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Community Building in Chemical Engineering

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Community Building in Chemical Engineering

Common First-Year Engineering Program:

At the University of Pittsburgh (Pitt) for over twenty years, all first-year engineering students pursue a common academic program consisting of mathematics, chemistry, physics, humanities/social science electives, and two specially designed first year engineering courses[1]. These courses were further refined ten years ago to provide each student with an overview of the fields and methods of engineering; introduce skills which are basic to engineering; and acquaint students with the interaction of skills, techniques, logic, ethical responsibility[2], and creativity in engineering problem formulation and solving. Although the curriculum is common, the actual schedule for each student is based on their incoming background and their anticipated major. The science and general education requirements are the same regardless of whether they enter the First Year Engineering Program or as a first-year student or as a transfer student. Upon the successful completion of the first-year curriculum, students choose their major from any of the ten departments or programs.

First year students (and transfer students) also participate in an engineering seminar, facilitated by their Academic Advisor and an Engineering Peer Mentor. These seminars provide general information on the transition to college, study skills, co-curricular opportunities, and provide an overview of the various engineering fields. This seminar is a group advising experience that provides weekly contact with advisors and peer mentors. Advising is about so much more than registration for classes and is designed to assist first-year and continuing student advisees, to develop and implement plans for achieving educational and vocational goals so that students may be directed and successful in their second college year and beyond.

Academic Advisors in the First-Year Engineering Program are full-time professionals with graduate degrees (Masters) in Higher Education Administration, Student Personnel Services, Counseling, or a closely related field. They are knowledgeable about college student development, helping skills, and student engagement, as well as the institutional objectives of the engineering school and university as a whole.

Advising in the First-Year Engineering Program is a partnership between student and advisor. Students are expected to take responsibility for their education, to fully participate in the advising relationship, to be proactive in their approach to academics, and to ask questions. In turn, they can expect their Advisor to be approachable, available, responsive, supportive, a clarifier of information, and a knowledgeable and helpful resource.

The program utilizes an Academic Advising Syllabus to guide students through the first year of engineering studies, and eight desired learning outcomes to guide their work. By the end of the first year of academic advisement in the Swanson School of Engineering, students will:

- Establish a network and know how to use it
- Know how to use technology resources
- Understand the options of engineering majors/programs and make a department selection

- Understand basic policies and procedures, or know from whom or how to get the information online
- Master time management so as to be successful beyond the first year
- Gain academic self-awareness/knowledge of academic strengths and weaknesses
- Understand the value that diversity contributes to productive, creative engineering teamwork
- Understand and make a personal commitment to a high standard of academic integrity and professional ethics.

Chemical Engineering

Our students come to our department at the end of their first year common engineering program or as transfer students – which represents approximately 20% of our students. Transfer students are typically from 3-2 programs, regional campuses, and internal transfers from Arts and Sciences. Provided that these transfer students have completed all of the first year physics courses, introduction to engineering and programming courses, math classes (through differential equations) and chemistry courses (Chemistry I and II and Organic Chemistry I and II and their respective Laboratory courses), they are eligible to complete their Chemical Engineering core courses in four semesters. Therefore, it is important to provide professional development as quickly as possible, so that they can make decisions concerning cooperative education, internships and pursing undergraduate research.

Undergraduate Seminar

Two years ago, our department seminar had been restructured to support the collaborative, holistic advising practice that is the mission of the University of Pittsburgh Academic Advising Framework[3]. Under the guidance of the Academic Advising Manager, weekly seminar meetings in the classroom reinforce student-facing modules housed in the Canvas Learning Management System (LMS) that are to be completed on a self-paced timeline and used as student reference or referral tools as needed. Modules are created to support one of three main areas of instruction: professional development, academic performance and enrichment, and finally student development, health, and wellness. Invited speakers support learning in these three topical areas, offering in-depth examination of their area of expertise. Speakers include industry partner panels, early to mid-career professional panels, student affairs and support staff from campus resource offices and similar high-impact practice areas on campus. Student deliverables include a required resume, which is reviewed individually as a part of the advising process and can then be employed throughout the term to apply for a multitude of highlighted high-impact practice opportunities like co-op, internship, REU and undergraduate research positions.

During term registration and enrollment periods, this learning space supports our newly founded flipped advising model and is used for group advising purposes prior to individual advising and faculty mentor meetings. This ensures that students are grounded in their degree path expectations, university policy and procedure, and have a common knowledge base for making impactful decisions about their personal pace and course completion. Using a flipped advising module in this space, outfitting students with the tools required for their comprehension and articulation of their degree path, means that faulty mentors have more time to engage in meaningful conversation with their mentoring cohort rather than being limited merely to scheduling concerns.

