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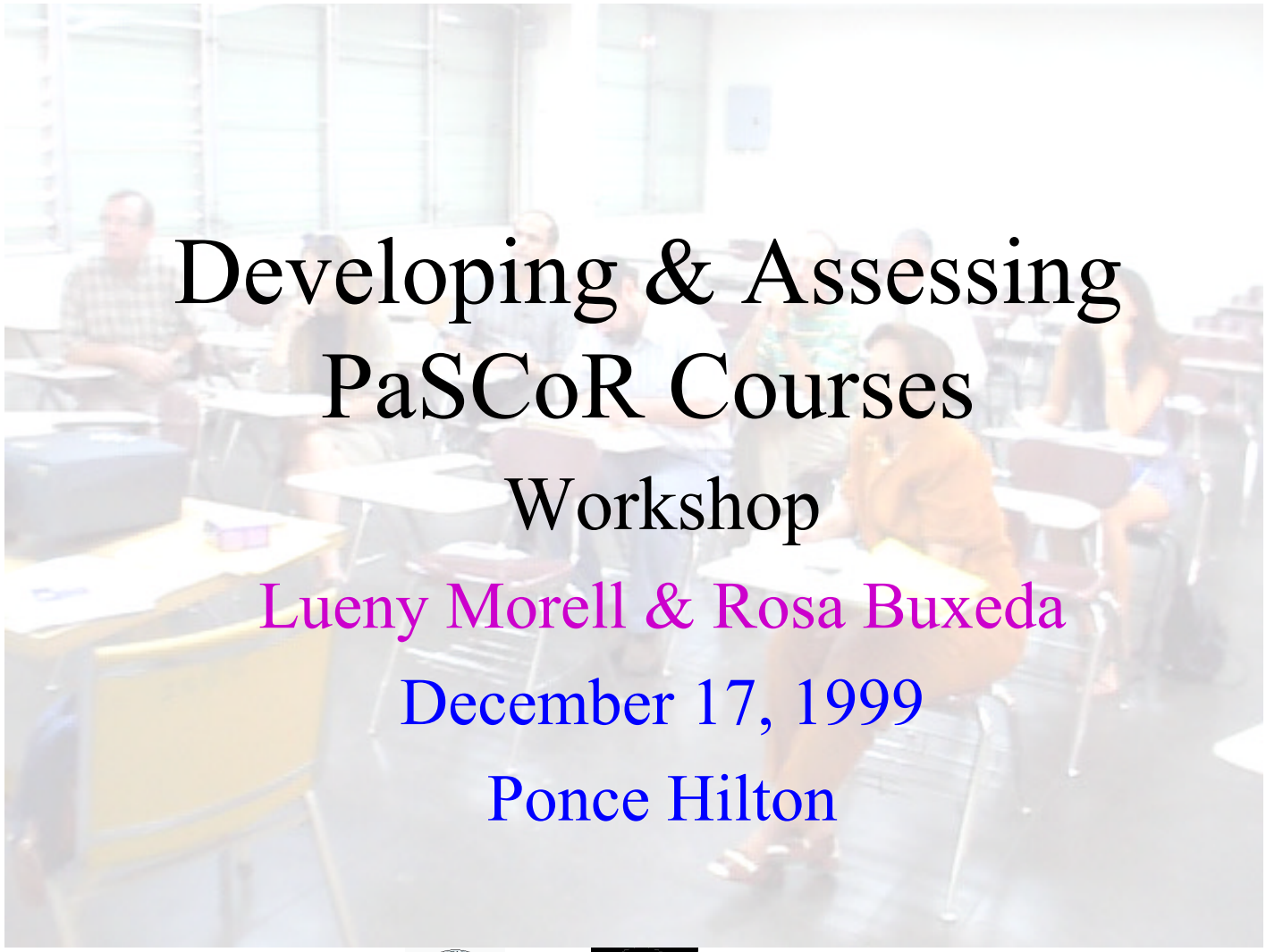

Developing & Assessing PaSCoR Courses

Workshop

Lueny Morell & Rosa Buxeda

December 17, 1999

Ponce Hilton

Workshop Goal & Objectives

- Provide a guide to develop PaSCoR Courses and assess student learning outcomes
  - Establish the importance of planning.
  - Become aware of learning styles & the impact on course/Course development.
  - Develop Course goals & objectives.
  - Design classroom activities to achieve Course goals & objectives.
  - Identify assessment strategies to evaluate student performance & learning.

