Tidbits

Tidbit - a choice or pleasing bit (as of information)

(Ideas from Chautauqua short course "Enhancing Student Success through a Model Introduction to Engineering Course" – by Raymond B. Landis)

1. "We aren't born knowing how to be effective; we learn how"

This is an idea we all know, but sometimes forget about. It just underscores that we can facilitate the growth of students in being effective students. And it reminds us that many of the strategies and approaches students bring from high school might not be adequate for university engineering study where the pace is faster, the conceptual difficulty is significantly greater, the workload expectations are much higher, and the competition is much greater.

2. "Give a person a fish, feed that person for a day. Teach a person to fish, feed that person for a lifetime"

An old Confucius saying (made "politically correct"). Typically, the college experience doesn't teach students to "fish." They are left to figure it out on their own. Most of what is done involves sharing knowledge with students primarily through one-way communication (lectures), giving them problems to solve that apply the knowledge, and then evaluating (testing) them on what they learned. Very little is done to teach them how to go about that process.

3. "Start of things can be extremely important"

This is true for many things—a first page of a book, the start of a relationship, the first class in a course. Think of a race. You're in the starting blocks, the gun goes off, and you hesitate, delaying your start. What chance do you have to win the race? Many of our new students don't realize the importance of getting off to a good start. Students who delay studying until the first test is announced and then try and cram for the test and do poorly on it may find that it's too late. They are already three or four weeks behind, and it may be impossible (or at least very difficult) to recover.

4. "First year engineering students were high school students three months ago."

Again. Something we know but may overlook. As Rich Felder points out:

> "Many high school students are mature, thoughtful, and industrious, but those are probably not the first three adjectives that come to mind if you are trying to describe the species

collectively. A sizable percentage of high school students lack the sound judgment, sense of responsibility, and work ethic needed to do well in a curriculum as demanding as engineering, and they're not likely to magically acquire these things in the summer between high school and college."

5. Idea of "transitions"

We experience many transitions in life--transition from elementary school to junior high school; transition from high school to college; transition from college to work-world; transition from being single to being married; transition from not having children to having children. Some of these transitions are harder than others. Some we get lots of help with. Others we are left primarily to figure it out with little help. When new engineering graduates start their first job in industry they are provided with close supervision, progressively more challenging assignments, rotating work assignments, formal training, on-the-job training, and time to mature. Strangely, when new students come to the university, they are left primarily on their own to figure out how to be successful. Academic organizations seem more interested in evaluating their newest members than in doing things to ensure that they succeed.

6. "First things first. First an engineering student; then an engineer."

Traditionally, engineering education has operated on the "trust me" approach. The first two years of the curriculum were primarily calculus, chemistry, physics, and general education courses and students were asked to "trust" that someday they would realize what learning these subjects had to do with becoming an engineer. In the past 20 years, engineering schools have strengthened their first-year engineering curriculum in an effort to bring more "relevancy" to the math/science curriculum by exposing students to engineering earlier on. The primary focus of this curriculum has been on either engineering tools (graphics, computing, etc) or engineering design projects. These courses are often an over anxious effort to make first-year students into engineers without first making them into engineering students.

7. Uncovering Lack of Peer Support

You're in front of a classroom/group of your students and you ask the following questions:

1. How many of you can name (first and last) every student in this room?
2. How many of you can name ten students in this room?
3. How many of you can name the student sitting on your right and the student sitting on your left?

And your students fail miserably on this test.

Do you see this as a problem worthy of attention? What would you do about it?

8. "The Name Game"

The Name Game is a systematic exercise for helping individuals in a group (e.g., a class) learn each others' names. Form students randomly into groups of 6-8. In their groups, the first student introduces himself or herself (first and last name); the second student introduces the first student and then himself or herself; the third student introduces the first two students and then himself or herself. This continues until each student can introduce all students in the group (generally takes about five minutes).

Mix groups each class. Repeat exercise until every student in the class can introduce every other student (generally five or six class periods for a class of 30). The instructor can learn the names of students in his or her class by sitting in on the exercise. Other attributes can be added such as major, hometown, favorite hobby, favorite book, etc. For example, first student gives name, major, hometown, and favorite hobby. Second students gives all the attributes of the first student and then his or hers. And so forth.

9. "Sink or swim" paradigm

The traditional approach in engineering education (and perhaps university education in general) in which new students are put through a difficult challenge and those that don't measure up are "weeded out." The "sink or swim" paradigm is generally connected to the black and white view that "some have it, and some don't." We may find satisfaction in the view that "not everyone can be an engineer," and believe that we have done a service by not foisting incompetents on our distinguished profession.

10. "Student development" paradigm

Facilitating students' growth, change, and development in areas that will enhance their success in achieving their goal of completing their degree in engineering. Generally involves working with students to strengthen their commitment to engineering and to change their attitudes and behaviors to those appropriate to success in math/science/engineering coursework.

11. Lathe analogy

Let's say you were given the task of teaching students how to use a machine tool, such as a lathe. Imagine you gave them a lecture on how to use it and had them read instructions on how to use it? How proficient would they be at using it? If this approach wouldn't work teaching students how to use a machine tool, then why would we expect it to work in developing students' proficiency in implementing new learning skills and academic success strategies? In general, lecturing to students about skills and giving them something to read about them is not an effective approach to achieving mastery.