Finally, we initiated the use of the university LMS in conjunction with seminar to serve as a repository for holistic student support resources. Chemical engineering students are offered through this Canvas site a comprehensive guide to university-based resources, which provides them the autonomy to find and utilize what they need when they can best use it. Within our departmental site, consistent connections are maintained each term to university mental health resources and outreach, professional development supports including resume guides, research opportunities and curricular planning guides. Consistent attention to module design – meaning that we house information statically in the same place within the LMS, using labeling, dating and terminology that has been taught as a department standard initially and employed regularly across terms – allows students to quickly navigate this information.

Undergraduate Senior Seminar

In addition, since 2019, we have hosted a separate weekly seminar for our seniors during the fall semester, which is focused on just-in-time professional development as our students navigate career fairs, job interviews and graduate school applications and visits. We review both legal and illegal interview questions, and how students can be proactive to field an illegal question into a legal answer. We also cover business etiquette[4] to help prepare them for attending conferences and business dinners; as well as electronic etiquette[5]. We also host seminars on life after undergrad – which focuses on professional licensure, financial advice[6] and career progression. Our most popular seminars are with our Alumni panels – we invite alums who have graduated within the last seven years and work in varying different fields of chemical engineering or are in/or have attended graduate school. The Alumni are selected based on the interests of our students, who are surveyed at the beginning of the semester. We typically have three separate panels with 5-6 alumni each – and it has been most interesting to discover that many of our alumni are already working at their third company since graduation!

Holistic Practice: Flipped Advising Using An Intrusive Lens

In a stereotypical or historical student support model, a student is individually responsible for finding connection to campus resources and services. This can lead to critical gaps in student connection to resources and support. With a holistic approach, there is an advising relationship that considers student support through more than a single academic lens and ensures connections to necessary and desired interventions and support. It is not possible for faculty and academic advisors to be experts in every resource a student may need to utilize within their tenure at a university; however, as Charlie Nutt, Executive Director of NACADA has stated, "They should be experts in the art of the referral"[7]. The University of Pittsburgh academic advising framework identifies a holistic approach as mission critical to student support.[3] In 2023, our department created the role of Academic Advising Manager to deploy a series of advising measures meant to align our practice with this mission and support department advising faculty in their transition to subject-specific mentors.

Holistic connection to resources, especially in a class cohort model, requires specific and intentional practice. Our choice was to lean heavily into intrusive advising practice, which requires the advisor to anticipate and deploy content for connection before emergent needs arise in the cohort population. Rather than a strictly prescriptive relationship that is driven by compliance or authority, it is a proactive model meant to prompt students to explore services and programs to improve skills and increase academic motivation, in three direct co-curricular areas 1) degree planning and academic advising; 2) understanding and connecting to high-impart practices and 3) developmental student engagement. Chief tools for employment of these enhanced support strategies include our seminar course, periodic advising faculty training, and concrete resource creation and development. Given the truncated time in the major after the common first-year experience, it is critical that our students have a rapid and seamless connection to high-impact practice resources and curricular understanding in order to be competitive.

With an understanding of student development and co-curricular scheduling, our advising professional is responsible for a term intensive relationship with incoming sophomores and transfer students before those students are transitioned to a faculty mentor for continued mentoring and support in their junior and senior years. This is accomplished through a variety of scheduled outreach scaffolded through the academic calendar year. Group matriculation orientation sessions are offered, usually virtually for best scheduling access, for newly declared sophomores and transfer students prior to the beginning of their first term in chemical engineering. Orientation is then followed by individual advising appointments early in the term prior to enrollment periods in which the students earned credit accumulation is audited and explained in terms of degree progress using a paper-and-pencil inventory. This gives each incoming student a foundation, providing them with fundamental connection to the department, the advising relationship, and the degree path they can then use to navigate various university-provided electronic scheduling and tracking tools.

The undergraduate cohort as a whole is further supported through flipped advising during the seminar experience, as the LMS platform and co-curricular scheduling predicts the commonly needed resources and provides these as described in our seminar section. Using these tools, it is our goal that students become adept at self-authorship as they move though the flipped advising model, are advised by faculty mentors who become free to explore practice and degree-related content, are prepared for their senior year and graduation. As shown in Figure 1, we see the critical thinking that happens inside an advising session, and above the line, the critical thinking goes on outside of an advising session. A sophomore student is going to likely approach advising in the traditional way, using their advising session primarily to learn critical pieces of information that inform their thinking. A more advanced student (juniors and seniors) will already have that critical foundation and therefore use their advising relationship more critically.