Agenda

9:00 – 9:40 am	Workshop Goal and Objectives
	PaSCoR Educational Paradigm
	PaSCoR Course Template
9:40 – 10:15	Course Description and Topics
10:15 –10:40	Break
10:40 – 12:00	Course Objectives & Skills

Agenda…

12:00 – 1:30	Lunch
1:30 –2:15	PaSCoR Student Learning profile
	Teaching & Learning Strategies
2:15 –3:00	Assessment strategy
3:00 – 3:30	Break
3:30 –4:30	Putting together the template
4:30 – 5:00	Presentations

Educational Paradigm

INCOMING STUDENTS	EDUCATIONAL PROCESS	GRADUATES
Who are our students? What is their back-ground? Skills?	What do we need to do in order to develop the professional we want? Experiences?	What do we want? What kind of engineer or scientist we want? Profile? Skills?

Paradigm...

- Education should:
  - increase ***both knowledge & skills***
  - promote new attitudes & values
- Educational process should be designed to:
  - maximize & enhance the student's knowledge base & skills
  - develop an individual who is a self-learner & thinks critically

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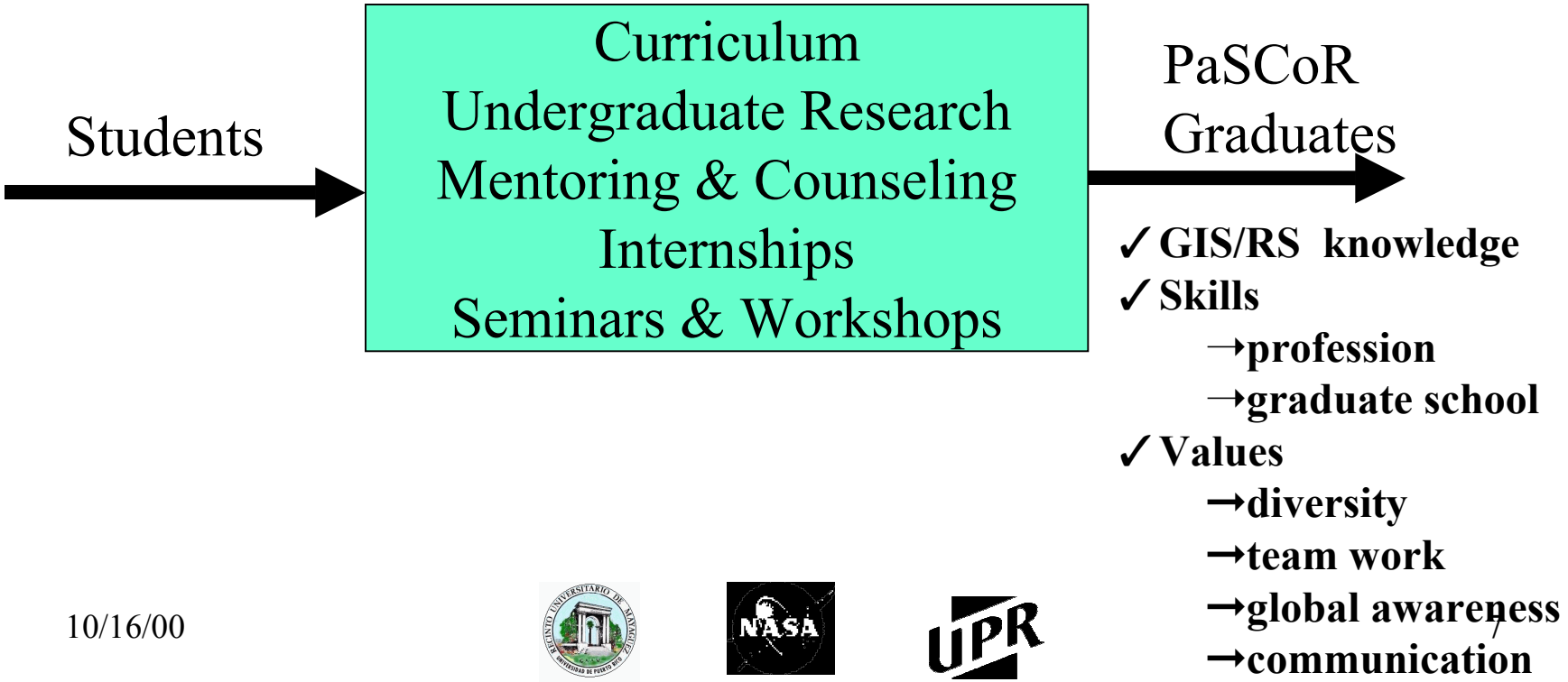
Project Model

