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The Truth about Learning Styles

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Participant Outcomes

After this session, you will be able to:

1) summarize 5 popular and heavily-used learning styles models
   - Gardner’s Multiple Intelligences
   - Fleming and Mills’ VARK learning styles model
   - Kolb’s Learning Styles Model (LSM) & Experiential Learning Theory (ELT)
   - Myers-Briggs Type Indicator (MBTI)
   - Felder-Silverman Index of Learning Styles (ILS);

2) explain their scientific and statistical status (reliability, validity, and effects on student learning);
Outcomes continued

3) draw on cognitive psychology research to account for how some can seem so useful while resting on weak scientific and statistical grounds;

4) apply this research to design effective assignments and class activities that allow students to process knowledge and skills through multiple senses and in multiple modes.
Free L.S. Instruments

- **Gardner’s Multiple Intelligences:**
  http://www.businessballs.com/freematerialsinexcel/free_multiple_intelligences_test.xls

- **Felder-Silverman ILS:**
  http://www.engr.ncsu.edu/learningstyles/ilsweb.html

- **Fleming & Mills’ VARK:**

- **Myers-Briggs (abbreviated version):**
Characteristics of “Learning Styles”

- preferences, easiest ways to learn, take in, process, retrieve, or express information/knowledge

- models vary by “base” (senses, personalities, initial learning hooks, cognitive modes)

- multiple styles likely

- styles somewhat malleable

ALL styles are in every classroom.
Jot down your answers to these 2 questions:

1) Which learning styles model(s), if any, do you use to learn about your students, to help them better understand themselves, or to better inform your teaching?

2) Why?
5 Popular Models of Learning Styles

- Gardner’s Multiple Intelligences
- Fleming & Mills’ VARK
- Kolb’s Learning Styles Model and Experiential Learning Theory (ELT)
- Myers-Briggs Type Indicator (MBTI) ← Jung
- Felder-Silverman Index of Learning Styles (ILS)
Gardner’s Multiple Intelligences

- Verbal Linguistic
- Logical-mathematical
- Musical
- Spatial
- Bodily Kinesthetic
- Interpersonal
- Intrapersonal
- Naturalist
Fleming & Mills’ VARK
Sense intake-output preference

- Read-Write (Digital): Symbols
- Aural (Auditory): Sounds
- Visual: Graphics/Pictures
- Kinesthetic: Space/Motion
<table>
<thead>
<tr>
<th>Left brain</th>
<th>Deductive</th>
<th>Inductive</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Read/Write (Digital)</td>
<td>Aural (Auditory)</td>
</tr>
<tr>
<td>Right brain</td>
<td>Visual</td>
<td>Kinesthetic</td>
</tr>
</tbody>
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Kolb’s LS Model & ELT

Preferred entrée into learning cycle

4-stage learning cycle

- **1. Concrete Experience (CE)** - feeling, as in “sensing” (not affect, values)
- **2. Reflective Observation (RO)** - watching
- **3. Abstract Conception (AC)** - thinking
- **4. Active Experimentation (AE)** - doing
Kolb’s LS Model & ELT

continued

Lines of Axis of Conflicting Modes

CE-feeling v. AC-thinking

AE-doing v. RO-watching
Kolb’s LS Model & ELT

continued

CE-feeling + AE-doing = Accommodator
CE-feeling + RO-watching = Diverger
AC-thinking + AE-doing = Converger
AC-thinking + RO-watching = Assimilator
Myers-Briggs Type Indicator (MBTI) - Jung

Combination of personality (E, I, J, P) & cognitive modes (S, N, T, F)

Extroversion (E) v. Introversion (I)
Sensing (S) v. Intuition (N)
Thinking (T) v. Feeling (F)
Judging (J) v. Perception (P)
Felder-Silverman ILS

Aspects of cognitive processing

Reflective v. Active
Verbal v. Visual
Sequential v. Global
Intuitive v. Sensing
Felder-Silverman ILS

Preference dimensions

Re-Ac: Method for processing info – introspection v. physical or social engagement

