First Things First.
First an Engineering Student;
Then an Engineer

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The Core Idea

Students can do much more than they do.

(and you can make it so!)

The Mystery

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***

CONCRETENESS

- Only 40-50 percent of students that start engineering programs in the U.S. ever graduate in engineering
- Those who do graduate probably work at about 70 percent (2.8/4.0 GPA)
- Overall efficiency of engineering education is between 28-35 percent
- Between 65-72 percent of our potential is wasted.

But How?

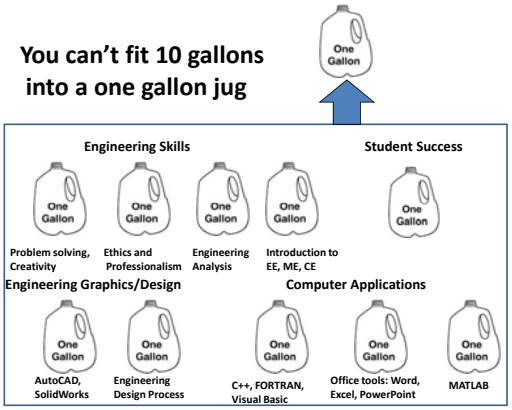
Key IDEAS

- We aren't born knowing how to be effective; we learn how.
- Give a person a fish, feed that person for a day. Teach a person to fish, feed that person for a lifetime.
- Start of things can be extremely important.
- Most first-year engineering students were high school students three months ago.
- Idea of "transitions"

Approaches for Transition from High School to Engineering Study

- "Sink or swim" (inaction)
- Content-focused Introduction to Engineering course (ineffective action)
- Student-development/Student-success Introduction to Engineering course (effective action)

You can't fit 10 gallons into a one gallon jug



Content-Focused Introduction to Engineering Course

Prentice Hall *E-Source* - 29 books totaling 8,379 pages

Computer Applications
Computer Applications
Introduction to VBA for Excel
Introduction to MATLAB
Introduction to Word
MATLAB Programming
Introduction to Excel
Engineering with Excel
Introduction to MathCAD
LabVIEW for Engineers
Introduction to Power Point 2002
MATLAB for Engineers
Introduction to Visual Basic 6.0
Introduction to Maple 8
Introduction to UNIX

Engineering Graphics
Introduction to AutoCAD
Design Concepts for Engineers
Engineering Design and Problem Solving
Concepts for Computer-Aided Design
Graphics Concepts with SolidWorks

General Engineering
Engineering Ethics
Introduction to Electrical and Computer Engineering
Introduction to Engineering Analysis
Engineering Communication
Exploring Engineering
Ready for Takeoff? A Winning Process for Launching Your Engineering Career
Introduction to Environmental Engineering
Introduction to Mechanical Engineering
Engineering Success
Thinking Like an Engineer

What Do We Mean by *"Student Development"* ?

Facilitating students' growth, change, and development in areas that will ***enhance*** their ***success*** in engineering study

"Enhancing Student Success"

- There is something called "success"
- We know what it is
- We aren't getting enough of it
- We believe that we can get more

"Success" is Multidimensional

- Retention/Transfer rates
- Academic performance
- Student satisfaction/attitudes
- Preparation for career (e.g., ABET Engineering Criteria 2000 outcomes)
- Other (e.g., percentage of graduates who pursue graduate study)

General Methodology for "Student Development"

- Know what to do (New knowledge)
- Want to do it (New attitudes)
- Do it (New behaviors)

Different Contexts for Applying the Lessons of this Presentation

- Student success course (required of all students or for special group of students)
- Student success module in content-focused Introduction to Engineering course
- Integration into a technical/content course
- Summer bridge program/Summer orientation
- Introduction to Engineering course for high school students
- One-on-one advising/counseling

Let's Solve the Mystery – Four things you can bring to your students that:

- Can't miss
- Will be of enormous value to them
- They will know that they got them
- They will appreciate you and your program for bringing these things to them

1. Each other

Your students are each others' most valuable resource.

2. Strengthened commitment to engineering

Achieving a challenging goal requires a strong commitment. Most of our students come to us with a weak commitment to engineering.

3. Change attitudes

Students arrive with a large number of negative attitudes.

4. Change Behaviors

90% of first-year engineering students are on the wrong side of the top five or six key behaviors for success in math/science/ engineering coursework (you can check this out for your students)

Problem – 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?