The "Learning Factory"Concept

An outcomes-based, student centered initiative



PaSCoR Courses Main Focus

- outcomes-based
- practice-based, hands-on educational experiences
- balance traditional scientific & mathematical principles with practical experiences
- development of skills
- compliance with ABET 2000

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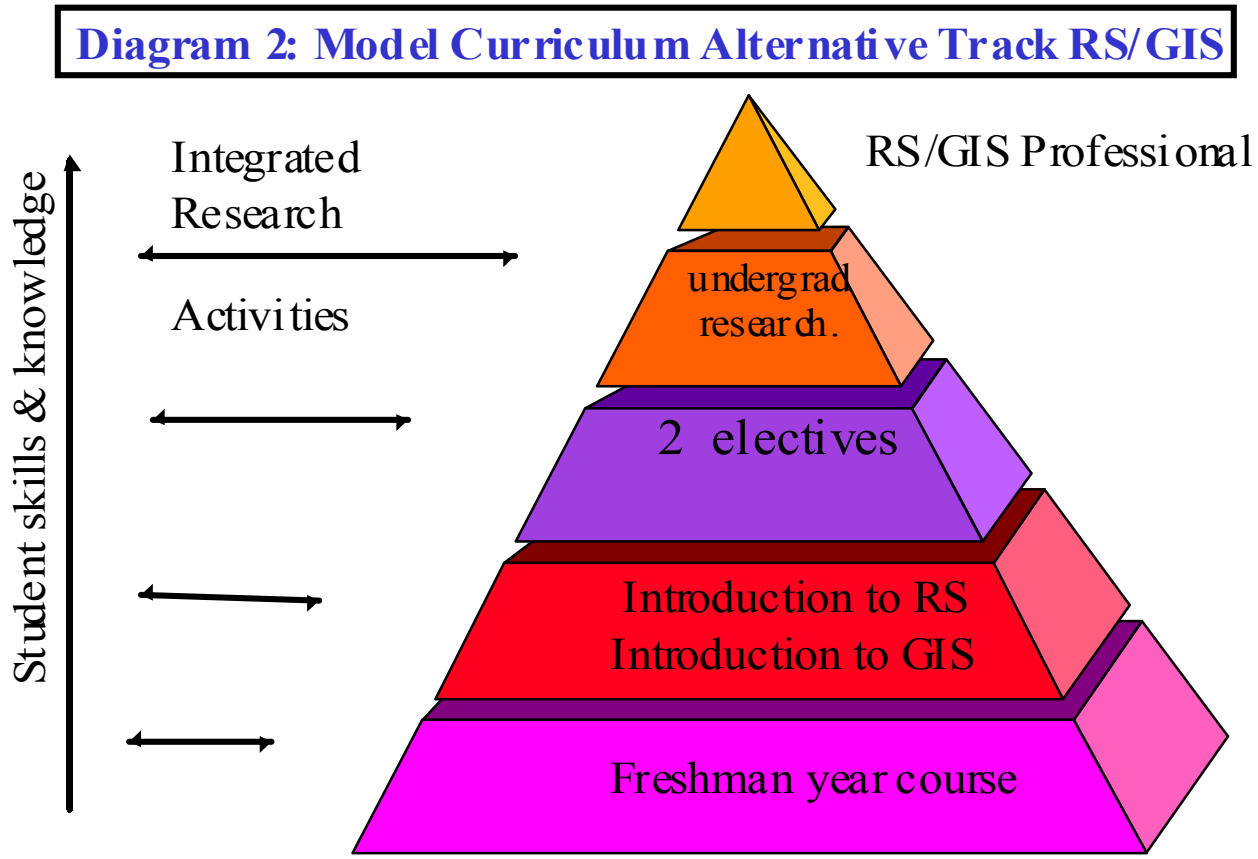
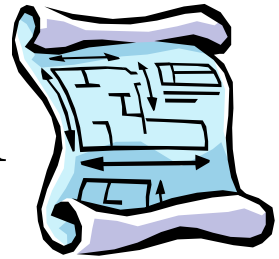
The "Learning Factory" Curriculum Model



Question

- What does the course syllabus represent to you?