Ve-Vi: Modality of sensory info – verbal (spoken or written) v. visual

Se-Gl: Method of gaining understanding – logical, small steps v. holistic, leaps

In-Se: Type of info – memories, ideas, insights v. sensory
Active: try things out, work w/others
Reflective: think things thru, work alone
Visual: graphic representations of material--pictures, diagrams, flow charts
Verbal: written & spoken explanations
Sequential: linear, orderly, learn in small incremental steps
Global: holistic, systems thinkers, learn in large leaps
Sensing: concrete, practical, oriented toward facts & procedures
Intuitive: conceptual, innovative, oriented toward theories & meanings

Dimensional Focus

<table>
<thead>
<tr>
<th>Personality</th>
<th>Cognition</th>
<th>Senses</th>
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</thead>
<tbody>
<tr>
<td>← Gardner’s Multiple Intelligences →</td>
<td>Felder-Silverman ILS</td>
<td>VARK</td>
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<td>Kolb’s LSM&amp;ELT</td>
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<td>Myers Briggs</td>
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THE THEORY/PROBLEM: Faculty & students tend to have different learning styles.

<table>
<thead>
<tr>
<th>LEARNING STYLE FRAMEWORK</th>
<th>FACULTY LEARN. STYLES</th>
<th>STUDENTS’ LEARN. STYLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardner’s Multiple Intelligences</td>
<td>Verbal Linguistic Logical-mathematical Naturalist</td>
<td>Musical Spatial Kinesthetic Interpersonal Intrapersonal Naturalist</td>
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<tr>
<td>Fleming &amp; Mills (VARK)</td>
<td>Read/Write (Digital)</td>
<td>Visual Auditory Kinesthetic</td>
</tr>
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<td>LEARNING STYLE FRAMEWORK</td>
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<tr>
<td>Kolb’s Learning Styles Model &amp; Experiential Learning Theory (ELT)</td>
<td>Convergers Assimilators</td>
<td>Divergers Accommodators</td>
</tr>
<tr>
<td>Myers-Briggs Type Indicator (MBTI)</td>
<td>INT (introverted, intuitive, thinking)</td>
<td>ESF (extroverted, sensing, feeling)</td>
</tr>
<tr>
<td>Felder-Silverman Index of Learning Styles (ILS)</td>
<td>Reflective Verbal Sequential Intuitive</td>
<td>Active Visual Global Sensing</td>
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Which Model(s) to Use?
Let’s evaluate each one.
Evaluating Gardner’s MI

- Too many modes to teach to
- Low validity & reliability
- Without empirical foundation

Gardner: “Intelligences are fictions—at most useful fictions—for identifying processes and abilities that (like all of life) are continuous with one another” (1993, p. 70).
Evaluating VARK

- Low validity & reliability

Fleming: “I sometimes believe that students and teachers invest more belief in VARK than it warrants” (Fleming & Baume, 2006, p. 3).

Marilla Svinicki: “We found that [VARK] was hard to validate statistically....We just couldn’t get a good fit with the data....The statistical properties are not stable enough to satisfy the requirements of research ....VARK is in good company” (quoted in Fleming & Baume, 2006, p. 3).
However: “Everyone who uses the VARK loves it.... So it is obviously striking a chord with almost everyone who uses it. We just have to realize that the constructs of learning style are too varied to pin down accurately and every instrument I’ve ever considered suffers from this same issue” (Svinicki quoted in Fleming & Baume, 2006, p. 3).
Evaluating Kolb’s LSM

- Mixed results on test-retest reliability
- No to low correlations among factors that should correlate with LS classifications (construct validity)
- Low to moderate predictive validity (effect sizes); no clear evidence that modified instruction leads to better learning
Evaluating Myers-Briggs

- More personality & career preference than learning?
- Fair-to-good test-retest & internal consistency reliability
- Mixed results on construct & predictive validity
- Separate dimensions (not 16 types) predicted diffs in approach to learning tasks, response to dif types of instruction & classrm envir’s, & career goals of engin students.
Evaluating Felder-Silverman ILS

- Good internal consistency reliability
  - Cronbach $\alpha = 0.5-0.8$ (exc Seq-Globl in $\frac{1}{4}$ studies)

- Decent test-retest reliability
  - $r = 0.73-0.87$ in 4 wks; $0.60-0.78$ in 7 mo.