Bringing Your Students Each Other

- Introduction to Engineering course
- Content-focused course
- Clustering students in common sections of their classes (learning communities)
- Living/learning communities
- Student study center
- Student organizations
- Structured study groups (e.g. AEWs)

Community Building – In a Course

- Socialization – Students know each other (as a minimum, by name)
- Group building – Students have a strong sense of group and are committed to a high level of mutual support
- Human relations training – Students have the interpersonal skills necessary to interact with each other in a positive and effective manner

Socialization - Name Game

- Person who starts states their first and last name
- Each person in turn gives the first and last name of those who have come before and then their own
- Continue until everyone can give the names of everyone in the group
- Don't use crutches! (trust the process)

Exercise – Human Relations Training

Have your students:

- First. "Write down three things you want and need from others in this group."
- Next. "Write down three things you don't want and don't need from others in this group."

Compile the two lists on the board. Solicit student ideas for eliminating the negative items.

Problem – Lack of Commitment

You're in front of a classroom/group of your 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?

Strengthening Student Commitment to Engineering

1. Goal clarification (What's the payoff?)
2. Learn about engineering (What is it?)
   - What is engineering?
   - Academic disciplines
   - Job functions
   - Employment opportunities
   - Future directions
3. Prepare a roadmap (How do I get there?)

Goal Clarification

Brainstorm "rewards and opportunities" that will result from success in graduating in engineering

Discuss each one in depth (may take several class periods)

Write 500-750 page term paper on "Why I want to be an engineer" by picking five or six "rewards and opportunities" and personalizing each one

Problem – 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 your students hold one or more of these attitudes.

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

Working with Students to Change Their Attitudes – Deepak Chopra's "Law of Karma"

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.

Deepak Chopra's "Law of Karma" (continued)

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.

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.

Most Important Attitude – Resistance to Change/Growth/Development

You're standing in front of a class/group of your students and you ask "How many of you want to change something about your self?" 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?"

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?

Comparison of Fixed and Growth Mindset Traits

	Fixed Mindset	Growth Mindset
Challenges	Avoid challenges; stick to what you know well	Embrace challenges; overcoming challenges makes you stronger, smarter
Obstacles	Give up easily when you encounter obstacles	Persist in the face of setbacks; failure is an opportunity to learn
Effort	See effort as unpleasant and fruitless; the need for effort is a sign of low ability	See effort as the path to growth and mastery
Criticism	Ignore useful criticism; see negative feedback as an insult	Seek feedback and learn from criticism
Success of others	Feel threatened by the success of others	Find lessons and inspiration in the success of others

Creating Receptivity to Change

- Make "change" the overarching theme of your course/program.
- Discuss "change" as the very purpose of your course/program.
- Look for frequent opportunities to seek testimonials through the question: "Can you tell me something you have changed in the way you look at things (attitudes/ values/mindsets) or the way you go about things (behaviors/actions)?

Problem 14 - Chapter 1
Studying Engineering

List five things you could do to study "smart" that you are not currently doing. Pick the two most important ones and try to implement them. Prepare a brief oral presentation for your Introduction to Engineering class that discusses your success or lack of success in implementing them.

Problem – Wrong Behaviors

A few weeks into the fall term, you're in front of a classroom/group of your first-year engineering students and you ask the pairs of questions on the next slide.

Six Pairs of Questions to Use in Surveying Student Behaviors

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?

Problem – Wrong Behaviors (continued)

You find that 90 percent of your students are on the wrong side of these top five or six key behaviors for success in math/science/engineering coursework.

Do you see this as a problem worthy of attention?

What would you do about it?

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, fresh fruits and vegetables, and whole grain products, get your heart rate up to 130 for 20 minutes three times a day, get regular sleep, avoid drugs and alcohol, meditate twice daily for 20 minutes

Pedagogy for Working with Students to Change Their Behaviors

1. Establishing a baseline
2. Delivering knowledge
3. Building commitment to the behavior
4. Requiring/assigning implementation
5. Processing the outcomes

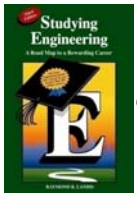
Delivering New Knowledge Types of Activities

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

Assigning and Processing New Behaviors

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.



Resources

Studying Engineering: A Road Map to a Rewarding Career, 3rd Edition, 2007

Instructor's Guide – "Enhancing Student Success through a Model Introduction to Engineering Course"
http://www.discovery-press.com/discovery-press/studyengr/instructorsguide.pdf

"Tidbits" - http://discovery-press.com/discovery-press/studyengr/Tidbits.pdf

Two "World Views"

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.

In Summary - Four Things of Great Value You Can Bring to Your Students

1. Each other
2. Strengthened commitment to success in engineering study
3. Substantive changes in their attitudes
4. Substantive changes in their behaviors