12. Mirror metaphor

The text *Studying Engineering* can be likened to a mirror. After you get ready in the morning, you look into the mirror. Why? To check whether your appearance meets an ideal standard you have in mind. If it doesn't, you make corrections/changes to move closer to or reach that ideal. In like manner, the text affords students the opportunity to look into a mirror and see whether they meet an ideal in terms of their approach to their academic study and make changes to move closer to that standard.

13. Tool metaphor

The text *Studying Engineering* can be likened to a tool. If you give me a hammer and a chisel and a block of granite, I can make a pile of broken rocks. If you give the same tools to a skilled sculptor, he or she can make a beautiful sculpture. In like manner, the book requires a master craftsperson to ensure that it works well.

14. There's the good news. And there's the bad news.

Which do you want first. Ok, first the good news.

> The easiest thing in the world is to teach an Introduction to Engineering course that benefits students and significantly enhances their academic performance and retention.

And now the bad news.

> The easiest thing in the world is to teach an Introduction to Engineering course that is a virtual waste of time and brings little benefit to students.

15. "From Sleep 101 to Success 101"

This is the title of an article from a 1995 issue of ASEE *Prism* magazine. The article states that:

> "Freshman orientation. For years, many first-year engineering students have called it 'Sleep 101.' In its most dreaded form, this crucial introduction to the engineering major has relegated freshmen to a seat in row ZZZ of a cavernous lecture hall where they quickly perfected the skills of dozing with both eyes open while a series of department chairpersons earnestly extolled the merits of their particular disciplines."

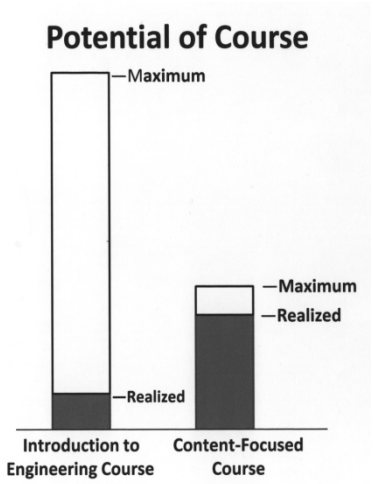
16. Engineering Problem Solving Analogy

Engineers are good problem solvers. They understand how to define problems and come up with solutions that solve the problem optimally within necessary constraints and using available resources. Take on the problem of "enhancing student success"

using the same problem solving skills and approaches. How can you take students from where they are to where they need to be to be successful in engineering study within the constraints you must operate under and using the resources you have available?

17. Potential of Student Success Course

I would hold that the maximum potential of a student success course to make a difference in a student's life is far greater than that of any single content-focused course they will take. This can be illustrated by the diagram to the below.



As the diagram shows, in most content-focused courses, a student will realize something close to the maximum available potential. If a student gets an 'A' grade he or she probably got 90 percent or more of what was there. If a student gets a 'B' grade, he or she probably got 80-90 percent of what was there. And so forth.

However, in a student success course, a student is likely to realize far less than the maximum potential available and much less even than he or she will get from a single content-focused course. That maximum potential will be realized only if the instructor is effective and the student is proactive or both.

18. Football Joke

This is the story about the football coach whose team was having a terrible season. All the games had been lost by large scores and the current game was no different. The first string quarterback had been injured in a previous game and now the team was backed up in the shadow of its goal posts when the second string quarterback was also injured. The coach called over the third string quarterback—a young man who hadn't played a down all season—and said "Son, unfortunately, I'm going to have to put you in. Just run R-22 twice and then punt." The young man ran out on the field. Ran R-22. The play worked beautifully. 40 yards down the field. He called R-22 again and again the play worked beautifully. Another 40 yards. First down and goal to go! He went into the huddle, called a punt, punted the ball, and as he was running off the field, the coach was livid and shouted at him "Son! What in world were you thinking out there?" The young man responded "Sir. I was thinking we sure do have a dumb coach."

What's the moral of the joke?

19. New engineering graduate story

A new engineering graduate was given a sports car by his parents as a graduation gift. He decided to put it through its paces on a very dangerous, curvy mountain road. As he approached a blind curve, a car speeding and careening out of control came around the curve toward him. He was sure that he would have a head on collision. Miraculously, at the very last second that driver got the car under control, and as he drove by shouted out of his window "PIG!!!" The engineering graduate thought "How dare you?" and rolled down his window and yelled back "And you're a pig too!" Then he rounded the curve ahead and crashed into the pig standing in the middle of the road and was killed.

What's the moral of this story?

20. "Change" as overarching theme of entire Introduction to Engineering course

I often start my Introduction to Engineering course by asking: "How many of you want to change something about yourself?" Generally, about three hands will go half way up. And I'll ask each of those who raised their hands: "What do you want to change about yourself?" They might relate: "I'd like to write better." Or "I'd like to get along better with people." Or "I'd like to stop procrastinating." Generally other students will "get with the program" and share things they want to change. Invariably there will be some students who say "I don't want to change anything." These are the ones with the "fixed mindset." Tell students that "change" is what this period in their life is all about, that the more they grow/change/develop, the better. I typically reinforce this idea over and over by starting each class by asking: "Who can tell me something they've changed? Either something you've done differently (behaviors) or something you've thought about differently?" Eventually, students become enthusiastic about having something to share.