Flipped advising, which requires students to complete their "homework" prior to each meeting with their advisor. This is meant to make advisor-student meetings more efficient by freeing students and advisors to spend more of their time together planning and decision making and less time with the advisor simply conveying information.

Flipped advising changes the focus and content of what takes place in and outside of advising sessions. For example, whereas traditional advising would devote the advising session to understanding and remembering information, flipped advising instead focuses the advising session on applying, analyzing, evaluating, and creating, under the assumption that the student will commit to understanding and remembering outside of the advising session.

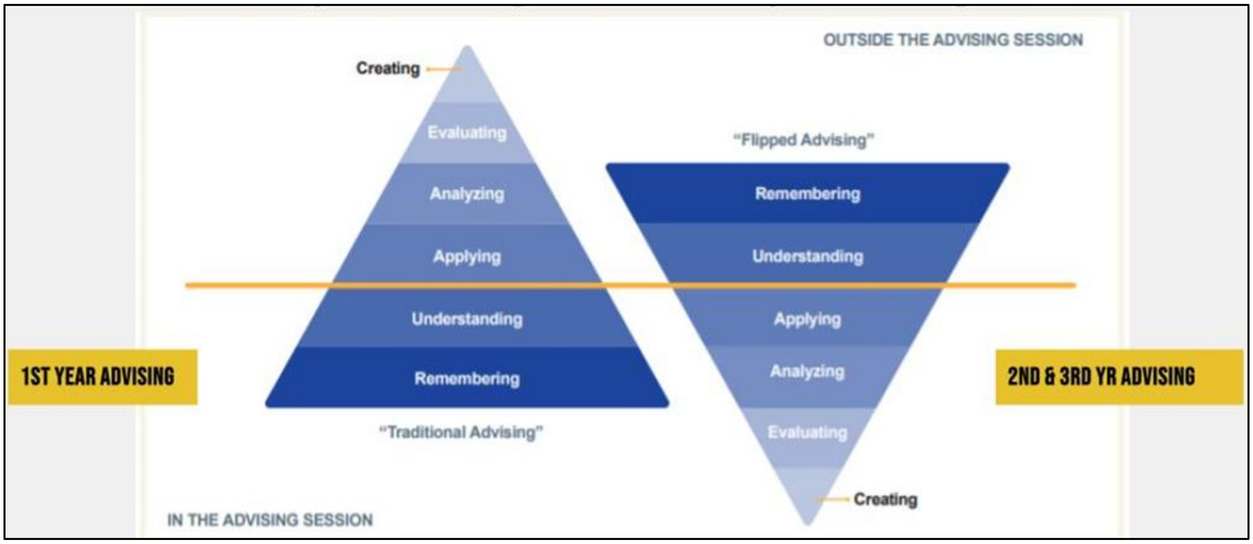

Figure 1. Flipped Advising and Critical Thinking as Illustrated by Boom's Cognitive Taxonomy of Learning[8]

Our goal is to take a first year from a traditional relationship within an advising relationship as a receiver of knowledge, primarily about credit and scheduling issues, to one who comes to an advising session prepared with analytical and strategic questions about their engineering career.

Flipped advising also lends itself to the best execution of intrusive advising practice in the cohort model as blanket interventions are deployed during the first-year matriculation that are assimilated as a part of the student learning process. It has been shown that high-impact practices support student success [9,10]. Engineering students are faced with a particularly narrow set of high-impact practices that can be hard to discern or attain when uninformed. Credit-based undergraduate research opportunities, paid or unpaid summer-term research and internship experiences, cooperative employment placement, and fostering close faculty relationships for the purpose of academic and professional references are all engineering-specific high-impact practices that can yield a competitive edge when applying for jobs or graduate-level programs. We do not assume a student arrives with the knowledge necessary to persist nor do we approach knowledge sharing as deficit-based rehabilitation. Instead, we provide egalitarian access to high-impact practice information intrusively through flipped advising tools.

Material and Energy Balance Course

The chemical engineering program[11] at the University of Pittsburgh is structured differently from most programs, in that our students take their core six-credit ChE classes in a 'block-schedule' which immerses them in *four* ~two-hour classes each week, with the *fifth* class each week spent in a one-credit experimental laboratory. Importantly, for the student, it provides larger blocks of time to actively engage in learning *in* the classroom *with* the support of the instructor. The 'lectures' are split into 5–10-minute blocks and the students engage in doing – with think, pair, share; brainstorming; starting a problem solution or derivation; thinking of a real-world application; connecting to their laboratory experiment; predicting an outcome; critiquing a computer code;

summarizing what was covered; etc. Since 2016, our students have worked through example problems in various forms which range from lecture notes with gaps to hands-on activities/demonstrations/videos where they predict what will happen and explain why. We frequently use Top Hat[12] to pose short concept questions, free student response, so that they receive timely feedback on their understanding and learning. We also use this online system to collect 'muddy' points, to uncover their misconceptions and adjust the next class to incorporate an activity to correct their understanding.

