

Faculty Development by Design

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Abstract

Based on fourteen years of work by the McCormick Teaching Excellence Institute in Cornell Engineering (MTEI), this evidence-based practice paper presents a framework for planning programming focused on engaging all our engineering faculty with their own next step towards teaching excellence.

As an R1 school, most of our tenure track engineering faculty are focused on research, but they are also aware of the growing push towards more student-engaged teaching methods than pure lecturing. However, perceived barriers (especially time) frequently limit actual, personal change.

We have developed a teaching pyramid that categorizes teaching levels by competence and expertise. Measuring resources and programming against this pyramid ensures our focus on actionable next steps across a wide range of faculty teaching performance.

The focus at each level is on the teaching, the course, and the students, not a judgement of the professor. These teaching levels are weak, basic, solid, engaged, inspired and inspiring. At each level it is important to recognize the strengths of what is being done and to lower barriers for faculty implementation of next steps toward research-based best practices. The levels help with identifying specific approaches to improving a particular course, by focusing the limited faculty time on the most important aspects to fix. Over multiple semesters these strategic steps can move the teaching of a course up a level.

The teaching pyramid can also be used as part of assessing the teaching center. Are there programs that support faculty at each level? Do the programs help faculty or courses move up a level over time? Are any faculty consistently in the lowest level and how is that being addressed? Are there any patterns of courses or classrooms often showing up at the lowest levels and what support is needed to make changes?

In summary, this paper shares a teaching pyramid framework for thinking about teaching improvements, for planning programming to meet faculty where they are with enable actionable next steps in moving towards teaching excellence, and for assessing the teaching center.

Introduction

The mission of our teaching center is to improve the quality of teaching across the engineering college. This means reaching the majority of courses and most of the faculty each semester to support incremental progress towards excellence. Even spectacular courses need occasional support such as pre-planned room scheduling or someone with whom to discuss a new approach. With faculty focus split between teaching, research and service, teaching support and progress needs to be packaged in a way that is incremental and efficient, while building towards excellence. Changes must show value and be adoptable within faculty time constraints.

Initially, as a new program, it made sense to work with the faculty who directly asked for help or whom the department chair sent for help. Over time it became clear that this approach reached two pools of faculty: those most engaged in teaching who chose to engage with the teaching center and those who were really struggling with teaching and needed significant assistance.

Adding teaching workshops for new faculty leveraged their desire to excel at a time they were willing to learning research-informed good practices. However, these efforts rarely reached the established teachers whose courses could benefit from incorporating more research-informed teaching methods, but who did not typically engage with a teaching center. Thus, we needed to re-examine our programs using an overarching view to ensure we were reaching nearly all faculty across the college.

Based on multiple years of working with various classes and faculty, a pattern emerged of several different categories of courses and teaching issues. This is not a full evaluation of individual teachers as described by Little, Goe and Bell [1], but rather defined categories of teaching as a functional approach to considering how the center interacts with many faculty across the college. The types of interactions with faculty and the needed support generally match the categories. We formalized these categories into a teaching pyramid that defined six categories or levels of teaching. Interventions and support are described for each level. By specifying levels in terms of skills and student engagement, we explicitly support a growth mindset for teaching as faculty can learn and improve and up levels. Finally, the teaching pyramid can focus teaching center assessment on whether we have relevant programming for each level and its effectiveness at helping faculty move up a level.

Thus, the teaching pyramid has four main uses:

- Identifying the teaching level of a course,
- Focusing initial assistance based on what has been most useful for that level,
- Monitoring teaching center to programs to ensure each level is reached by programs, and
- Illustrating a change model of teaching as the gaining of attainable skills.

The approaches we developed empirically include aspects from all 6 of the “components of change” in the review paper on instructional change by Cruz, Hampton, Adams and Hosseinichimeh [2]: cultural, change management, institutional support, pedagogical knowledge and skills, student experience, and faculty motivation. Cruz et al. describe a complex systems approach rather than a single, linear change model. Which of the six components of change are most important varies across our teaching levels, but all are relevant within the entire faculty cohort or the steps needed to move from a weak or beginning teacher to an inspiring teacher. Thus, our mapping various types of faculty support to different levels of teaching is consistent with their complex model. In comparison, our mapping of programs to teaching levels in order to ensure programs reach all teaching levels is much simpler than the full, teaching center effectiveness-methodology described by Wright [3] and has thus been easier to implement with a very small teaching center. Cook and Marincovich recommend teaching centers at research universities focus on innovation, cutting-edge teaching techniques and leadership’s priorities [4]. They encourage developing programs that are time efficient for faculty such as within departments, or focused on specific faculty ranks, or specific skills or technologies. The mapping described in this paper doesn’t preclude that focus but rather provides a countering balance to also be sure to include programs and support that addresses faculty where they are in teaching skills. Austin describes how to support faculty members at different stages of their

careers [5] whereas the teaching levels approach focuses on where faculty are in their individual teaching development.