21. Uncovering Negative Attitudes

You are standing in front of a classroom/group of your first-year students and you ask your students, "Which of the following apply to you?"

I lack confidence in my ability to succeed in engineering study.
I have a tendency to sabotage my success.
I tend to blame others for my failures.
I don't see any need to change myself or to grow or develop.
I'm generally unwilling to seek help from others.
I tend to procrastinate, putting off the things I need to do.
I tend to avoid doing things that I don't enjoy.
I avoid contact with my professors outside the classroom.
I prefer to study alone rather than with other students.

You find that many of our students hold one or more of these attitudes.

Do you see this as a problem? What would you do about it?

22, Deepak Chopra Quote on Attitudes Guides the Way

The following is a quote from the section on the "Law of Karma" from Deepak Chopra's excellent book *Seven Spiritual Laws of Success*. The quote guides the way to working with students to change their attitudes.

> *Most of us, as a result of conditioning, have repetitious and predictable responses to the stimuli in our environment. Our reactions seem to be automatically triggered by people and circumstances, and we forget that these are still choices that we are making in every moment of our existence. We are simply making these choices unconsciously.*
>
> *If you step back for a moment and witness the choices you are making as you make those choices, then in just this act of witnessing, you take the whole process from the unconscious realm into the conscious realm. This procedure of conscious choice-making is very empowering.*

23. Methodology for Changing Negative Attitudes

1. Identify/become "conscious" of an attitude
2. Ask "Is attitude working for me?" (If yes, then attitude is by definition positive; If no, then attitude is by definition negative)
3. For negative attitude ask: Where did I get it? (you may not know)
4. Does attitude come from a source that can be changed?
   a. If yes. Try and eliminate the source.
   b. If no. Try and change the attitude.

24. Coach analogy

One of the important roles of the coach of a sports team is to try to get peak performance from each of his or her players—to get each player to be the best that he or she is capable of being. In teaching your Introduction to Engineering course view yourself as the "coach" whose job it is to get each of your students to perform at the highest level they are capable of.

25. Idea of "Institutionalization"

Often courses, programs, or projects achieve exceptional results because of the charisma and hard work of the leader. They exist because of a talented, dedicated, hard-working person. When that person leaves, retires, or just burns out, the exceptional results cease. View your most important job is ensuring that what you start will sustain itself after you leave. This is the concept of "institutionalization."

26. Jon Shively story

Some years ago, I team taught an Intro to Engr course with two other faculty members. The first five weeks of the course were my student success stuff, the second five weeks

focused on the engineering design process, and the last five weeks focused on the importance of oral and written communication skills for engineers. The first time we taught the course, I noticed that that the faculty member who would be following me was sitting in on my sessions. I didn't think much about it. The second time we taught the course, I was a bit surprised that he was there again. And the third time he was there, I asked him "Why?" I was very flattered when he told me "After sitting in on your stuff the second time, I realized that I could put the principles into practice in my work and in my life." You could do the same.

27. Career Day Role Playing Story

Role playing can be an excellent way of reaching people. During my tenure as dean, we held an annual engineering career day. The event was meant to be a career awareness day to motivate our students rather than a job placement or employment fair. But every year, I got reports from students that the corporate representatives who attended were only interested in talking to graduating seniors. Our efforts to communicate the purpose of the event to corporate representatives were ineffective until we had our students put on a skit at the Dean' Brunch that preceded the event. The lined up two employers to play the "good" employer and the "bad" employer. We had a group of our students play "first-year" engineering students. The group arrived but was skeptical about whether the event was for them and considered leaving. But one of students in their group convinced them to try one employer. They went over to the "bad" employer who asked them what year they were in school, and when they told him they were freshmen, he told them to come back when they were seniors. The students decided to leave but the "good" employer had overheard what happened and called them over and told them his company was interested in their education and had scholarships and summer internships that they could be considered for. The scene switched to four years later. When the students walked in, the "bad" employer tried to get them to come to his table, but they indicated they were not interested because they had received scholarships and worked during the summer at other companies, which they expected to stay with when they graduated. I never heard a complaint about employers "brushing off" younger students after that.

28. Idea of "self-growers"

It's one thing to assist a student in changing his or her attitudes and behaviors. It's another thing to teach a student processes that he or she can implement continuously to improve his or her performances and values. This is the process of "self growing." A useful article on this process can be found at: http://www.pcrest.com/PC/PE/4_2_2.htm.

29. Assessment

Definition – *Process of measuring a performance, a process, or a work product*

Provides feedback on strengths, areas for improvement, and insights

Purpose is to improve future performance (or quality of process or product)

Strength – identifies ways in which the product (or performance) was of high quality; includes reasons why particular strengths were selected

Area for improvement – identifies what changes can be made in the future to improve the product (or performance); also includes mention of how changes can be implemented most effectively

Insight – identifies what new and significant discoveries/understandings were gained through the assessment process

30. Assessment vs. Evaluation

Purpose of *assessmen*t is to improve quality
Purpose *of evaluation* is to judge quality

31. Approach for Reading *Studying Engineering* (or any student development book) for Comprehension

Have students read a paragraph, section, chapter and answer the following four questions either in writing or verbally.