The teaching philosophy is to help students understand fundamental engineering principles by bringing practical examples and hands-on activities into the classroom and to incorporate industrial experiences. Giving practical industrial examples, explanations, and problems allow the students to understand how a solid foundation in the fundamentals will enable them to be creative problem solvers in traditional and non-traditional areas of chemical engineering, which in turn will help them become successful engineers. The material and energy balance class begins with the instructor introducing themself, sharing their industrial experiences, expectations for the course and enthusiasm for chemical engineering. It is important that our students understand that we ***care*** about them and are ***vested*** in their success in studying engineering[13, 14] – the first day of class, pictures are taken of each student and they provide their name, phonetic spelling, preferred pronouns[15] and a fun fact on an index card. The instructor can be found studying these 'flash cards' to learn each of their names within the first week of the semester. The first assignment is to write their bio, so that the instructor can get to know them personally, as well as to learn about their future aspirations – so that we can better help them find the right research experience, internship, or co-op to help them accomplish their goals.

Students are provided with a detailed course schedule and syllabus with learning objectives which are tied to ABET (Accreditation Board of Engineering and Technology) student outcomes related to the course. We are transparent in how they will *earn* their grades and the class policies. Due our commitment to establishing a professional and ethical[16] environment, the instructor is explicit in what is considered cheating and what kinds of collaboration are acceptable. One of their early assignments requires them to review the university academic integrity policy and understanding of situations which are in violation of this policy. Active learning[17] is incorporated into the class – and time is taken to explain what it is and that it leads to deeper learning and understanding than traditional teaching methods[17]. In small groups, students work through *many* example problems as they gain their '10,000 hours' of practice[18] to become successful chemical engineers. They are motivated to learn what they are being taught – for example, the class starts by brainstorming a common chemical to produce, and drawing on their knowledge of chemistry, what raw materials that can be used – in small groups they come up with possible steps in the process and then together we create a process flow diagram – over the course of the semester, they master material and energy balances on splitters, distillation columns, pumps, compressors, furnaces, reactors with recycle, etc. On the last day of class, we revisit the process flow diagram that was created on the first day of class, to help them understand how what they have learned provides the foundation of becoming a successful chemical engineer. This process flow diagram is revisited with the same students in the capstone process design course – so that they can reflect on their progress – and then use their critical thinking skills through process synthesis and design each piece of equipment required for the chemical process that each team will design.

An important aspect of the material and energy balance and corresponding laboratory course (since 2021) is that we hire Undergraduate Teaching Fellows[19], who are senior-level chemical engineering students, who provide weekly students hours to assist with the homework assignments and design project testing, as well as grade the homework assignments. The Fellows are recruited by the instructor and have demonstrated both collaboration and leadership in the classroom and their ability to work well with students due to their previous experience in taking the core courses and laboratory courses.

UBelong

During the second class period of the material and energy balance course, the students are engaged in the UBelong Ecological Belonging Intervention[20] activity (since 2023). This program aims to establish a classroom norm that adversity in the course is common and temporary, and that students from marginalized backgrounds can succeed. The activity is grounded in the concepts of belonging uncertainty and stereotype threat, which are psycho-logical states that can negatively impact academic performance. We deploy it in an engineering context to address issues of social belonging, stereotype threat, and underperformance among marginalized students. The activity aims to disrupt these negative feedback loops and promote a positive sense of belonging and resilience.

The activity is implemented as a reflective classroom exercise and engages students in discussion around the message that social and academic adversity is normative and surmountable in six steps. *Step 1. (5 mins)* Students form teams *Step 2. (5 mins)* Activity introduction: "It can be easy to feel overwhelmed or to sometimes wonder to yourself 'do I really belong here?'" *Step 3. (10 mins)* Independent reflective writing activity – What has your experience been like in engineering so far? Take a few minutes to write about the challenges you have experienced in your transition into chemical engineering, and how these experiences have begun to change over time. *Step 4.* (*5 mins*) Students listen to stories from former students that discuss adversity & overcoming challenges. *Step 5.* (*10 mins*) Small groups discuss their writing and the quotes. *Step 6.* (*5 mins*) Class-wide discussion.