This paper describes our teaching pyramid framework and resulting uses.

The teaching pyramid levels

The teaching pyramid in Figure 1 shows six levels of teaching. While six levels are somewhat arbitrary, there are distinct aspects of each of these levels. The base of the pyramid shows the weakest teaching level and a few descriptors for it. Each successive level upwards describes increasingly stronger teaching. At the top is teaching that inspires the students beyond the course. Because an instructor can teach different courses at different levels, and a course can be taught differently by various instructors, we typically address instructor-course pairs rather than just an instructor or just a course. The pyramid or arrow shape indicates a growth in skills building up from a base level, rather than the number of teachers at each level.

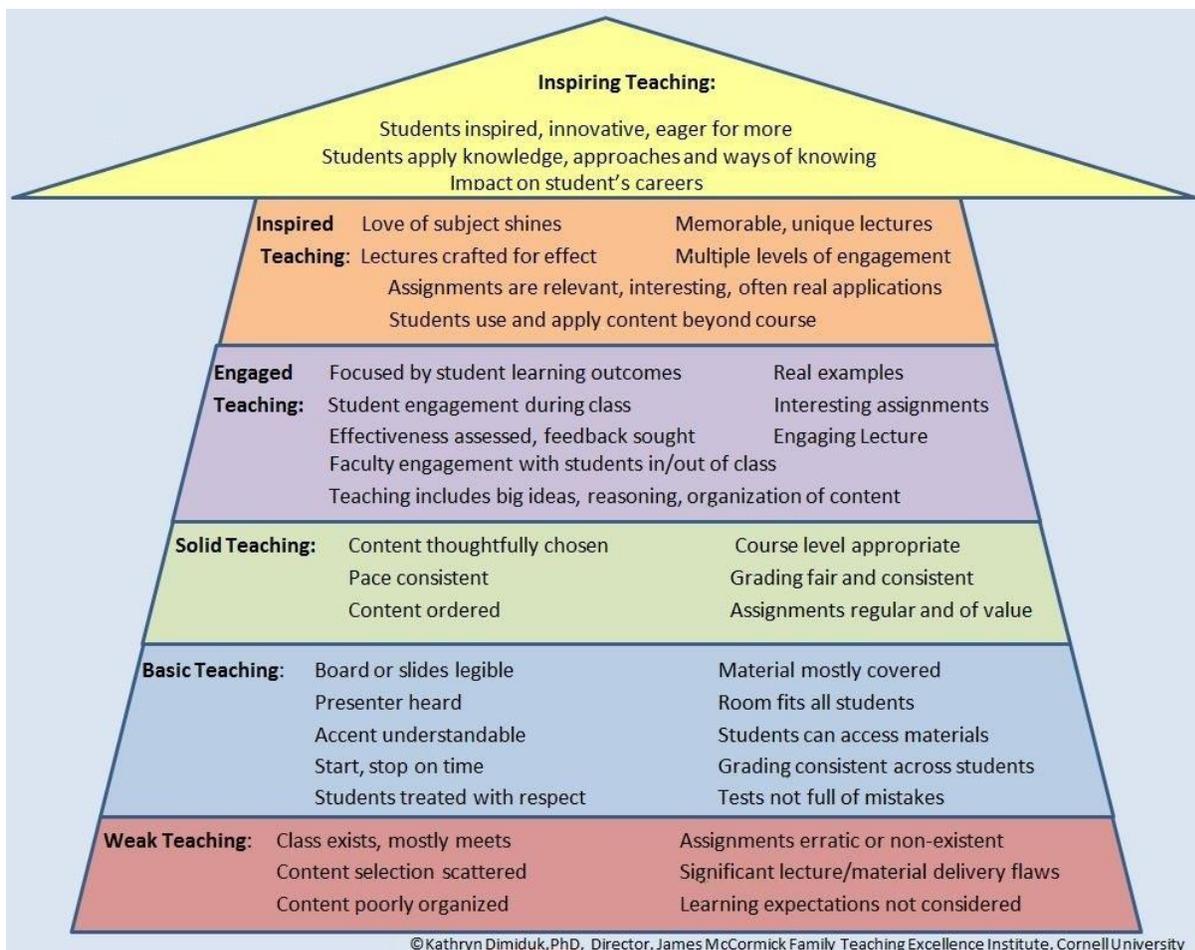


Figure 1. Teaching level pyramid.

