ESSENTIALS OF LEARNER-
CENTERED TEACHING

LEARNING STYLES

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How Students Learn

- Seeing and hearing
- Reflecting and acting
- Reasoning
- Memorizing
- Visualizing
- Drawing analogies
- Building models

How We Teach

- Lecture
- Demonstrations
- Discussions
- Focus on fundamental principles
- Focus on practical applications
- Emphasize memory
- Emphasize understanding

How much does a student learn?

□ Depends on match between learning style and teaching style

Teaching-Learning Mismatches

□ Worksheet Activity #1
□ List some consequences that might arise when the teaching and learning styles do not match
□ Teams of 3
□ Recorder – birth city is first in alphabetical order
□ 2 min

Learning/Teaching Style Mismatches

Students
□ Become bored
□ Don't learn effectively
□ Won't develop balanced learning skills
□ Do poorly on tests
□ Get discouraged
□ Drop course or change majors
Professors
□ Become critical of students
□ Wonder if they are in the right profession

Overview

□ Aspects of learning styles that are most important in engineering education

□ Student learning styles vs. common teaching styles

□ How do we address student learning preferences?

Learning

Reception	Processing
□ External information	□ Internal information
□ Observable through senses	□ Arises introspectively
❑ Seeing	❑ Memorization
❑ Hearing	❑ Reasoning
❑ Feeling	❑ Reflection
	❑ Action
	❑ Introspection
	❑ Interaction with others

Learning Style Model

□ Classifies students based on how they preferentially receive and process information

❑ Perception: sensory or intuitive

❑ Sensory channel (input): visual or auditory

❑ Processing: actively or reflectively

❑ Progression (understanding): sequentially or globally

□ Everyone learns both ways; sometimes preference is moderate or strong

Learning Style Model from Felder, R.M., and Silverman, L., Engineering Education, 78(7) 674-681 (1988)

What is Your Learning Style?

- Take the quiz online at (write down this url)
  http://www.engr.ncsu.edu/learningstyles/ilsweb.html
- Or complete the hardcopy of the same quiz (included at the end of the Learning Styles handout)
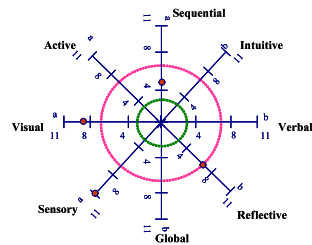

Index of Learning Styles (ILS)

- Helps identify the degree to which the specific learning style is preferred.
- Allows easy visual comparison of your students' learning styles.

Barbara Soloman, Richard Felder, Linda Silverman
North Carolina State
www.ncsu.edu/felder-public/RMF.html

Perception

Sensory	Intuitive
□ Sights	□ Ideas
□ Sounds	□ Insights
□ Physical sensations	□ Memories

Sensory and Intuitive Learners

Sensors	Intuitors
□ Like facts, data, experiments	□ Like innovation
□ Like solving problems by standard methods	□ Dislike repetition
□ Dislike surprises	□ Grasp new concepts
□ Patient with detail	□ Quick but often careless
□ Good at memorizing	□ More comfortable with symbols and words
□ Careful but slow	

Everybody learns with sensing and intuition. Your preference for one may be mild, moderate or strong.

Teaching-Learning Mismatch

□ Most courses favor intuitive learning
  ◘ Most courses emphasize concepts
  ◘ Most lectures use words and symbols
  ◘ Most professors are intuitors
  ◘ Most students are sensors

Teaching Sensors and Intuitors

□ Sensors
  ◘ Provide examples related to concepts
  ◘ Show how concepts apply in practice
□ Intuitors
  ◘ Provide interpretations or theories to link facts
  ◘ Should force themselves to check their work

Processing

Active	Reflective
□ Learn by interacting with others	□ Learn by thinking things through
□ Learn by doing	

Active and Reflective Learners

Acitve	Reflective
□ Learn by doing something active with new information (discuss/apply/explain)	□ Prefer to think quietly
	□ Let's think through it first
	□ Prefer to work alone
□ "Let's try it out"	
□ Like group work	
□ Have difficulty sitting through passive lecture	

Everybody learns actively and reflctively. Your preference for one may be mild, moderate or strong.