UBelong Story Sample: "I literally failed the first exam. I spent so much time re-watching the videos and working through problems, and I still failed. I was like, why am I even here? I ended up reaching out to my instructor, and she gave me some great advice. She helped me think about the exams in terms of the learning objectives and using those to guide how I was studying. For the second exam I started studying earlier, but I focused on really understanding the important concepts and how they applied in each problem instead of breaking down each and every problem step for hours on end. And I got an A! Figuring out how to study and putting in the work really paid off, and I learned that I can do it. If I can, you can too."

Results from the intervention[20] among 1,800 college students at Pitt showed promising outcomes. The reflection activity successfully reduced performance gaps in Biology I and Physics I. The experiments showed both short term (e.g., improved course performance) and long term (e.g., improved one-year retention) benefits for students who received the intervention versus the control. The benefits of the intervention were most pronounced among student-groups that were identified through qualitative interviews and archival data analysis as prone to underperformance in the course. Specifically, the intervention eliminated race/ethnicity achievement differences in Biology I (predominantly pre-med students), and gender and race/ethnicity achievement differences in Physics I (predominantly engineering students). The results were replicated for course performance in a first-year engineering coding course at Purdue and in macroeconomics at Pitt. They also found enhanced sense of belonging for Black, Latinx, and Indigenous students in engineering at Purdue and study behavior benefits at Pitt in macroeconomics. They are currently examining retention in these courses and will also be testing the benefits of the intervention in organic chemistry, general chemistry 2, and genetics at Pitt, and at UCI in engineering where the intervention has been implemented.

Group Quizzes

For student success, it is important to provide frequent feedback – a variety of opportunities are provided for them to receive this feedback (since 2016) – from in-class concept questions using Top Hat to weekly group quizzes[21] to homework assignments (typically two assignments per week) to frequent exams (three exams and a comprehensive final) and semester-long design projects. Each of these assessments are connected to the course learning objectives and are designed to evaluate various levels of educational objectives[22]. If students receive frequent feedback on low-stakes assessments (concept questions, homework, and quizzes) then they will be less anxious for high-stakes assessments (exams). For each of the exams, students are provided a study guide, in-class review and a practice exam (exam from the previous year). The exam solution for the practice exam is not provided – however, questions are encouraged and always answered during class, student hours or review sessions. In addition, the Teaching Fellows, in conjunction with our student chapter of AIChE, host a review session before each of the exams and final exam. Since they all have experience with taking this course, they provide helpful review problems (which are reviewed/approved by the course instructor) for the upcoming exam. Grading rubrics are created to ensure consistent grading, the graded exams are always returned during the next class period, and the solution is reviewed.

Hands-on Design Project

We also believe that it is important for students to experience an active learning and hands-on engineering design challenge. Because of the instructors' industrial experience, the importance of learning teamwork skills and communication skills are an important part of the course. CATME[23] is used to create equitable teams and provides the platform for peer evaluation and feedback. In addition, the design teams are required not only to research, design, construct, evaluate, test, and present their product, but also to develop a mathematical model of their product's performance[24]. We believe that it is important that the students have a fun project to design and *build*, but they must also develop a mathematical and physical understanding of the fundamental engineering principles which make their design successful. Because of our commitment for students to experience project-based inductive learning[25], which requires students to design and to think creatively and critically – which is what they will be required to do as engineers – it has become a hallmark of the hands-on design challenges which have been used in the material and energy balance course (since 2016). Check lists for written reports and grading rubrics for reports, projects, and presentations are also provided. In addition, the design project is broken into chunks so that students can receive feedback several times during the semester long project – this enables them to reflect, iterate and improve their design.

After First Exam

It has been our experience that students do not perform as well as they anticipate (hope) on their first exam in the material and energy balance course. This is typically their first engineering course which is not a review of material that they learned in high school, and they are required to integrate learning from multiple difference courses (chemistry, math, physics and chemical engineering) – and they are required to synthesize/apply information, rather than just recall information. We remind the students that a single exam does not define them and review the difference between studying and learning. We also discuss Bloom's Taxonomy[22], the benefits of active learning, group quizzes, and how to implement the Study Cycle[26] (shown in Figure 2). Students are also encouraged to read articles on test taking tips[27] and checklist[28] for students who are disappointed in their exam scores. Towards the end of the class period (without the course instructor present), the Teaching Fellows and other seniors who struggled on their first exam, are invited to attend class and share their experiences – which often times resulted in them learning how to study and learn the material – and many of whom went on to earn an A in the course. Students who earn less than a 50% on an exam are encouraged to complete exam corrections and thereby are eligible to earn up to 35-50% of the points that they did not originally earn on the exam. The final exam in this course is comprehensive – and students are allowed to use their final exam score to replace a lower exam score for exams 1-3.