Weak teaching – Weak teaching covers courses that are failing at very basic levels due to poor design of the course itself or poor implementation of the design. Some common errors at this level include lack of any overall course plan, little thought into how the pieces of the course

connect with each other, insufficient attention to what the students will be doing with their time on assignments outside of class, basic problems with delivery of the lecture content, and a general sense that the instructor may not have put in enough time and thought into the overall course. New instructors with little training can often fall in this category because they lack the experience to know how to avoid basic problems and how to plan and integrate all aspects of a course. These courses rarely have learning objectives created by the instructor. If a prior instructor created learning objectives, the current instructor doesn't engage with them. The chosen pedagogy may not match the content or the physical classroom and AV resources. The technology might work so poorly that it impedes the ability of the instructor to convey the content to the students; students might not be able to hear the instructor or read what the instructor writes or has on slides. The result is the students are not receiving the content. Or maybe the students can see and hear but the content is just stream of thought from the professor without any indication of content organization. Other issues can include not class starting and stopping on time, the instructor not knowing how to use the technology in the classroom, few examples, scattered or poorly written assignments, poorly designed exams, and little engagement with the students. A curve may pass students, but they aren't learning what they need to know.

Basic teaching – In this category the basics are right: classes meet on time, the students can hear and see, they can read the slides and the writing on the board, assignments are given regularly, the content has some inherent organization, but the course doesn't really engage the students. This course may have learning objectives, possibly set by the department, and it will cover the prescribed content. The professor will roll through the various topics as scheduled, whether or not students are learning.

The pedagogy is often very straightforward lecture; the teacher talks the entire class period with neither an engaging delivery nor an effort to engage with the students. The explanations are there, but they don't particularly connect with the students. The material is often very dry so while there's nothing terribly wrong, the course just isn't working well for student learning. The students likely view the course as a rite of passage; it is likely a required course, so students get by with learning what is needed to do to pass the tests and then forgetting much. Likely they are saved by a curve.

Solid teaching – Courses with solid teaching are often the most common in a department. These tend to be core courses that meet the requirements as they move students through the curriculum. The courses follow a schedule, pace the material and assignments reasonably, have content that fits the curriculum and are graded fairly. There is a plan for the course and individual lectures, though there may or may not be articulated learning objectives shared with the students. There is nothing really wrong with the course, but there is nothing really inspiring either. Students work the way through the material; they learn something, and they feel like they're learning. But they are not learning as much as they could be, and many are not excited by what they are learning. Many will have difficulty applying the material in a new situation. Often the material needs a bit of updating as the examples may be older and feel stale; even though still valid, they are not exciting to the students. The course works, but is static and boring, with the status quo accepted. Easily overlooked, these course and teachers need to be drawn into improvements.

Engaged teaching - Engaged teaching has all the strengths of solid teaching, but, in addition, it engages the students more with the ideas and content. Lectures usually include active learning thereby causing the students to think more deeply about the material, bring up questions and address misconceptions. Examples feel current and connect to student interests. Learning objectives likely focus the course and allow effective assessment of whether the students are learning the material. The instructor specifically teaches the big ideas, not just the details, and shows the students the structure of the content they are learning. Often there's an effort to show the students where they can apply this material beyond the course. The instructor focuses on explaining, not just covering the material and actively engages the students with thinking about the content. This is apparent in the assignments as well as the lectures.

Inspired teaching – This level describes courses students look forward to. The classes are interesting, students are engaged, content feels relevant and fits the curriculum well. The instructor has chosen a pedagogy that works for themselves and for the students. Students enjoy class, learn well, and engage with the content. Teaching is thoughtful, focused and interesting. The classroom and AV are functioning well for the class, or at least not preventing, the pedagogy that the instructor is using. Some faculty at this level may read engineering education literature, attend teaching workshops, attend conferences such as ASEE and most are interested in learning more about teaching. These instructors are often open to new ideas and willing to attend a teaching center workshop. They are open to considering research-based information and whether a different pedagogy or method might be more effective. They are generally willing to at least experiment with new ideas and test them in their own class.