The syllabus or course plan



- The instrument that reflects the course design and establishes what is required and expected from the student
  - Course objectives
    - Content & skills
  - Educational activities to achieve goals/objectives
    - Traditional (e.g., lecture)
    - Non-traditional (e.g., hands on lab activities, team experiences, industrial interaction)
  - Outcomes Assessment
    - traditional (e.g., exams) and custom-made (e.g, to evaluate teamwork)

PaSCoR Courses

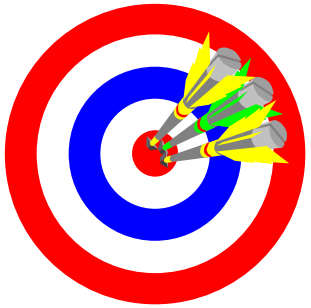
- Course Title
- Description
- General Objectives and Skills
- Course Outline
- Student Outcomes Assessment & Evaluation Criteria

Course Design

- Common format/template
  - WORD 7, Power Point 7
- Be available through electronic means
- Team developed
  - Share strategies & assessment tools

Course Development Steps

- Step 1: Establish Rationale
- Step 2: Define General Objectives and Student Outcomes (Instructional Objectives)
- Step 3: Design Teaching/Learning Strategies
- Step 4: Develop Criteria/Tools to Assess Student Performance/Outcomes
- Step 5: Determine Special Contacts Needed
- Step 6: Pilot test & assessment
- Step 7: Re-engineer & Report



Why establish instructional objectives?

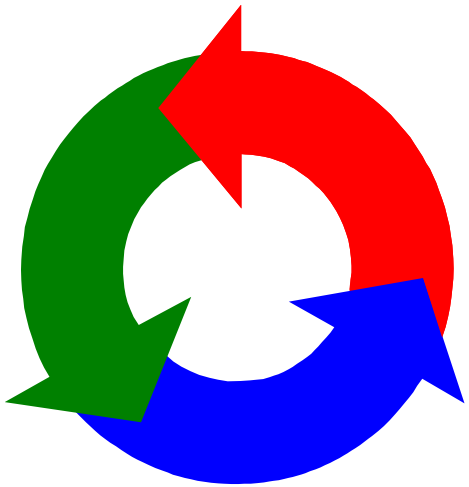
- Identify critical course material
- Facilitate the design of in-class activities
- Facilitate effective student evaluation
- Focuses the student' s attention on learning tasks by telling what they can expect...

Instructional Objectives

- Example: *"At the end of this (course, week, lecture), the student will be able to…"*
- "…" is an action word like:
  - calculate, estimate, solve, derive
  - describe, compare, distinguish, list
  - explain, outline, construct…
- Can be measured

Bloom's Cognitive Objectives

- Cognitive Domain
- Affective Domain
- Psychomotor Domain
- Levels
  - Knowledge
  - Comprehension
  - Application
  - Analysis
  - Synthesis
  - Evaluation



KNOWLEDGE

- Remember previously learned material.
- Lowest level of learning outcome.
- Recognize or recall information about specifics, terminology, facts, methodology, classifications and sequences.
- Verbs to use: define, repeat, name, identify, relate, remember...

COMPREHENSION

- Ability to understand the meaning of the information.
- Represents the lowest level of understanding.
- Verbs to be use: describe, explain, discuss, identify…

APPLICATION

- Ability to use learned material in new and concrete situations.
- Represents a higher level of understanding than comprehension.
- Verbs to be use: apply, interpret, demonstrate, illustrate, use...

ANALYSIS

- Ability to break down material into its components parts.
- Represents a higher level of understanding than comprehension.
- Verbs to be use: calculate, solve, compare, contrast, categorize, derive, model.

SYNTHESIS

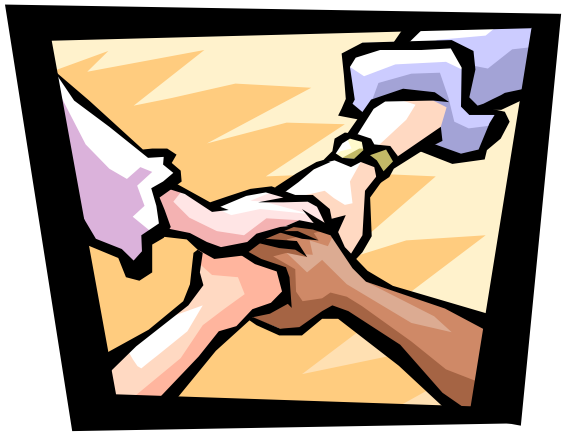
- Ability to put parts together into a whole.
- Creative behavior is stress.
- Verb to use: Create, invent, predict, construct, design, imagine, improve, produce, propose…

EVALUATION

- Ability to judge the value of the material for a given purpose.
- The highest level of intellectual activity.
- Verb to use: judge, select, decide, critique, justify, verify, debate, assess, recommend, argue.