1. What were the key ideas contained in what you read? i.e. prepare an executive summary of what you read either in writing or verbally (recitation)

2. What does what you read mean to you? (e.g., Does it make sense? Does fit with your way of thinking? Does it fit with your past experience? Are you persuaded of its efficacy? Are you likely to make changes based on it?)

3. What questions would you like to ask the author or your instructor?

4. What can you/will you change (either in your attitudes or your behaviors) as a result of what you read?

32. Delivering New Knowledge - Types of Activities

The following is (not complete) list of activity types that can be used to bring new knowledge to students. The typical approach used in engineering education is to give students a lecture on the subject, have them read something about the subject, and have them solve some problems that apply what they learned from the lecture and the reading.

Lecture	Assessment/peer assessment
Reading	Technology-based learning (e.g., Internet)
Problem solving	Problem-based learning
Writing	Consulting
Interactive lecture	Portfolio building
Brainstorming	Self-assessment/reflection
Group discussion/dialogue	Journaling
Role playing	Cooperative/collaborative learning
Projects	Story telling
Laboratory/experiments	Demonstration
Research	Interviewing
Student as teacher	Planning
Student presentations	Case studies
Guided discovery learning	Panel of experts

Use “the process of elimination” to figure out whether you can use one or more of the other activity types to bring new knowledge to students.

33. “Bright students don’t need this stuff”

Often there is confusion between the concept of intelligence and the concept of effectiveness. Many faculty at so-called "top-tier" institutions believe that because their students are bright, those students don't need to be taught how to be effective. I have just the opposite take on it for two reasons. First, I think for many bright students, their K-12 education came so easy to them that they didn't need to develop effective strategies (time management, collaborative learning, getting what you need from professors, etc) to be successful. Secondly, I believe that the brighter a person is the more they are going to be able to make new "tools" work. Perhaps the reason I feel so strongly about this is that I was one such student when I entered MIT as a freshman. Another important issue is how do you get someone who is bright and overconfident to realize that they "don't have a clue."

34. Strategies for getting students to engage book

There are at least three strategies for getting students who are busy and don’t like to read to engage *Studying Engineering*:

A. Use multiple choice exams in the “Instructor’s Guide” to motivate students to take reading assignments seriously

B. Have students read a section (or chapter) of the text, do some exercises at the end of the chapter, and formulate at least three issues, questions, or perspectives

that came up from the reading. Use class time to help students "process" what they read through small group or class of the whole discussions.

C. Have students reflect on what they read through structured writing assignments. Typically such assignments include the following:

   i. Summarizing what was read in the form of a short executive summary
   ii. What did students think about what they read? What did they like? What did they dislike?
   iii. Formulate two or three questions that they would like the author to clarify
   iv. How specifically could they put what they learned from the reading into practice in their study or in their life?

35. Success process

Studying Engineering is about the process of being successful with a particular focus on achieving the goal of graduating with a B.S. degree in engineering. *Success* is the process of achieving something desired, planned, or intended—i.e., achieving a goal. The process logically divides itself into four steps:

- Goal identification/goal setting
- Strengthening commitment to goal
- Changing attitudes to those appropriate to goal
- Changing behaviors to those appropriate to goal

36. Uncovering Lack of Student Commitment

You're in front of a classroom/group of first-year engineering students and you ask them:

"How many of you have a personal goal of someday receiving your bachelor of science degree in engineering?" And all the hands are raised quickly and high.

Then you ask them:

"How many of your would say your commitment to that goal is really, really strong? You're going the who way not matter what. Nothing is going to stop you."

And then about half of the students raise their hands half way up.

Do you see this as a problem worthy of attention? What would you do about it?

37. Strengthening commitment to goal

Strategies for strengthening commitment to the goal of graduating in engineering include:

- Getting clear on the rewards and opportunities that will derive from a B.S. degree in engineering (goal clarification)
- Learning about engineering (definition, academic disciplines, job functions, industry sectors, etc)
- Having a step-by-step process (a road map) of what need to be done to achieve the goal

Of these three, goal clarification is perhaps most powerful. The most difficult thing I experienced during the 12 years I was director of a minority engineering program was having a student who had failed trigonometry sitting across from me who I was trying to help find another major that they could be successful in and having them say "But the only thing I want to be is an engineer!" I always said to myself "We did too good a job with the goal clarification bit."

38. Albert E.N. Gray

There are a number of reasons why a person would fail to do the things they need to do to achieve a goal they have clearly identified—would, in effect, "shoot themselves in the foot." One of the reasons is that they have difficulty choosing to do things they don't find easy or enjoyable. On Page 215 of *Studying Engineering*, the impact of students choosing to do things they like to do rather than things they don't like to do on their success is described through a remarkable presentation by Albert E.N. Gray to a national meeting of life insurance underwriters in 1940 titled "The Common Denominator of Success." The full text of Mr. Gray's talk can be found at: http://discovery-press.com/discovery-press/studyengr/CommonDenominator.pdf.