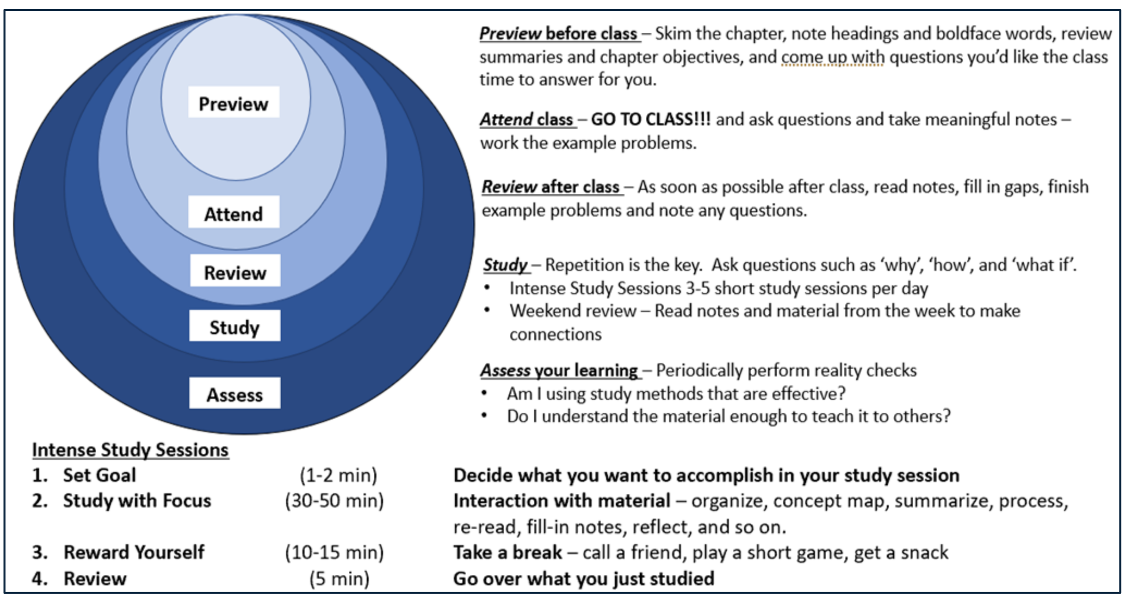

Figure 2: The study cycle[26] adapted from F.L. Christ.

Engagement Shaping: Get Your Ducks in a Row

It has long been acknowledged that student persistence and success in college can be linked to sustained contact with a single significant person[29]. Traditional approaches to advising and mentoring often frame the relationship in terms of passive transaction, with the significant person imparting knowledge in exchange for student compliance to directives. In an effort to disrupt traditional roles and lower the threshold to advisor access, we began a term-long, building wide treasure hunt. Engineering students can experience significant stress[30] and we have informally observed that the second term can bring a kind of capitulation to academic fatalism to the student experience, especially as the time to commit to competitive summer professional development opportunities like co-op and internships draws closer. Our spring undergraduate seminar couches its focus on time-management and organization, academic success and professional development preparation in a tongue-in-cheek pun to, "Get Your Ducks In A Row." Using humor and light-hearted, even juvenile, imagery and props evocative of much younger childhood experiences, what we actually are offering is a casual way to connect with high-impact practice advice and STEM learning spaces.

Throughout the spring term, our students are invited to seek and return miniature plastic ducks to the advising manager's office, claiming in return a "Duck Buck" to be entered into the "duck pond" (a duck-shaped infant tub), shown in Figure 3. At the end of the term, evocative of many K-12 classroom celebrations, prize winners are pulled from that pool of duck bucks during an all-class party. Participation is voluntary, is not attached to attendance or similar compulsory evaluation, and every student in attendance at the end-of-term event receives at least a token prize. The over-arching goal is to foster familiarity and connection with the engineering environment as a third space[31].