SKILLS

- The Graduating SMET Profile
  - Team work
  - Problem solving
  - Communication



ABET 2000 a-k competencies

a. ability to apply knowledge of math, science & engineering
b. ability to design & conduct experiments, analyze data
c. ability to design a system component or process
d. ability to function on multi-disciplinary teams
e. ability to identify, solve & formulate engineering problems
f. understanding of professional & ethical responsibilities
g. ability to communicate effectively
h. understand the impact of engineering solutions in a global & societal context
i. life-long learning
j. knowledge of contemporary issues
k. ability to use techniques, skills & engineering tools necessary for engineering practice

Example of Student Outcomes

- Clearly defines a need/problem and analyzes the situation
- Clearly establishes goals & objectives for product/process & defines a work-plan
- Timely follows a work-plan
- Accurately demonstrates knowledge from his/her area of expertise, & integrates other areas
- Communicates ideas clearly, both in written reports & oral presentations
- Facilitates effective interpersonal/inter-team relationships

Course Development Steps

- Step 1: Establish Rationale
  - Course title (page 1)
  - General description (page 1)
  - Identify topics to be covered (page 2, column 1)
  - Establish:
    - class size
    - faculty/student ratio
    - role of instructor

Steps...

- Step 2: Define General Objectives and Student Learning Outcomes (Instructional Objectives) (page 1):
  - Student Outcomes
    - What do you expect students to learn?
    - What do you expect students will be able to do with what they learn?
  - Determine what specific skills & competencies will be developed in the students
    - Bloom's taxonomy
    - ABET 2000 a-k skills & competencies
    - recommended by constituents
      - » industry
      - » Other (See PR-AMP ***Skills for the Millenium***)