39. *Success* vs. *Happiness*

Students sometimes confuse the concepts of success and happiness. A good issue for discussion is whether success brings happiness, which could lead to a discussion about "What is happiness." Dale Carnegie's quote at the beginning of Chapter 1 points the way:

> *Success is getting what you want.*
> *Happiness is wanting what you get.*

Greeks philosophers believed that "eudymonia" was what one should search for in life. The word combines Eu (good) + dymon (soul). Perhaps the best translation into English is "flourishing." You might consider having your students research the word *eudymonia.*

40. Pleasure vs. Happiness

Pleasure is enjoyment of an outside stimuli
Happiness comes from within

Happiness is what you feel when you're not feeling:

self doubt
depressed
hateful
fearful
worried
unsatisfied
bored
grief
shame
guilt
discontent
anxious
annoyed
angry
irritated
stressed
frustrated
upset
down
sad
envious
or
jealous.

41. "Brass ring" analogy

When I speak to Introduction to Engineering courses that use my book, I tell students that they probably never had a course like this and perhaps they'll never have another course like this until perhaps they have been working for a number of years in industry and are judged ready for promotion into a management (either line supervision or project management) role and will be sent off to some management or leadership training to give them the skills they need and lack. It's somewhat like they are on a Merry-Go-Round and as they pass by there're supposed to grab the brass ring. But they miss it. And go around again. They can either grab it or miss it.

42. Plant seed – "If you're not ready for the stuff and get into some difficulty down the road, come back to the stuff"

Invariably there are some students who are not ready to embrace the material from *Studying Engineering*. They are either overconfident, or not paying attention, or not motivated, or whatever. I always make a point to tell students to put the idea somewhere in the back of their mind that if somewhere down the road they get into academic difficulty, don't think they can't do engineering or they can't do college, come back to the "stuff." The stuff works. I indicate that from time to time I had a student stop me in the hall and tell me "Dean Landis. When I was in your ENGR 100 class, I wasn't ready for the stuff you were trying to teach us. But you said, if I ever get into academic difficulty, come back to the stuff. And I did get into academic difficulty. And I came back to the stuff and now I'm making straight A's." That was a good day!

43. Goals/objectives/outcomes

Goals and objectives are intended results
Outcomes are achieved results

Goals are generally broad statements about what will be achieved. Objectives are more specific statements of what will be achieved in the areas of:

New knowledge
New attitudes, values, ways of thinking
New skills

Goals and objectives are generally "teacher" or course-focused.

Outcome are statements about what students know, what students think, and what skills student have.

44. Bloom's Taxonomy

In 1956, Benjamin Bloom and a group of educational psychologists identified six levels within the cognitive domain, from the simple recall or recognition of facts, as the lowest level, through increasingly more complex and abstract mental levels, to the highest order which is classified as evaluation. Verb examples that represent intellectual activity on each level are listed here.

1. ***Knowledge***: arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce, state.
2. ***Comprehension***: classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate,
3. ***Application***: apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write.

4. ***Analysis***: analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test.
5. ***Synthesis***: arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write.
6. ***Evaluation***: appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, core, select, support, value, evaluate.

45. Study to prove the "efficacy" of Introduction to Engineering courses having a "student development/student success" focus

Introduction to Engineering courses are generally held to a higher standard than more traditional curriculum. We are called on to "prove" that they work. We do have a great deal of anecdotal data about the "efficacy" of these courses, but unfortunately we do not have the definitive study that is needed.

Want to become famous? Set up a study that offers this type of course to a participating group and identify a comparable control group. For each group measure:

Freshman year GPA
Freshman-to-sophomore retention
Average grade in Calculus I (regardless of when taken)

46. Acknowledge Economic Downturn with students

Whenever I speak to Introduction to Engineering classes, I make it a point to acknowledge that we are in by far the most significant economic downturn in my lifetime. I tell students that in my view the situation is really scary and could get much worse before it gets better. I express to students that I am concerned that through some convoluted rationalization, they may use the economic downturn and the reduction in available jobs as an excuse for not applying themselves to getting their engineering education. I tell them my take is just the opposite. My take is that if there is ever a time when you should work hard, excel, and get strong educational credentials, the time is now.

47. Betances model of attendees

According to Samuel Betances, there are three kinds of people who attend short courses, workshops, conferences.

Hostages – This is when your boss comes in and says she received information about the course and suggests that you go
Vacationers – This is when you decide the weather is nice in Southern California and you need to visit Aunt Myrtle in Anaheim
Willing learners –

Hopefully, by the end of this course, all hostages and vacationers will be converted to willing learners.

48. Vision for Introduction to Engineering course

> If I can have quality time with a group of students, I can create a major "life changing" experience for those students—one that will significantly enhance their success.

The Introduction to Engineering course is unique in that it is perhaps the only course in the engineering curriculum for which such a vision would be appropriate. Try applying this vision to other courses you teach. I expect it doesn't fit.