Inspiring Teaching - Inspiring teaching goes a step beyond inspired teaching. While inspired teaching focuses on the instructor teaching well so that students engage and enjoy learning, inspiring teaching focuses on the students being inspired to excel beyond the course material and to use the content and skills beyond the course. This is the teacher whose course sticks in your mind 10 years later when you're solving a problem and you remember something from that course. It's the course that helps you select your major or informs your direction after graduation.

Teaching center interventions and support matched to teaching levels

The types of support and interventions needed for teaching differ at each level. This is captured in the Programming Pyramid, Figure 2, which matches the Teaching Pyramid. The Programming Pyramid serves the dual role of focusing on effective support at each level and, also, enables a cross-check that there is programmatic support at each level. We use mid-semester student feedback, both numeric and comments, from nearly all courses in the college to match courses and needed support. Our mid-semester feedback program is described by Dimiduk et al. [6].

Identifying the Teaching Level and matching Programming Pyramid Level serves as a reminder of what to focus on at each level. For example, for weak teaching, focus on fixing very basic logistics issues rather than going after pedagogy. For Basic and Solid Teaching, start to work on course organization, lecture flow and experimenting with developing student engagement through active learning techniques. Pedagogy discussions can start following experimentation

with active learning. Engaged teaching uses a thoughtful pedagogy and is more likely to need only fine tuning and adding some variety to the active learning. At the Inspired and Inspiring Teaching levels, teaching center personnel serve more as a sounding board for teaching ideas and how they might be implemented in a particular course. While confirming the basics are all solid is necessary, work is more likely focused on assisting with classroom infrastructure and college level issues and with providing opportunities for faculty to share what is working so well for them. Details of working with each level are given in the following paragraphs.