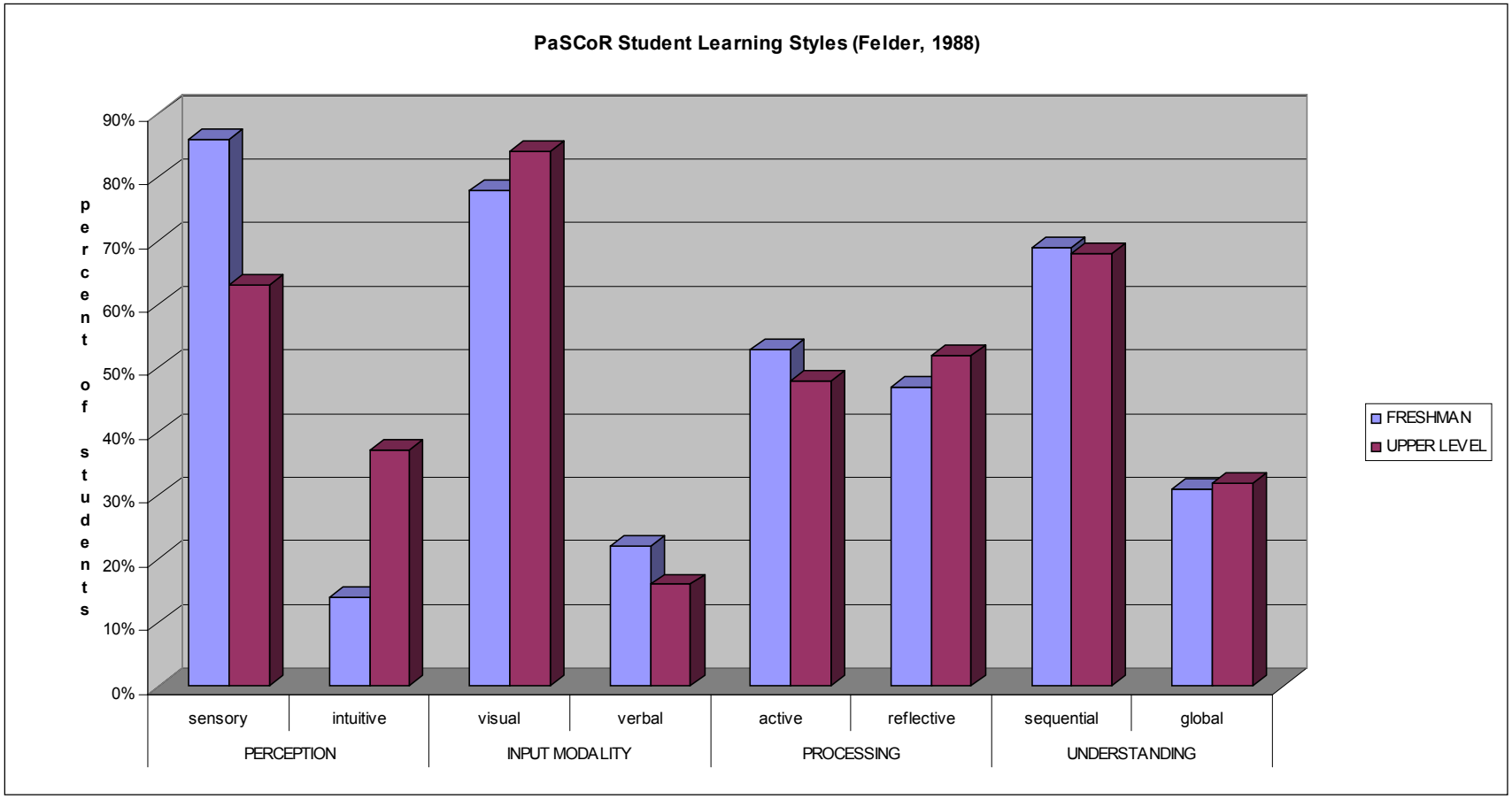
Steps…

- Remember to consider all cognitive levels
  - All PaSCoR courses/modules must include the development of (at least) the following:
    - **diversity**
    - **team work**
    - **global awareness**
    - **ethics**
    - **communication**

How do students learn?

- Learning Style Model, Felder 1988
  - Perception - Sensory, Intuitive
  - Input Modality - Visual, Verbal
  - Organization - Inductive, Deductive
  - Processing - Active, Reflexive
  - Understanding - Sequential, Global

PaSCoR Student Profile



Teaching/Learning Strategies

- Are relative to the course objectives.
- Establish relevance and applications for all course material.
- Should balance concrete information (facts, observation) and abstract concepts (model, theory).
- Should use a variety of delivery modes (e.g., use pictures, schematics and graphs, videotapes, demonstrations, hands-on) to address most of learning styles.

Teaching/Learning Strategies

- Use numbers, not just algebraic variables.
- Give time to think.
- Use cooperative learning
  (small group exercises)
- Use computer-assisted instruction.
- Assign open-ended problems for analysis and synthesis.

Traditional and Non-traditional Teaching/Learning Strategies

- Lectures
- In-class demonstrations
- Laboratory experiences
- Consultations
- Field trips to industry
- Oral presentations
- Written reports
- Working in teams

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Teaching/learning Strategies Suggested by Wankat

TEACHING AND LEARNING ACTIVITIES (Harb et al., 1991; McCarthy, 1987; Svinicki and Dixon, 1987)

Diverger (1)	Assimilator (2)	Converger (3)	Accomodator (4)
Motivation	Information and Facts	Try it	Do it themselves
"War stories"	Lecture	Homework problems	Self-select projects
Brainstorming	Reading	Laboratory	Design
Observation: Field trips, "on street", Logs, Journals	Instructor or TV demonstration	Simulations	Open-ended problems
Role Playing	Patterns	CAI	Write problems
Discussion	Organizing	Problem solving	Field trips
Questioning	Objective tests	Short answer	Work experience
Visualization	Library Work	Report	Simulations
	Problem-solving examples	Demonstrations	Teach yourself
	Seminars	Experiment	Teach someone else
		Tinker	Think tank
		Record	
		Make things work	

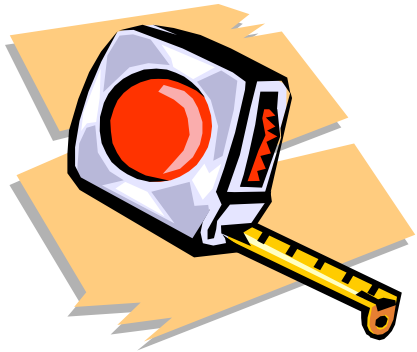
From: "Teaching Engineering" by Wankat & Oreovicz Mc Graw-Hill, 1993

Steps...

- Step 3: Design Teaching/Learning Strategies (page 2)
  - What classroom/lab activities & strategies will be necessary for students to learn the desired concepts?
  - What classroom (or otherwise) activities & strategies will be necessary for students to develop desired skills & competencies?
  - Examples:
    - lectures, labs, demos, field trips, professionals in the classroom, working in teams, coop learning, oral presentations, written reports, etc. (See ***Wankat)***

How to Evaluate Student Performance?