49. MEP Story

I started the first Minority Engineering Program in California and one of the first in the nation at California State University, Northridge in 1973. One of my first thoughts was that I needed regular contact with my students and gained approval to offer an Introduction to Engineering course for them. I recall vividly, walking into the first class, and nervously wrote on the blackboard "The purpose of this class is to enhance your success as a student, and as a person." I turned to the class and said "I have absolutely no idea how to accomplish this. So I would like to start by having you tell me what I could bring to you that would accomplish this purpose." Lucky for me they had some ideas. They wanted to learn about the curriculum, tour the facilities, hear from role model practicing engineers, learn how to study, and so forth. I started by delivering what they had asked for. Many of the concepts in *Studying Engineering* were developed through brainstorming with MEP students in the Intro to Engr course over the years.

50. NAMEPA Name Game Story

I was invited to conduct a session on "community building" at the annual conference of the National Association of Minority Engineering Program Administrators (NAMEPA) some years ago. During my presentation, I illustrated the Name Game by having the eight people in the front row learn each other's names. I told the rest of the audience (about 200 people) that they couldn't tune out because I was going to call on several of them to name the eight people in the front row, which I did. Later in the conference every one of the people in that had been in the front row came up to me and said "You made me famous. Everyone here knows me."

51. Analogy with "Good Health"

Having knowledge about a behavior is not sufficient to bring about implementation of the behavior. Telling people how to run their lives is just not an effective pedagogy.

As an example. I could tell you should give up all animal protein (become a "vegan"), but I doubt you will do it. I could go further and also tell you all the reasons why. That wouldn't be likely to work either. I could even persuade you to read T. Colin Campbell's wonderful book *The China Study* that documents the studies that have shown the effect of high animal protein diets on all of the so-called "Western diseases" (heart disease, diabetes, cancer of all kinds, and many others). That might work, but is still unlikely. You have lots of reasons for eating what you eat, and getting you to change would take more than knowledge about the "whys" and "hows" of the new behavior.

Students--just like you and I--have lots of reasons for keeping on doing what they are doing. Getting them to change their behaviors will only occur if you use an effective pedagogy.

52. Fixed mindset vs. Growth mindset

Ultimately, a good objective is to help students develop a "growth" mindset. If you're really interested in this stuff an excellent new book is *Mindset: The New Psychology of Success*, by Carol S. Dweck. The basic tenet of this book is that:

> *Everyone has one of two basic mindsets. If you have the fixed mindset, you believe that our talents and abilities are set in stone—either you have them or you don't. You must prove yourself over and over, trying to look smart and talented at all costs. This is the path of stagnation. If you have a growth mindset, however, you know that talents can be developed and that great abilities are built over time. This is the path of opportunity—and success.*

53. Uncovering Resistance to Change

You're standing in front of a class/group of your students and you ask "How many of you want to change something about yourself?" and three or four hands go up.

You ask each of the students that raised their hand "What do you want to change about yourself?" One student says: "I want to write better." Another students says: "I want to get along better with people." A third student says: "I want to develop better study habits."

Now that the other students see what you're talking about, a few more raise their hand, but invariably many of the students stand on the principle "I don't want to change anything about myself. I like myself just the way I am."

Do you see this as a problem? What would you do about it?

54. South Carolina Story – Direct pedagogy

Some years ago, I conducted a workshop for faculty at the University of South Carolina who taught their Introduction to Engineering course. I asked each faculty member to tell me what they did in their course. One professor related that he had students work on design projects in groups. I asked him what was the purpose of that. He quickly replied

"So they learn how to work in groups." I asked him what was the purpose of that and that stumped him. He went into a long "huddle" with himself and when he came out he hesitatingly said "So they'll work together in their calculus class." I asked him why he thought having students work on structured projects in groups mandated by him would cause them to form study groups in their calculus class. That that's not likely to happen. And if what he wants is for students to form study groups in calculus take a "direct" pedagogical approach for getting that.

55. Two Uses of Term "Commitment"

Commitment to changing behaviors – Part of the process of getting students to change their behaviors is to help them examine their current behaviors and decide whether they are working for them and if not to develop a commitment to a new behavior.

Commitment to engineering – Many students that choose to major in engineering lacks a strong commitment to the goal of becoming an engineer. Students can benefit greatly from guidance in strengthening their commitment to that goal.

56. Chess Analogy

If you were to take up a game of skill—chess, for example—what would you do? Learn the basic objectives, rules, and moves and then begin to play? Probably. But you'd soon discover that mastering a game of skill like chess requires much more. So you might read a book, take a lesson, watch experts play, or engage in similar activities to improve your knowledge of the game. You would realize that to become a chess "master," you would need to spend time *both* playing the game *and* learning about it.

The study of engineering can be likened to a game. To become a "master" students you must not only play the game—i.e., be a student—you must also devote time and energy to learning how to play it.

57. How do you know whether you can become an engineer?

To become an engineer, you have to be able to pass Calculus I at the university level. You don't have to like it. You just have to do it. If you can't pass Calculus I, you can't be an engineer. Why is passing Calculus I the "decider"? Because if you can pass Calculus I, you can pass Calculus II. And if you can pass Calculus II, you can pass Calculus III. And if you can pass Calculus I, II, and III, you can pass the junior level engineering courses. And if you can pass the junior level engineering courses, you can pass the senior level engineering courses. Calculus I sets the level of difficulty of the entire curriculum.