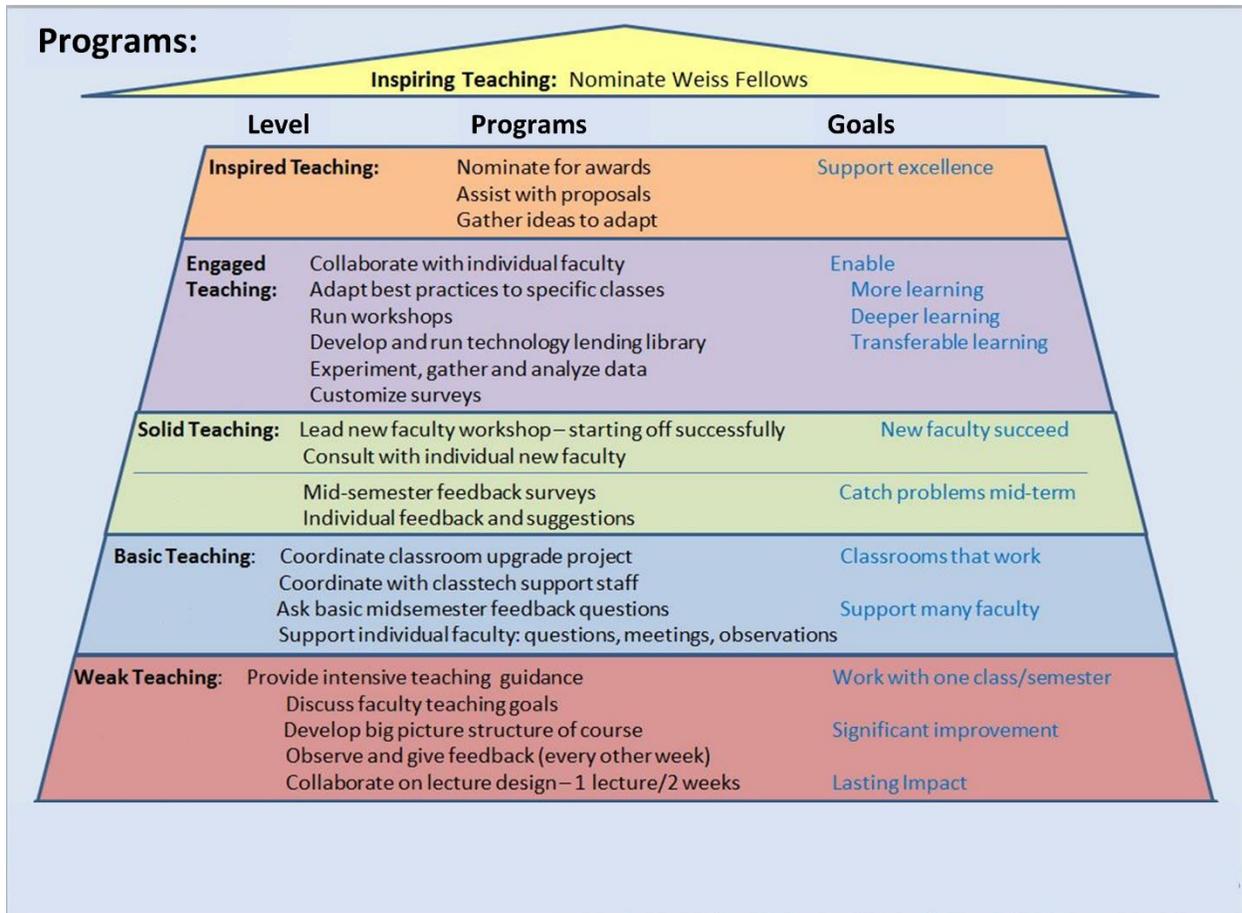


Figure 2. Programming support pyramid aligns programs with teaching levels.

Weak teaching - Intervention at the weak teaching level often starts with information from student complaints. Then the instructor is contacted and permission to observe the class is requested. Lecture delivery issues are noted and 2-3 chosen to discuss with the instructor. Change is more likely when presenting 2-3 issues that are easy to fix, rather than presenting an overwhelming list of what it would take to be great. The course structure may also be problematic, but it is harder to fix mid-semester so just mention that it is worth discussing before next teaching the course. Specific assignment or exam issues can be addressed at a later meeting. Then, observe the class again in 2 to 3 weeks looking for progress on the initial, suggested improvements and looking for another class delivery item to add to the working list.

Noticing improvement is a good starting point for the next discussion. Ideally the first changes are now routine, and another change can be the focus for the next couple of weeks. Repeat this periodically across the semester. While this will not create a great course this semester, it will introduce the professor to the notion of making step-by-step progress and provide steps they can actually accomplish. Focus on a goal of moving the course up to basic teaching and out of weak teaching.

Across a couple of semesters, an instructor who is willing to work on small incremental steps can build a weak course up to a solid course. Instead of being overwhelmed with all the necessary changes and thus doing nothing, the instructor has a detailed, manageable roadmap to solid teaching by building specific teaching skills. If there is midsemester student feedback to work with, this can inform choosing steps that particularly impacts students; it reinforces for the instructor that these details matter to students and are worth fixing. Students appreciate efforts to improve the course which are often reward it in student course evaluations. Course design planning and syllabus review then precedes the next semester's course.

Basic teaching- Intervention and support for basic teaching starts with meeting with the instructor to first understand how they see the course, followed by observing a class. Initially address any simple logistics issues. This may involve solving issues with the classroom or AV support such as using a microphone. Then make one or two specific lecture delivery improvement suggestions that support accomplishing the instructor's goals for the course. Assignments or communication issues brought up in student feedback may need to be addressed. Plan a return visit later in the semester to address next steps in lecture organization or delivery. Once the lecture delivery doesn't have any significant issues, seed the idea of a simple active leaning addition to engage the students, typically either Think/Pair/Share or polling or an intro hook. Work with the professor to create a prompt to add to a future lecture (actually co-create that question for use in a future class). The goal is to help them create something that they can successfully implement in a future lecture rather than critiquing how boring a previous lecture might have been. Follow up on the activity and offer to help design another, including discussing any issues with implementation.

Offer a planning session for a course the following semester. That is the time to address any basic course organization issues and encourage the regular inclusion of a little active learning (maybe once per week initially).

Solid teaching – This is often initially the largest group within a department, so effort includes individual instructors and this cohort of instructors more broadly. Over time, this group will shrink as faculty move up the pyramid.

Work with individual faculty - There is a common flow to individual coaching sessions. Typically, these instructors have been teaching long enough they have the basics under control, which mid-semester student feedback can confirm. Strategies include: 1) individual meetings to help tailor an approach to a specific course, 2) pointing to student feedback requesting making the course more engaging or other specific issues, and 3) encouraging attendance at a teaching center workshop to learn more about a particular technology or method. Explain several methods of addressing an issue and engage in a discussion of which would best fit the course.

Often a potential solution is adding simple active learning such as Think/Pair/Share or Brainstorming or Polling. For whichever seems most promising, discuss details of writing the prompts and implementation tips. Showing a key figure from a paper on active learning such as [7] can help make the case that change is worth considering. For these faculty there is often a journey from learning some new approaches, considering how they might work in their course, experimenting in a low stakes manner with some techniques to see what works for them, to finally incorporating a piece of improved pedagogy regularly.