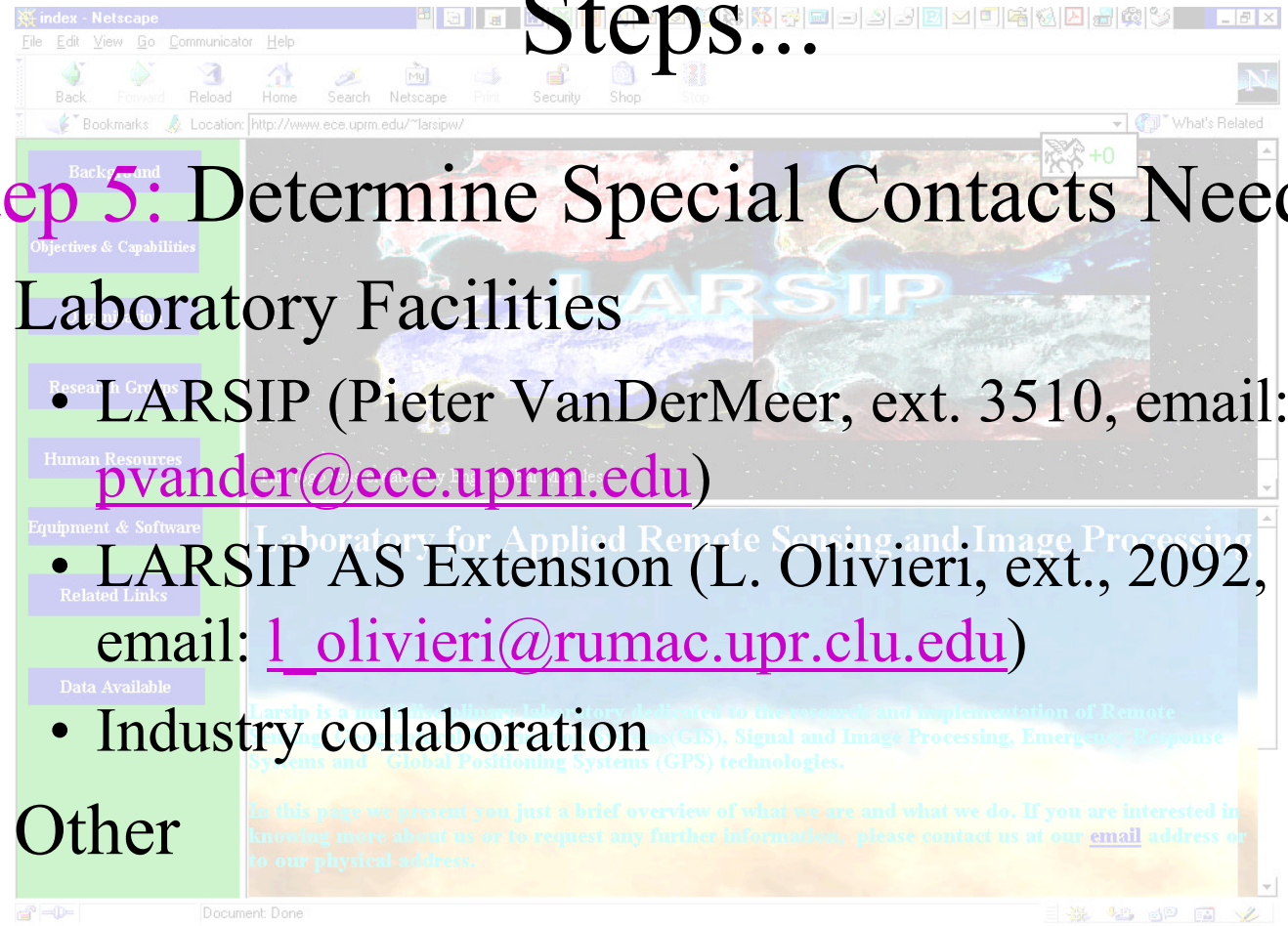
- Depends on Course goals/objectives
- Tools
  - Traditional & Non-traditional
    - exams, quizzes, homework,
    - oral reports
    - written reports
    - team experiences
- Assessment Tools Examples



Steps...