58. "Fill the Time" Approach

Often faculty who are assigned to teach their Introduction to Engineering course use the "fill the time" approach. This is how it works. "I have 30 hours to fill. How can I fill them"? "I can have each department chair come in and talk about their discipline. That's five." "I can arrange a tour of the library. That's six." I can spend two periods discussing the rules and regulations. That's eight." "I can have two speakers from industry. That's ten." And on and on until 30 is reached. Such courses have no "development" objectives and are generally of virtually no value to students.

59. Project to have students "design" their learning process.

How about improving the problem statement and injecting a project like the one described below in your course?

Engineers "design products or processes to meet desired needs." But most of the focus of design in first-year engineering courses is on designing products. How about a project that is focused on designing processes? How about having your students work individually or in groups to: "Design Your Process for Becoming a 'World-Class' First-Year Engineering Student"? The text *Studying Engineering* could be used as a resource and the objectives of the design project could be things like designing a process that will:

1. Strengthen your commitment to engineering
2. Build relationships that will benefit you during and after college
3. Teach you how to get the most out of "stiff" systems
4. Develop you at becoming effective at managing time and tasks
5. Lead you to practice best academic success strategies
6. Involve you in appropriate co-curricular activities
7. Enhance your self-awareness and improve your skills at self-accessing for the purpose growing and changing to improve performance ("self-grower")
8. Etc., etc., etc.

Develop a plan that will indicate:

a. Where you are currently on the above items

b. Where a "world-class" first-year engineering student would want to be on each of these items

c. What you need to do to move from where you are to where you want to be

Note: Ray is seeking help in developing and piloting a "design" project along these lines. Maybe you could help.

60. Getting your degree in engineering is not like "high-jumping 7-feet"

When I grew up, the thought that someone could get their entire body of a seven-foot high bar was thought to be impossible. So even though it has been done (first in 1956 by Charles Dumas) and now the world's record is 8 ft-1/2 inch, "high jumping seven feet" is still an expression that is used to indicate something that can't be done no

matter how hard a person works at doing it. Getting a degree in engineering is not like "high jumping seven feet." It's challenging, but very doable. Each year more than 75,000 bachelor's in engineering degrees are granted in the United States.

61. William Perry Quote

Well-known Harvard professor and pioneer in the area of student development said:

"Whenever someone comes to me for help, I listen very hard and ask myself, 'What does this person really want—and what will they do to keep from getting it?'"

This quote underscores that students (and professors) often "shoot themselves in the foot" by having a goal but not doing the things that would enable them to achieve the goal.

62. Four "don't miss" things

Often students do not appreciate Introduction to Engineering courses having a student development focus. They may think they haven't gotten anything of substance or value from such a course. I tend to agree with them. After all, who knows better than they do. If you want to ensure that this is not the case with your students, there are four things that you can bring to them that are "don't miss" things. Students will recognize the enormous value of these things, know that they got them from your course, and appreciate you for bringing these things to them. The four things are:

1) Each other - Your students are each other's most valuable resource. Building them into a learning community will greatly enhance their educational experience.

2) Strengthened commitment to engineering - Many students enroll in engineering without sufficiently strong commitment

3) Significant changes in attitudes (that they can articulate) - Most of our students arrive with a number of "shoot yourself in the foot" attitudes.

4) Significant changes in behaviors (that they can articulate) - My anecdotal surveys of first-year engineering students indicate that 90 percent are on the wrong side of the key five or six behaviors necessary for success in math/science/engineering coursework

Each of these things can be achieved through straightforward pedagogical approaches described in the "Instructor's Guide." And you can readily determine whether you provided them to your students.

63. Producing change is not that hard

If you picked three or four behaviors that you think are important (scheduling study time, studying collaboratively with other students, making effective use of professors,

preparing for lectures, etc) and devoted one period to each, you could bring about significant change. This could be accomplished through assignments such as this:

Assignment #1

1. Read Section 5.4 "Making Effective Use of Your Peers" (pp 188-196) in *Studying Engineering*
2. In the next two weeks, identify a study partner in one of your key classes and get together with that person for at least a two-hour study session (incorporate the principles delineated in your textbook to the extent possible)
3. Write a one-page critique about what happened
4. Come to class on __(date)__ prepared to discuss your experience.

Then on the appointed date, lead students in a discussion of what worked, what didn't work, etc.

64. Checking on student behaviors

My anecdotal surveys of first-year engineering students at a large number and wide variety of institutions, indicates that 90 percent of them are on the wrong side of the top five or six key behaviors for success. You could check this out by asking for a show of hands midway through the Fall semester on the two sides of the following six questions:

How many of you would give yourself an A+ on the amount of time and energy you devote to your studies?	How many of you feel you need to increase the time and energy you devote to your studies?
How many of you schedule your study time so as to master the material presented in each class before the next class comes?	How many of you tend to wait until a test is announced and then try to cram for the test?
How many of you study on a regular basis with at least one other student?	How many of you spend virtually 100 percent of your study time studying alone?
How many of you regularly seek advice and one-on-one instruction from your professors during their office hours?	How many of you never go to see your professors during their office hours to seek advice or one-on-one instruction?
How many prepare for each lecture by reading ahead, trying a few problems, formulating a few questions?	How many of you go to each lecture unprepared?
How many of you spend as much time on campus as possible and take advantage of the resources available to you here?	How many of you come onto campus to take classes and leave as soon as you can?