The goal here isn't a major change, but rather convincing these instructors to experiment in their own class and let them see the immediate feedback and fun of teaching with active learning. For a course that feels stale, encouraging updates to a few examples, maybe one per unit, is easier than facing a course overhaul. Enlisting a TA to help with creating a new example may be an option. Sometimes an offer to help with crafting the first trial activity can overcome resistance to trying something. The goal is to unlock the course a little and experiment with what might make the class work better. Perhaps something can be removed that isn't relevant anymore, or isn't used in later courses, making space for trying something new. These instructors generally do care that the students learn, and they want the students to be able to use the material.

Plant the seeds for change broadly across this group – Package information in bite-sized bits that are quick to consume and sent to all faculty as emailed teaching tips, invitations to teaching discussion lunches on specific topics, and seminars by guest speakers. Introduce the idea that increasing student engagement increases students' ability to remember and use the material later. Share a key figure or research result that might catch attention and start someone pondering a change.

Support exploring potential change – This can be done partially as a shared activity in a workshop on implementing a technology or teaching technique and partially through individual coaching sessions. The breakthrough is trying something in class, even if just for a lecture or two.

Growing the improvement – There are three steps here: demonstrating students appreciate the change, faculty growing more comfortable with the change, developing more activities or question prompts to spread the change across more of the course. This last step may happen over several semesters. It may include adding a second strategy to keep student interest or may just extend the first strategy if it's working well.

Across several semesters, professors at this level can shift their pedagogy by incremental changes. Making small step each semester may be easier to fit into their overall workload than completely revising a course all at once. As the shift grows across the, the teaching moves up to engaged teaching.

Engaged teaching – This level usually has student learning outcomes, active learning, and an instructor who enjoys teaching and who is open to new ideas and approaches. However, faculty time constraints limit major change. Progress comes from easy access to information through teaching tip emails and focused events, lowering of barriers to making and sustaining changes, support for considering implementation logistics, problem solving for specific difficulties, and change friendly classrooms. Instructors are often willing to ask if something doesn't work.

These instructors pay attention to student feedback and learning which this motivates them to keep improving. A little bit of funding or task relief for the additional time and effort to make changes can go a long way at this level. A course redesign grant or effort release can prompt a major course overhaul of both content and pedagogy.

Inspired teaching - These classes and faculty are already very successful. Their class time is full of interesting material, student engagement, and showmanship designed to keep students focused on important details. Faculty will likely know where they need help brainstorming solutions to a particular issue or where a teaching center can leverage a particular teaching need such as redesigned classrooms. The teaching center can be effective in addressing a problem at the college level. This might be engaging with AV and facilities support, planning a classroom redesign, assistance with an education focused grant proposal or component of a proposal. In Cornell Engineering, we pre-book these classes into classrooms designed for specific types of teaching. This has increased faculty willingness to spend the time to redesign a course if they know that they will continue to get a classroom where the redesign works well.

These professors are often open to trying new approaches, attending teaching focused workshops and events and enjoy discussing what they have tried in their class or are considering trying. Coaching sessions are fun, challenging, problem-solving sessions, acting as a sounding board that often leads to action. Class observations are valued as providing another pair of eyes on what is happening in the classroom. These instructors typically look forward to their student feedback, partly because they care enough to see what they need to improve and partly because it is positive and validating as students like their courses.

Encourage and support for nominations of these faculty for university level or external teaching awards. Encourage presentations at ASEE or in education tracks at their discipline-based conferences. Point to course redesign grants or departmental support to spread their approaches to additional courses.

Inspiring teaching – These teachers are already doing a spectacular job inspiring their students to learn more and giving students tools to use well beyond the course content. The focus is beyond an excellent lecture and course and on the field and student's future success. Ideas grow beyond the class as students own the content and take it beyond the classroom. As a teaching center, our job is to provide support or problem solving where needed and provide pointers to new tools, ideas and papers, and share opportunities to disseminate their teaching. For those interested in scaling their teaching further, assistance with applying for grants is valuable. Support departments in nominating these teachers for university level teaching awards and teaching awards at a regional or national level. These are the courses that impact career choices and success well beyond the classroom.