Teaching Active and Reflective Learners

□ Active
  ◘ In-class - discussion time
  ◘ In-class - problem solving activity
  ◘ Outside class - study groups can take turn explaining concepts to each other
□ Reflective
  ◘ In-class - time to reflect
  ◘ Outside class – time to reflect on significance and applications of concepts
  ◘ Outside class - summarize readings, notes, problems

Sensory Channel
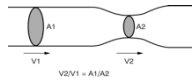
Visual	Verbal
□ Pictures	□ Sounds
□ Diagrams	□ Written/spoken words
□ Demonstrations	□ Formulas

$$p_1 - p_2 = \tfrac{1}{2}\rho(V_2^2 - V_1^2)$$
$$and \quad A_1V_1 = A_2V_2$$
$$Therefore,$$
$$A_2 < A_1, \quad V_2 > V_1$$
$$V_2 > V_1, \quad p_2 < p_1$$
$$decreasing\ area = increasing\ velocity$$
$$increasing\ velocity = decreasing\ pressure$$

Visual and Verbal Learners

Visual	Verbal
□ Remember what they see: pictures, diagrams, flow charts, films, demos	□ Learn better from words, written or spoken.

Everybody learns better when information is presented both visually and verbally. Everybody learns both ways, but preference for visual or verbal may be mild, moderate or strong.

Teaching-Learning Mismatch

- □ Most courses favor verbal learning
  - ◘ Most professors present little visual information
  - ◘ Students mainly hear lectures and see material written on chalkboard or text using symbols and words
  - ◘ Most professors are verbal
  - ◘ Most students and people >college age are visual

Teaching Visual and Verbal Learners

- Visual
  - In class - use diagrams, sketches, schematics, photos, flow charts etc.
  - Outside class – refer students to CDs, videos, websites
  - Outside class – develop concept map in flowchart form
  - Outside class – color-code notes by topic using highlighter
- Verbal
  - Outside class – write summaries or outlines
  - Work with group – take turns explaining concepts

Organization

Sequential	Global
Learn in logical progression of small steps	Learn in large disconnected jumps

Sequential and Global Learners

Sequential	Global
Learn in linear steps with logical progression	Learn in large jumps in seemingly random order
Follow logical stepwise path to solving problems	At first, see no connections, then "get it"
May solve problems without full understanding	Solve complex problems quickly after they "get it"
	Often have difficulty explaining solution process

Everybody can relate to global learners… but true global learners who lack sequential skills may have *serious* difficulty until they see the big picture.

Teaching Sequential and Global Learners

- Sequential
  - In class - Mention skipped steps in solution process
  - Outside class – fill in details of skipped steps
  - Outside class – outline lecture material in logical order
  - Outside class – strengthen global skills by relating new topics to familiar ones
- Global
  - In class - provide overview of new topic
  - In class – make connections between new material and old
  - Outside class – skim chapter for overview before reading
  - Outside class – immerse yourself in a topic for a large block of time.
  - In class/outside class – don't lose faith!

13 tips for better learning

1. Movivate. Relate new material to previous and future topics/courses (sequential, global)
2. Provide balance of concrete information (sensing) and abstract concepts (intuitive)
3. Balance practical problem solving (sensing/active) with fundamental understanding (intuitive/reflective)
4. Provide illustrations of intuitive patterns such as logical inferences and sensing patterns such as observations. Encourage all students to exercise both sensing and intuitive learning
5. Provide concrete examples of phenomena described by theory (sensing); then develop theory (intuitive, sensing); show how theory can be validated and deduce consequences (sequential), present applications (sensing/sequential)
6. Use pictures, schematics, graphs, demos, etc. before, during and after verbal material is shown (sensing/visual). Use hands-on demos when possible (active)

13 Tips

7. Use computer-assisted instruction (sensing/active)
8. Pause to allow time for reflection (reflective)
9. Plan active learning activities such as 5 min. brainstorming (active)
10. Assign some drills for practice (sensing/active/sequential). Assign problems requiring analysis and synthesis (intuitive/reflective/global)
11. Encourage cooperative learning on HW (active)
12. Encourage creative solutions (intuitive/global)
13. Talk to students about learning styles during advising, in class. Have them take the LS Inventory. Explain how they can help themselves.

Learning Styles References

□ R.M. Felder and L.K. Silverman, "Learning and Teaching Styles in Engineering Education," *Engr. Education, 78*(7), 674-681 (1988). Presents the original learning style model and strategies for addressing a variety of learning styles.

□ Index of Learning Styles online questionnaire
http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSpage.html

□ A variety of literature related to the Felder and Silverman learning styles model can be found on Dr. Rich Felder's website at
http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Learning_Styles.html

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Learning Styles Activity

□ Worksheet Activity #2

□ Redesign a lecture to address different learning styles
   ◘ Refer to 13 tips for better learning – use them!
   ◘ Indicate what kind of learner this strategy helps

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