as well adapting our approach and materials as needed based on changing circumstances. For example, during spring 2018, the KEEN Team developed a set of three videos titled "EM 101" that feature Dr. Brent Sebold. These videos were designed to serve as a virtual workshop for faculty and instructors who were or will not be able to attend an in-person workshop. Similarly, during summer 2018, we launched a new faculty mentorship program, and we expect it will affect our EM training over time. Finally, as is true for our integration effort overall, we will be assessing the impact of these component efforts by evaluating their effect on both faculty and student engagement.

Considerations

Not surprisingly, training numerous faculty members and lecturers through multiple meetings and reviews can be challenging—logistics can be time-consuming. As a result, in addition to the individuals who develop the training content and lead sessions, individuals in administrative support roles can greatly improve process efficiencies and overall outcomes.

Similarly, training staff (student employees included) as well as (and ideally before) faculty members and lecturers will likely yield the best results, as the staff will be able to help plan and deliver the faculty and lecturer sessions. The dual trainings can also serve to reinforce one another and further the development of an EM ecosystem at your school.
Finally, you may want to keep in mind one of our key lessons learned: The workshops are more successful when the EM leads present the EM framework, have participants design an EM module, and then have the EM leads meet with each individual or team to go over the modules they designed so that they can incorporate feedback and revise before presenting to the entire group. In essence, our initial approach came at the task from where participants were rather than what was needed. If we had done it differently from the beginning, we would have inserted the consultation step between the training’s instruction and the participants’ presentation of the solutions they designed.

**KEEN Card**

This case study has a companion card on the KEEN Engineering Unleashed [website](#).

**Related Cases**

**Curriculum**
- Immediate Contributions: EPICS (FSE 104)
- Foundations 1: EGR 101 and FSE 100
- Foundations 2: EGR 102
- Full Integration: Biomedical Engineering Design Spine

**Engagement**
- A Natural Fit: Grand Challenge Scholars Program
- Change Makers: KEEN Professorships

**Workshops**
- Onboarding 2: EM Workshop for Staff
- Onboarding 3: EM Workshop for Undergraduate Teaching Assistants

**Life Cycle**
- Institutional Learning: Evaluating the Initiative