- Low inter-scale correlation
  - $r < 0.2$ (exc Int-Sen & Seq-Global)

- Good construct & predictive validity
  - Predicts well to specializations of engin students & faculty
In small groups (4-5), answer this question:

- How can it be that some models “feel” so right and test so poorly?
1 Obvious Answer:

- You can test only the instrument—never the theoretical model.
  - *Model may be more valid than its instrument.*
Also... Parallels/Comparabilities Between Models

- Superior models can make inferior models appear more effective when they share learning style types or dimensions. (See diagram.)
Cognitive Psychology Also Has Answers

- Research on the general learning value of
  - Visuals
  - Using best modality(-ies) for the content
  - Multi-modal modal repetition
Visual Tools Help Everyone

○ Deeper learning, conceptual understanding
  ● Show BOTH structure of knowledge ("big picture") and integration of its elements

○ Better, longer retention + easier retrieval
  ● Require less working memory, fewer cognitive transformations
  ● Dual coded in semantic and episodic memories

○ Cognitive operations easier
  ● Easier to locate and extract information
  ● Easier to draw inferences

○ Cross-cultural
Using Best Modality(-ies) for the Content

For example:
- Using visuals for visual material
- Using experience for learning how to do something physical
- Using reading & auditory for poetry
- Using many modes for relatively recent history
Multi-Modal Repetition

- People learn new material best when they receive it
  - *multiple times* and
  - *through multiple senses & modes* that use different parts of their brain.

(Kress et al., 2006; Tulving, 1985; Veriki, 2002)
In small groups (4-5), answer this question:

- How can we design assignments and class activities to give students the chance to process knowledge and skills through multiple senses and in multiple modes?
Verbal (Reading and Writing) Mode

- Reading text, instructions, outlines
- Writing
  - informal (writing-to-learn exercises)
  - formal
- Lectures if taking notes
Verbal-Oral and Auditory Modes

- Lecture & podcasts, if in the right structure (e.g., stories)
- Cases & PBL problems
- Discussion, especially in small groups; all group work
  - Actively devises own way of orally expressing material
  - Listens to own way and others’ ways
Action/Experiential Mode

- Experiential learning
  - Cases, PBL, inquiry-guided labs & activities
  - Role plays, simulations, games
  - Service-learning, field work, field trips
- Examples (if relevant to students)
- Physical models, analogies, manipulatives (ex. next side)
- Learning objects (animated, interactive)

www.merlot.org
How to Write a Review of the Literature

Motor

= INTRODUCTION
(Define the issue/controversy.)

ONE SIDE SAYS 1, 2, & 3 -- ALL GOING IN THE SAME DIRECTION.

THE OTHER SIDE SAYS 4, 5, & 6 -- ALL GOING IN THE OPPOSITE DIRECTION.

"However,..."

CONCLUSION:
Choose to favor going in one direction (one side) or the other (other side).
Visual Mode

- Thinking maps
- Concept and mind maps
- Graphic syllabus
- Graphic metaphors
- Flowcharts, diagrams, graphs
- Matrices, tables
- Pictures, sketches
- Learning objects (animated) – www.merlot.org
Classification (Tree) Map

What are the main types/categories?
What distinguishes these types/categories from each other?
Give examples of each type.
Flow Map - Sequencing

What happened? What are the substages? What is the sequence of events?
To define the types of information and communication technologies (ICTs)

To explain the implications of ICTs for business and marketing strategies

To assess the impact of the Internet on key sectors of the tourism industry

- eAirlines
- eHospitality
- eTravel agents & eTour operators
- eDestinations

To explain the terminology in your own words and use it correctly

To recognize demand/supply-driven tourism in the business world

To create an online marketing plan for a tourism organization

Outcomes Map
Irem Arsal, PRTM 391: E-Commerce & Tourism Marketing
What are the causes and effects of this event? What might happen next?
Venn Diagram

Overlapping Concepts or Categories

What concept/category identifies objects that are both A and B?
Comparison-Contrast (Double Bubble) Map

What are the similarities and differences between the two objects/concepts?
Data Retrieval Matrix – Comparison-Contrast Type