- Step 4: Develop Criteria/Tools to Assess Student Performance/Outcomes (page 3)
  - specific criteria
    - how will you know if students have learned concepts and developed skills?
  - traditional tools (tests, quizzes, homework)
  - non-traditional assessment tools/instruments

Steps...



- Step 5: Determine Special Contacts Needed
  - Laboratory Facilities
    - LARSIP (Pieter VanDerMeer, ext. 3510, email: pvander@ece.uprm.edu)
    - LARSIP AS Extension (L. Olivieri, ext., 2092, email: l_olivieri@rumac.upr.clu.edu)
    - Industry collaboration
  - Other

Steps...

- Step 6: Pilot test & assessment
  - All course materials & assessment tools ready
    - Word/Power Point format & in electronic means (to be posted on PaSCoR web-site)
- Step 7: Re-engineer & Report

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New PaSCoR Courses

Courses (credits)/Semester		98-99		99-00		00-01		01-02		02-03	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
ECE: INEL 5995 Introduction to Remote Sensing Dr. Ramón Vásquez	3			X (50 students)	X	X		X		X	
ECE: Introduction to GIS Dr. Ramón Vásquez	3				X		X		X		X
AGR: AGRO xxxx Application of RS/GIS in Agricultural Sciences Dr. Luis Olivieri	3					X		X		X	
ECE: INEL 53xx Image Processing Dr. Hamed Parsiani	3		X (7)			X		X		X	
ECE: INEL 5995 Pattern Recognition Dr. Luis Jimenez Course web page: http://ece.uprm.edu/~jimenez	3		X (15 students) seminar	X (17 students) course			X		X		X
ECE: INEL xxxx Signal Systems (required course for Pattern Recognition) Dr. Luis Jimenez, Dr. Domingo Rodriguez, Dr. Miguel Vélez, Dr. Shawn Hunt	3										
GEO: GEOL 3105 Images of Earth (submitted & approved) Dr. Pamela Jansma	3				X		X		X		X
GEO: GEOL 4060 Geodesy in Earth Sciences Dr. Pamela Jansma (institutionalized)	4		X (10)				X		X		X
GEO: GEOL xxxx Field Verification Dr. Pamela Jansma	4						X		X		X
MATH: MATH 4xxx Topics in the Mathematics of Remote Sensing Dr. Robert Acar	3				X				X		
MATH: MATH 4xxx Scientific Visualization Dr. Robert Acar	3						X		X		X

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Revised PaSCoR Courses

Courses (credits)/Semester		*98-99*		*99-00*		*00-01*		*01-02*		*02-03*	
		1st	*2nd*	*1st*	*2nd*	*1st*	*2nd*	*1st*	*2nd*	*1st*	*2nd*
UNIV 101 Freshman Year Experience (no-credit) Dr. Rosa Buxeda	N/C	X (x students)		X		X		X		X	
GEO: Geology 3047 Introductory Laboratory (2 RS/GIS Courses) Dr. Allen Smith, Dr. Pamela Jansma	3		X (25)	X	X	X	X	X	X	X	X
GEO: Geology 4048 Geological Applications of Remote Sensing Dr. Pamela Jansma	4				X		X		X		X
AGR: CFIT 3005 Crop Production (1-hour lecture) Dr. Luis Olivieri	4		X (200 students)	X	X	X	X	X	X	X	X
AGR: AGRO 4018 Soil Fertility (Laboratory experience in the use of GIS in soil fertility) Dr. Luis Olvireri	3			X (25 students)	X	X	X	X	X	X	X
AGR: AGRO 4025 Seminar (1-hour conference on applications of RS/GIS in agriculture) Dr. Luis Olivieri	1		X (25 students)			X		X		X	
AGR: AGRO 4037 Soil Chemistry (1-hour laboratory experience) Dr. Luis Olivieri	3					X	X	X	X	X	X
MATH: Math 4061 Numerical Analysis (Chapter on Discrete Fourier Transform which is used in signal processing) Dr. Robert Acar, Dr. XY	3		X (~30)		X	X	X	X	X	X	X
MATH: ESMA 3101 and ESMA 4001 Applied Statistical Analysis I&II (Laboratory or Course being developed), Dr. XY	3			X (y students?)	X	X	X	X	X	X	X

Resources

PASCoR Team Addresses

NAME	DEPARTMENT	TELEPHONE	FAX	EMAIL
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Resources

- PaSCoR course syllabus template
- Sample IQ 4016 syllabus
- Description of Bloom's Major Categories
- "Objectively Speaking", paper,R.M. Felder
- Some assessment tools