Figure 3. Ducks, Duck Buck and Duck Pond

While on the surface we merely sustained a ten-week hunt for miniature plastic ducks hidden in student study, classroom, faculty advising, and similar high-impact practices spaces, in practice this seemingly juvenile class activity meant that students were regularly cycling through the academic advising managers office to return tokens and claim prizes. They were regularly showing up to classroom spaces early to hunt ducks, forming teams and break plans to explore the building. Chemical engineers were, in the hierarchy of student opinion, viewed as "lucky" by engineering peers for having the opportunity to embrace a game as part of their curricular activities for the term, giving them a sense of connected group identity. Lastly, weekly updates and the continuation of the labored punning reduced the threshold of access to holistic advising practice. Engagement shaping sounds technical, but silliness is accessible. Students had more low-stakes reasons to be in contact with high-value mentoring and through that lowered threshold, were able to become comfortable in their student spaces. A visit to the administrative office to complete gaming transactions is often closed with questions or clarification of policy, connection offered to campus resources, or students sharing personal updates. Imparting a literally transactional, lighthearted game into the learning space gives students the opportunity to become familiar and comfortable enough with the department advisor to then explore more vulnerable or higher stakes questioning during formal advising and mentoring periods. We know that student persistence and success is related to the extent in which students interact with support adults on campus[9]. Change happens at a pace relevant for the people involved – we are not ahead of or behind each other; we are in a million small experiments taking shape at once[32]. Injecting collegiate spaces with mild mischief and merriment as a way of fostering interactions is a small experiment in disrupting anxiety, staid pedagogy, and prescriptive thinking.

Results and Conclusions

While we are in just the first two years of some of these initiatives, we have received early positive results from these efforts. For example, the overall student rating for "the instructor creates an inclusive learning environment for all students" was an average of 4.89/5.0 (138 students) in the material & energy balance course and was 4.95/5.0 (140 students) in the senior seminar.

Some of our seniors provided their consent to share the following comments regarding the senior seminar:

- "The professor offered meaningful advice on a variety of things that will assist the senior ChemEs transition to full time
- Provided panels of graduates to share their stories and answer questions
- The instructor tailored the material toward the graduating seniors and made it applicable to our future, so the information was easier to retain
- We got great guest speakers and kept the class engaged!
- Loved the speakers and the finance seminars
- The instructor creates a very welcoming and supportive environment that encourages the exploration of ideas
- I like the way the instructor presented the modules; it kept us engaged. We now know what sides the bread and drink go on (at a formal dinner), (and) to max out our 401ks. It was actually really helpful.
- The instructor provided extremely valuable knowledge this semester about finance, careers, practical life skills and etiquette that will surely benefit me after graduating. To learn from this instructor is a privilege."

In addition, we had a very successful semester end celebration as shown in figure 4. Each student in attendance in the undergraduate seminar received a token prize and department 'merch' was awarded to the duck buck prize winners which were drawn from the duck pond. But more importantly, we are building a broader sense of community with our students in chemical engineering where they are thriving and feel that they belong and are demonstrating they can be successful.

Figure 4. Semester End Celebration of "Get Your Ducks in a Row"

In the presentation of this paper we will include results from our senior exit survey (completed by students who have engaged in our programming for the last two years) for comparison with students who did not have the opportunity to participate (prior to when some of these initiatives were incorporated).

References:

1. Meyers, K., Uhran, J., Pieronek, C., Budny, D., Ventura, J., Ralston, P., Estell, J. K., Slaboch, C., Hart, B., and R. Ladewski, (2008), *Perspectives On First Year Engineering Education* Paper presented at 2008 ASEE Annual Conference & Exposition, Pittsburgh, Pennsylvania. 10.18260/1-2-3740
2. Mena, I. B., & Sanchez, D. V. (2017), *Perceptions of Academic Integrity of Students in a First-Year Engineering Program* Paper presented at 2017 ASEE Annual Conference & Exposition, Columbus, Ohio. 10.18260/1-2—28736
3. https://www.studentsuccess.pitt.edu/advising-framework
4. Bullard, L.G., (2015) personal communication.
5. Bullard, L.G., (2024) https://cbe.ncsu.edu/bullard/electronic-etiquette/
6. Sethi, R., (2019) *I Will Teach You to Be Rich: No Guilt. No Excuses. Just a 6-Week Program That Works (Second Edition)*. Workman Publishing Company, Incorporated.
7. Kafka, A. (2018, October 9). How faculty advisers can be first responders when students need help. The Chronicle of Higher Education. https://www.chronicle.com/article/How-Faculty-Advisers-Can-Be/244757
8. Williamson, P., Trask, D., Williams, M., Park, J., Zarges, K., & Steele, G. (2018, September 25). Flip Your Advising! Advance Advising as a Teaching and Learning Experience [PowerPoint presentation]. http://apps.nacada.ksu.edu/conferences/ProposalsPHP/uploads/ handouts/2018/C071-H01.pdf
9. Kuh, G. D., Kinzie, J., Jenifer A. Buckley, Bridges, B. K., & Hayek, J. C. *What Matters to Student Success: A Report of the Literature*. https://nces.ed.gov/npec/pdf/kuh_team_report.pdf.
10. Bettencourt, G. M., Manly, C. A., Kimball, E., & Wells, R. S. (2020). STEM degree completion and first-generation college students: A cumulative disadvantage approach to the outcomes gap. *The Review of Higher Education, 43*(3), 753-779. https://doi.org/10.1353/rhe.2020.0006
11. McCarthy, J.J. and R.S. Parker (2004). Pillars of Chemical Engineering: A Block-Scheduled Curriculum. *Chemical Engineering Education*, 38 (4), 292-301.
12. Top Hat (2024, Dec 31). Retrieved from https://tophat.com/
13. Astin, A.W. (1993). *What Matters in College: Four Critical Years Revisited*. San Francisco: Josey-Bass.
14. Addy, T. M., Dube, D., Mitchell, K. A., & SoRelle, M. E. (2021). *What Inclusive Instructors Do Principles and Practices for Excellence in College Teaching*. Stylus Publishing (VA).
15. ASEE Safe Zone Ally Training Workshop (2015).
16. Carpenter, D.D., Harding, T.S, Finelli, C.J. and H.J. Passow (2004). Does academic dishonesty relate to unethical behavior in professional practice? An exploratory study. *Science and Engineering Ethics*, 10(2), 311-324.
17. Prince, M.J. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93 (30), 223-231.
18. Gladwell, M. (2008*). Outliers: The Story of Success*. Little, Brown, and Company.
19. Bayles, T.M., (2004), "Improving the Freshman Engineering Experience", Paper presented at the American Society for Engineering Education Annual Conference & Exposition. Salt Lake City, UT.
20. Binning, K.R., N. Kaufmann, E.M. McGreevy, O. Fotuhil, S. Chen, E. Marshman, Z. Yasemin Kalender, L.B. Limeri, L. Betancur, and C. Singh, (2020) "Changing Social Contexts to Foster Equity in College Science Courses: An Ecological-Belonging Intervention," *Psychological Science*, Vol. 31(9) 1059–1070. DOI: 10.1177/0956797620929984.
21. Bayles, T.M., (2020) "Teaching Tip: Group Quizzes to Promote Collaborative Learning", *Chemical Engineering Education*, Volume 54, Number 2, pg. 51.
22. Bloom, B.S. and D.R. Krathwohl. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals by a Committee of College and University Examiners*. Handbook 1. Cognitive domain. New York: Addison-Wesley.
23. Comprehensive Assessment of Team Member Effectiveness (2024, Dec 31). Retrieved from https://info.catme.org/
24. Bayles, T.M., (2022), "Hands-on Project Based Learning Design Project to Accommodate Social Distancing and On-line Learners," Paper published and presented at the American Society for Engineering Education Annual Conference & Exposition, Minneapolis, Minnesota.
25. Prince, M.J. and R.M. Felder, (2006). Inductive teaching and learning methods: definitions, comparisons, and research bases. *Journal of Engineering Education*, 95 (2), 123-138.

26. Christ, F.L (1997). “Seven steps to better management of your study time.” Clearwater, FL: H&H. Louisiana State University, Center for Student Success (2015). “The Study Cycle: The Path to Improving Study Techniques.” Accessed June 9, 2020.
27. Felder, R.M. and J. E. Stice, (2012) “Random Thoughts: Tips on Test Taking”, *Chemical Engineering Education*, Volume 48, Number 1, pages 57-58.
28. Felder, R.M., (1999), “Random Thoughts: Memo To Students Who Are Disappointed with Their Last Exam Grade”, *Chemical Engineering Education*, Volume 33, Number 2, pages 136-137.
29. Chickering, A.W. and Gamson, Z.F. (1989), Seven principles for good practice in undergraduate education. Biochem. Educ., 17: 140-141. https://doi-org.pitt.idm.oclc.org/10.1016/0307-4412(89)90094-0
30. Jensen, K.J., Mirabelli, J.F., Kunze, A.J. *et al.* (2023) Undergraduate student perceptions of stress and mental health in engineering culture. *IJ STEM Ed* **10**, 30. https://doi.org/10.1186/s40594-023-00419-6
31. Whitchurch, Celia. *Reconstructing Identities in Higher Education : The Rise of 'Third Space' Professionals*, Taylor & Francis Group, 2012. *ProQuest Ebook Central*, https://ebookcentral.proquest.com/lib/pitt-ebooks/detail.action?docID=1075438.
32. Brown, A. M. (2017). Emergent strategy: Shaping change, changing worlds. AK Press.