Results - assessing the reach of the teaching center

As a complement to assessing whether individual teaching center programs are effective, it is important to assess whether the overall suite of programs is effective in offering to meet all faculty where they are in teaching. If the goal is to improve teaching across the college, there needs to be support for improvement focused on the needs at each level. First, does the Programming Pyramid have something for faculty at each level. Then how does each program

work at the various levels and are there needs at certain levels that are missing. As faculty move up from the lowest two levels, are there programs that address the next level. Faculty at the bottom two levels are pushed to improve by their students and departments. Faculty in the top 2-3 levels actively engage with improving teaching. Is the large population in the third level, solid teaching, passively ignored as resistant to change, or does programming actively try to connect with them where they are? See Table 1 for a mapping of programming against teaching levels served. The more intense the shading, the more the program engages that population.

Table 1. Table showing teaching center programs and how they impact different levels of teaching. Intensity of the shading in each block shows how much that type of teaching center program typically engages faculty whose courses are at those levels.

Program	Teaching Level					
	Weak	Basic	Solid	Engaged	Inspired	Inspiring
Direct observation						
2-3 direct suggestions						
Course design discussion						
Syllabus review						
Mid-semester feedback						
Teaching Tip Emails						
Discussions						
Workshops						
Classroom design						
Website						
Special room scheduling						
Teaching award nominations						
Proposal support						

From Table 1, we can see that solid teaching is reached by programs that reach all faculty and catches the edge of those for low performers and high performers, but there is very little focused or centered on the solid teachers. This indicated a weakness in our programming as many teachers were at this level at Cornell Engineering and many students had multiple classes at this level when we first did this assessment. We then made changes and added programs to better address the solid teaching level.

Examples of using this approach to strengthen programming – addressing the paucity of effort for solid teachers.

1. Solid teachers need to see value to learning a at least a little about simple potential teaching changes so we added a question regarding teaching professional development to the faculty activity reports. This was possible by tying into a college strategic plan goal of increasing faculty training.
2. Solid teachers need a simple way to meet the faculty development expectations. Our new Engineering Teaching Day offers a menu of teaching workshops prior to the start of classes and that day is protected from department meetings.

3. The solid teachers all receive feedback from mid-semester feedback surveys. The reports are sent out individually from the teaching center with a few individual comments. Thus, if we focus the most effort writing those comments towards the solid teachers, we can find openings to help them improve. We could use student comments to help identify an area for change and seed some possible solutions. We could write the comments to highlight an area for improvement and point to a specific location on our website that provides more information on solution ideas. Tying this to an offer to meet with a specialist who could help devise a sample element could meet those faculty where they are and open the door to real change.
4. Presenting department specific teaching topics at a department meeting reaches the solid teachers where they are and where they feel comfortable.
5. Asking top teachers to lead a Teaching Lunch Discussion on implementation strategies for a teaching approach offers programming for middle level teachers and dissemination opportunities for top teachers.

These additional programming elements are shown in Table 2. Their impact is centered on Solid Teaching so when Tables 1 and 2 are combined, the teaching center’s programming is better spread across teaching levels.

Table 2. Proposed New Programming

Program	Teaching Level					
	Weak	Basic	Solid	Engaged	Inspired	Inspiring
Focused comments on mid-semester feedback						
Add website information on easy techniques to improve a class						
Adding teaching professional development to faculty reports						
Engineering Teaching Day Workshops						
Dissemination Opportunities leading workshops and lunch discussions						

Combining Tables 1 and 2 gives a better balance of teaching center programs. It can be used to show the value of the teaching center beyond just the rating by faculty attendees of their satisfaction with specific programs.

Midsemester feedback informs detailed programming topics as well as course improvement

Midsemester student feedback surveys, when done across the college, can provide aggregate information on teaching. Dimiduk et al. describes a process and the value of surveying all courses [6]. By including all courses, the middle teaching levels are surveyed, not just those

with very strong teachers who want the feedback and the weak teachers who are included as part of an improvement plan. By including all the courses in the middle of the pyramid, issues across middle level teaching can be recognized and inform topics for workshops, events, teaching tip emails, and website topics. Feedback emails to individual faculty can include context from across the college and can point to additional resources and content developed in response to these more general teaching issues. Programming can address specific issues that impact multiple instructors. For example, the teaching tips emailed to all faculty can start by noting something that came up in the feedback for many courses and then provide a suggestion to consider and a link to additional information on a website.