<table>
<thead>
<tr>
<th>WAR/Feature</th>
<th>Duration</th>
<th>Causes</th>
<th>How started</th>
<th>+ Effects for U.S.</th>
<th>– Effects for U.S.</th>
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<tbody>
<tr>
<td>WW I</td>
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<tr>
<td>WW II</td>
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<td>Korean</td>
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<td>Desert Storm</td>
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Mind & concept maps show hierarchically organized knowledge

- from most inclusive/general/broad/abstract (superordinate) concept
- to most exclusive/specific/narrow/concrete (subordinate) concepts
Concept Map
Pressure

defined as

Force \text{ per unit } Volume

Life-giving

Oxygen
Food

Appearance  Texture  Taste
Point of Material

Best Arrangement

Photosynthesis

requires Light

requires CO2
Energy

one form is

Light

which has this property

Life-giving

which describes

Photosynthesis
GRAPHIC SYLLABUS
Dr. Darlene Panvini
Biology 115: Conservation Ecology

Conservation Ecology

Understanding Biodiversity

Definitions of Biodiversity

Value

Why Value Biodiv?

Are We Obligated to Save Biodiv?

Losing Biodiversity

The People Factor

Habitat Fragmentation

Exotics: Service Learning at Warner Parks
Paper: Exotics

Case Study: The Dusky

Case Study: Birds

Saving Biodiversity

Preserve Design

Endangered Species Act

Policies for Conservation

Resolution What to do?

Paper Symposium: Environmental Organizations

Conservation in Action: TDEC

Case Study: Balcones Canyonland HCP

Case Study: Jobs or an Owl?

Species

Population

Ecological

Definitions of Species

Patterns of Species Richness

Measuring Species

Genetic Variation within & Among Populations

Population Demography

A New Approach to Conservation

Ecosystem Management

Conservation in Action: TNC

Defining Ecosystems Paper: Wetlands

Zoos

Case study: Red Wolf
ME 404: Manufacturing Processes and Their Application, Professor Laine Mears

**DESIGN**
- Integration
  - QFD
- Interpretation
  - GD & T

**MANUFACTURING**
- **Material Removal**
  - Machining Processes
    - Turning
    - Milling
    - Drilling
    - other
  - Sheet Metal
    - Bending
    - Stamping
    - Blanking
    - Punching
  - Casting Processes
    - Sand casting
  - Bulk Deform.
    - Forging
  - Polymer Processes
    - Inj. Molding
  - Joining
    - Welding

- **Material Transformation**
  - Machining Processes
    - Milling
    - Drilling
  - Sheet Metal
    - Bending
  - Casting Processes
    - Sand casting
  - Bulk Deform.
    - Forging
  - Polymer Processes
    - Inj. Molding

- **Material Addition**
  - Joining
    - Welding
  - Adhesion
    - Brazing
  - Rapid Prototyping
    - SLA
    - SLS
    - 3D Printing
    - other

**INDUSTRIAL**
- Quality
  - Metrology
  - SPC
- Time
  - Push / Pull
  - Lean Mfg.
How can we teach more effectively to Felder & Silverman’s 8 anchor styles?


Apply to your own courses.
Teach theoretical material by first presenting phenomena and problems that relate to the theory (sensing, inductive, global).
Balance conceptual information, such as concepts, theories, and models (intuitive), with concrete information, such as descriptions of phenomena, demonstrations, results from real and simulated experiments, real-life examples and applications, and problem-solving algorithms (sensing).
Complement oral and written explanations in lectures and readings (verbal) with pictures, sketches, matrices, graphs, schematics, diagrams, flowcharts, concept, mind, and thinking maps, and demonstrations (visual). Also have students develop their own graphics.
To illustrate a concept or problem-solving algorithm, use at least one real-world or numerical example or application (sensing) to supplement the usual theoretical of algebraic example (intuitive).
Use physical analogies and demonstrations to illustrate the magnitudes of calculated quantities (sensing, global).
Give some observations or examples before presenting the general principle, and have the students (preferably working in groups) see how far they can get toward inferring the latter (active, sensing).
○ Provide class time for students to think and write about the material (reflective) as well as to participate actively in discussion, small-group exercises, or question-answering/problem-solving lecture breaks (active).
Demonstrate the logical flow of individual course topics (sequential), but also point out connections between current material and other relevant material in the same course, in other courses in the discipline, in other disciplines, and in everyday experience (global).
What is your take-home lesson from this workshop?