COMP 915
Learning Styles and Course Planning

Don Porter

(Portions courtesy Samarjit Chakraborty)
Disclaimers

- I am not an education or psychology expert
- And some of the scholarly consensus has changed since I took a similar course
- Lessons: Stay humble, stay curious
Bold Assertion:
People are different
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- Hence: Many, many personality tests/types
  Most fun and no real scientific grounding

- Big 5/OCEAN (actually scientifically validated):
  Openness: curious vs. cautious
  Conscientiousness: organized vs. careless
  Extraversion: outgoing vs. reserved
  Agreeableness: compassionate vs. critical
  Neuroticism: sensitive vs. confident

- Myers-Briggs (e.g., INTJ)
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Lesson 1:

- What worked for you to learn, will NOT work for all of your students
- And, it is not the students’ shortcoming
All models are wrong, Some are useful

* My favorite: the Whole Brain Dominance Instrument

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<th>Left</th>
<th>Right</th>
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<tbody>
<tr>
<td>High</td>
<td>Analytical</td>
<td>Visionary</td>
</tr>
<tr>
<td>Low</td>
<td>Detail-Oriented</td>
<td>Empathetic</td>
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* People have varying degrees of comfort in each area
Example: Bill Clinton

- 42nd President of the United States (1992—2000); spouse of Hillary Clinton
- Only US President from my home state of Arkansas
- Widely considered an exceptional speaker
- Why?
The formula for a Clinton Speech

1. I feel your pain
2. Here is why you are experiencing your pain
3. I have a vision for a world without your pain
4. And a 12-point plan to accomplish it!

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There are multiple dimensions in learning and teaching styles.

To account for all students, what should you do?
Accommodate all the 32 styles?

<table>
<thead>
<tr>
<th>Preferred Learning Style</th>
<th>Corresponding Teaching Style</th>
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<tbody>
<tr>
<td>sensory</td>
<td>concrete</td>
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<tr>
<td>intuitive</td>
<td>abstract</td>
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<tr>
<td>visual</td>
<td>visual</td>
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<td>auditory</td>
<td>verbal</td>
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<td>inductive</td>
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<tr>
<td>active</td>
<td>active</td>
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<tr>
<td>reflective</td>
<td>passive</td>
</tr>
<tr>
<td>sequential</td>
<td>sequential</td>
</tr>
<tr>
<td>global</td>
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"Just think of it as if you’re reading a long text message."
Sensing and Intuitive Learners

Gap between engineering education and what would be effective

- E.g., sensors like data, facts vs intuitors like concepts
- Ideas?
Sensing and Intuitive Learners

Gap between engineering education and what would be effective

- E.g., *sensors* like data, facts vs *intuitors* like concepts
- Solution: blend concrete information with abstract concepts
Visual and Auditory Learners

Visual vs Auditory vs Kinesthetic (taste, touch, smell)

- Most college teaching is verbal
- Result - serious learning/teaching style mismatch

Visual + auditory modalities reinforce learning for more students

- Solution: blend figures, graphs, logic/information flow into the text
A Note on Kinesthetic Learning

- My spouse teaches Montessori at the elementary level (6—11 yrs old)
- They cover math topics through **algebra**
- Introduced kinesthetically!
- Then generalize to symbolic manipulation
Inductive vs Deductive Learners

Induction - observations to laws/theory

  E.g., Scientific method rooted in inductive reasoning

Deduction - theory to consequences

  E.g., Mathematical proofs rooted in deductive reasoning

CS is a rare field where we get some of both!

Engineering education - “fundamentals” for sophomores “applications” later (if ever)

  * Research says that inductive teaching better promotes effective learning
  * Solution: First induction, then deduction. Let the students deduce the rules
Active vs Reflective Learners

Active - doing something with the information

Reflective - examine information introspectively

Effective teaching strategy:

- Interleave lectures with pauses for thought and discussions & problem solving
- Emphasize both - fundamental understanding (reflective) & problem solving (active)
Sequential vs Global Learners

- Sequential learners can work with material they understood partially/superficially
- Global learners require a fuller picture

Standard curriculum follows sequential flow

- Instructors should pay special attention to help global learners
- How? Provide more context, relate to previous courses, assign creativity exercises, encourage alternative solutions

Challenge in COMP 530: No sequential path through an OS
So how will you incorporate all the 32 styles?

You probably can’t all the time

- But covering a few strategies (poles of each dimension) should help a very large section of students
- Experiment and evolve …
Finding Science in Education

- In OS research, the lag between idea and data is measured in years.
- In teaching, the lag between course meeting and assessment can be as short as days, or even minutes!
Disclaimer

- Recent research has somewhat challenged learning styles as the absolute truth
  - Most people learn via most styles, and need all styles
    - Even if they have preferences
  - Again, “some models are useful”
- And, these slides will likely need updates in future years, as humans collectively learn more about learning
Course Planning and Evaluation
What is your first step towards preparing a talk or writing a report?
Why are you teaching this?

- A new course
- A talk at a conference
Why are you teaching this?

- Goals tied to outcomes (e.g., what will the students be able to do?)
  - Your goals vs goals of the student (e.g., employment)
- Listing the goals will serve as a basis for designing the course/talk
- Evaluation will be easier - have you achieved those goals?
- Methods of assessment - operational definition of your goals
Bloom’s Taxonomy (Revised by Anderson and Krathwohl 2001)

Bloom’s Taxonomy (levels of educational objectives)

- Remember
- Understand - interpret, infer
- Apply
- Analyze - how different components relate to each other
- Evaluate - make judgements based on criteria
- Create

My test questions:
- Some simple definition questions
- Some simple word problems
- Some challenging problems
- Some performance analysis
- Some “what if?” questions
Bloom’s Taxonomy Lessons

- Different learning objectives have different assessment methods
- In courses, students realize different degrees of mastery
  - Good to measure at each level
  - Builds confidence, if nothing else!