Impact on teaching

After roughly a decade of working with faculty and taking advantage of the insights provided by the teaching pyramid, MTEI has succeeded in moving many faculty up to higher levels on the Teaching Pyramid. Our course evaluations rate teaching effectiveness on a scale of one to five, with five being the top score. Figure 3 summarizes Cornell Engineering scores on overall teaching effectiveness from Fall 2022, by score bins on the right of the figure, and by the percentage of faculty in each bin on the left. We have moved most of the faculty out of the bottom two levels, and only about a quarter of the faculty are in the Solid Teaching bin or lower. The lowest bin covers the 43% of the teaching score range and only 2% of the teachers. The remaining bins each cover 12.5% of the score range.

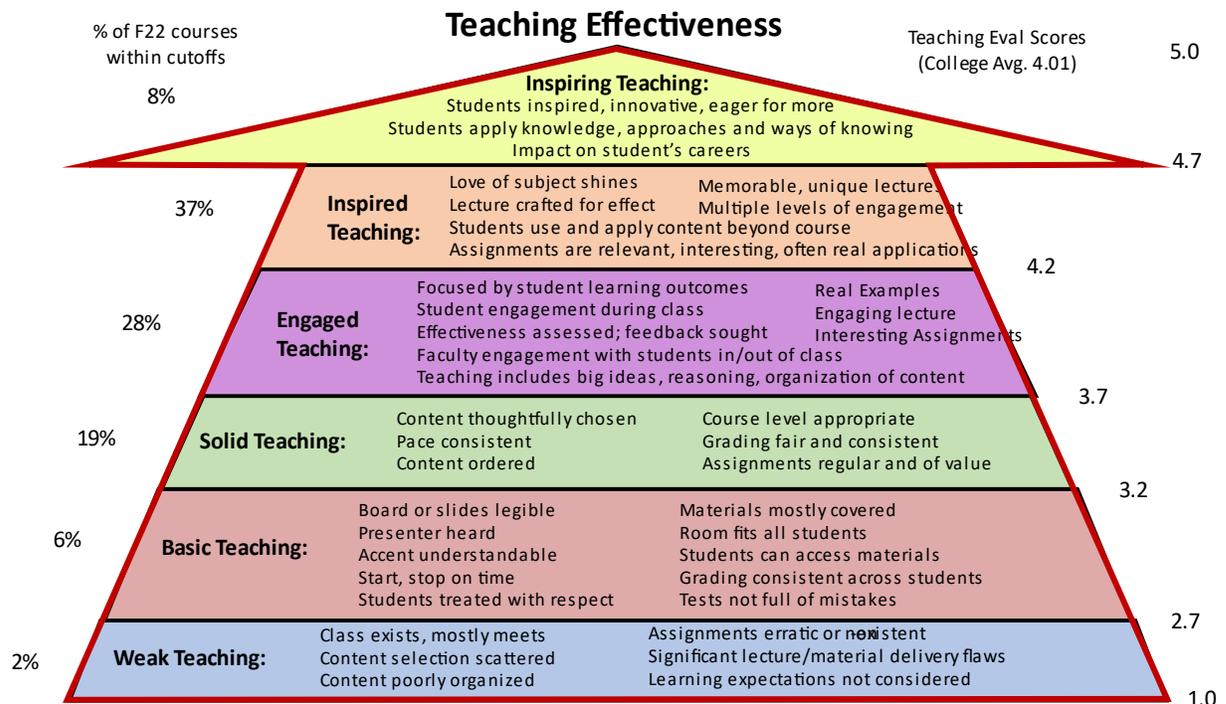


Figure 3. Teaching evaluation score buckets and the percentage of faculty in each bucket.

Conclusions

As a teaching center it is all too easy to fall into working with the faculty who are interested in working with the center and specific faculty that are directed to the center for help, but **that can leave out many faculty who could use some assistance improving their teaching.** For our teaching center to add value to courses across the college and to try to connect with most faculty, in most courses, at least to some extent, we need to be self-aware as to who we are reaching. The Teaching Pyramid distinguishes six different levels of teaching. The Programming Pyramid describes teaching center programming to reach each level and help faculty develop the skills to move up a level in the Teaching Pyramid.

Teaching center programming can be mapped against the teaching levels to help identify gaps in the programming resulting in specific levels that are not well served. Using our teaching center as an example, we identified a weakness in reaching faculty at the Solid Teaching Level and gave examples of programs that were then initiated to better include those faculty. With those additional programs in place, our teaching center has programs directed at all teaching levels. All faculty are reached directly with mid-semester feedback and programming is tailored to provide support at each level.

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