In that you move students from the right-hand column to the left-hand column, their academic performance will improve.

65. Conditional for Collaborative Learning

If you and I are going to work together on our academic work, four conditions must be met;

1. We must be taking one or more of the same classes
2. We must be in the same sections of those classes
3. We must know each other
4. We must be aware of the efficacy of group study and collaborative learning

For instructors of “content” courses, the first two condition are already met. There is a group of students who are taking the same class (your class) and are in the same section of that class (your section). All you have to do is help students get to know each other and teach them about the efficacy of collaborative learning.

66. An Ineffective Pedagogy for Changing Behaviors

Telling people how to run their lives doesn’t work!

For example: I could tell you to eat lean meat in moderation if at all, fresh fruits and vegetables, and whole grain products, get your heart rate up to 130 for 20 minutes three times a week, get regular sleep, meditate twice daily for 20 minutes, and avoid drugs and alcohol.

I could further tell you that if you did these things, you would live longer, get sick less, have more energy, be more creative, get along better with people, be more productive, and be more successful.

Now that I’ve done this, I don’t expect you will change a single thing. Make me wrong!

67. Five-Step Pedagogy for Changing Behaviors

The following is a “Five-Step Pedagogy” for changing behaviors.

1. Establishing a Baseline - Survey students to assess whether or not they are currently practicing a particular success behavior to the extent desired.

2. Delivering knowledge - Provide students with information and knowledge about why they should put the behavior into practice and how to best go about it.

3. Building commitment - Work with students with the goal of gaining their willingness to try out the behavior.

4. Requiring implementation - Assign the students the task of putting the behavior into practice.

5. Processing the outcomes - Provide students with an opportunity to "process" what happened, both introspectively (e.g., "Write a one-page critique of what happened.") and/or through class discussions.

68. Advantages of an “engineering-specific” freshman orientation course over a UNIV 101 freshman orientation course

There are distinct advantages of engineering-specific courses over a course that serves all majors. Among these are:

1) The opportunity to build first-year engineering students into a learning community and promote a high level of mutual support. If first-year engineering majors are assisted in developing relationships with students in other majors, the only purpose of those relationships can be social, and the resulting excessive social activity can have a detrimental impact on engineering student performance.

2) The opportunity to work to strengthen the commitment of first-year engineering students to their goal of receiving their B.S. degree in engineering. Many students that choose to major in engineering lack the strong commitment necessary for success in such a demanding field of study.

3) The opportunity to work on specific academic success strategies appropriate to math/science/engineering problem solving coursework. As one example, the importance of keeping up in one's classes is much more important in courses where each new concept builds on previous concepts.

4) The opportunity to instill the value of participation in engineering-related, co-curricular activities such as engineering student organizations, pre-professional employment, engineering student competitions, and undergraduate research experiences.

69. "Student-centered" approaches for Introduction to Engineering course having a student success focus.

1) Run the class like a student organization with purposes like: a) social/community; b) professional development; c) academic development d) person development/leadership development; and e) service. Divide the class into subcommittees, each of which handles one of those purposes, and let them go at it.

2) Start the course by putting out a purpose like "The purpose of this class is to enhance your success as a student and as a person" and have students brainstorm all the things that can be done to achieve that purpose. Start delivering them.

3) Have students work in groups to "design" their learning process

4) Have students read sections of the text, do some exercises in the text, and formulate at least three questions, perspectives, issues that came up from the reading. Use the class time to "process" what they learned and what they came up with either as class of the whole or in groups with report outs at the end.

5) Pick some important behaviors (keeping up in classes, group study, making effective use of professor outside the classroom, preparing for lectures) and use the "Five Step Pedagogy" in the Instructor's Guide to establish a baseline on the behavior and to change students from the wrong side of the behavior to the right side.

6) Make "change" (growth, development, improvement) the overarching theme of the class. Start each class by asking students to give testimonials about changes (no matter how small) they have made in either the way they thing about things (attitudes) or in the way they go about things (behaviors) as a result of the class or the text.

70. Two World Views – Change student? Or change system?

Which of the following matches your "view of the world"?

- The engineering education system is a stiff system. That's fine. Our job is to teach our students how to be effective in negotiating that stiff system. If our students can

negotiate that stiff system, they will be well prepared to negotiate all of the stiff systems they will encounter in their careers and their lives.

- The engineering education system is too stiff. It should be changed to better accommodate the needs of the students we are getting today.

71. Ray's Top 10 Best Practices

Consider where you are on each of the following 10 items, where you would like to be, and how you can get there.

1. Committed to the potential of a student success course and advocate for it with both students and faculty

2. Make change the overarching theme of the course and create a "culture" of change in your students

3. Use "Name Game" and other community building activities to bring students each other

4. Guide students in understanding the "success process"

5. Strengthen students' commitment to engineering

6. Facilitate change in students' attitudes

7. Facilitate change in students' behaviors

8. Model "self growing" skills and teach them to students

9. Use difference activity types to bring knowledge

10. Measure/access effectiveness of practices

72. Final Thought

Students <u>can</u> do much more than they <u>do</u> do.

More next year