HOW LEARNING WORKS – STRATEGIES FOR TEACHERS

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At the end of this session, you should be able to:

- Describe 3 principles of learning to a colleague and, for each, provide a concrete strategy that puts that principle into practice for a course you plan to teach.

THE 7 PRINCIPLES

1. Students' prior knowledge can help or hinder learning.
2. How students organize knowledge influences how they learn and apply what they know.
3. Student's motivation determines, directs, and sustains what they do to learn.
4. To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned.
5. Goal-directed practice coupled with targeted feedback enhances the quality of students' learning.
6. Students' current level of development interacts with the social, emotional, and intellectual climate of the course to impact learning.
7. To become self-directed learners, students must learn to monitor and adjust their approaches to learning.
THE 7 PRINCIPLES OF LEARNING ARE

- Grounded in
  - Research literature
  - Work with faculty
- Broadly applicable, across
  - Domains, Students (ages, levels), and Contexts
- Generative
  - Help staff devise effective teaching strategies that are appropriate to a particular situation
PRINCIPLE 1: STUDENTS’ PRIOR KNOWLEDGE

Students' prior knowledge can help or hinder learning.
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Students' prior knowledge can help or hinder learning.

“It’s not what we don’t know that gives us trouble. It’s what we know that ain’t so.”

Will Rogers
With insufficient knowledge, students can
- Define Newton’s Second Law, but not apply it.
- Describe different statistical test, but not identify which to apply in the context of a problem.
- Apply a formula, but not explain the concept from which it is derived.

Prior knowledge must be activated to be useful.
Q. How can we gauge our students’ prior knowledge and then use that information in our teaching to

- Activate prior knowledge?
- Address insufficient prior knowledge?
PRINCIPLE 1: STRATEGIES FOR TEACHERS

- Determine the extent, quality, and nature (e.g., declarative vs. procedural) of students' prior knowledge:
  - Talk to previous instructors
  - Use diagnostic tests
  - Ask self-assessment questions
  - Use brainstorming or concept mapping
  - Look for patterns of error

- Address gaps in prior knowledge:
  - Identify for yourself what knowledge is necessary
  - Remediate insufficient knowledge as determined above
PRINCIPLE 1: STRATEGIES FOR TEACHERS

- Activate accurate prior knowledge
  - Explicitly point out connections
  - Use analogies and examples
  - Use exercises that explicitly ask students to use their prior knowledge

- Avoid activating inappropriate prior knowledge:
  - Highlight the boundaries of what knowledge is applicable, either explicitly or with rules of thumb
  - Explicitly identify discipline-specific conventions
  - Show where analogies break down and examples don't generalize
PRINCIPLE 1: STRATEGIES FOR TEACHERS

- Help students correct inaccurate knowledge:
  - Ask students to make and test predictions
  - Ask students to justify their reasoning
  - Help students practice using knowledge meant to replace misconceptions
  - Allow sufficient time
PRINCIPLE 2: HOW STUDENT ORGANISES KNOWLEDGE

How students organize knowledge influences how they learn and apply what they know.
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An historian teaching US history of the 1960s...
Events are linked together; connections are apparent
Did students hearing a lecture on the 1960’s make the same connections: info fragmented, many connections missed
PRINCIPLE 2: HOW STUDENT ORGANISES KNOWLEDGE

Students’ sparse knowledge organisations make it hard for them to see connections that are apparent to you.

- How one lecture relates to the next
- How parts of a lecture connect
- How labs connect with lectures
- How assignments connect with other aspects of the course, etc.
Q. How can we help students develop more interconnected structures for organising what they learn?
Organise the material
- Create concept map for material to be taught
- Identify the knowledge organisation best suited for learning

Enhance students' knowledge organization
- Explicitly describe the organization of material at each level in the hierarchy of presentation—subject, course, lecture, discussion
- Use contrasting and boundary cases
- Explicitly point out deep similarities and other connections
- Encourage students to use multiple organizing structures

Expose students' knowledge organization
- Ask them to draw a concept map
- Use a sorting task (sort problems, concepts into categories)
- Look for patterns of mistakes
Student's motivation determines, directs, and sustains what they do to learn.
MOTIVATION WILL BE ENHANCED IF...

- Students perceive the value (relevance, importance, utility) of a particular task or goal.
- Students believe they have a reasonable expectation of attaining success.

Motivation is all about perception.
PRINCIPLE 3: STUDENT’S MOTIVATION

Students do not necessarily value the same things you do

- May not find the material inherently interesting
- May not see how it connects to other courses
- May not be interested in pursuing a higher degree in your subject
- May not see the real-world applicability of what you are teaching
Students often value multiple goals

- When a course activity satisfies multiple student goals, motivation increases

- E.g. Daniel is motivated to work on a group project in his industrial design course because it allows him to learn to apply design principles (learning goal), make friends (social goal), engage in stimulating activity (affective goal) and develop marketable skills (professional goal).
Are my efforts in vain?

If a student doesn’t see that efforts will pay off, his/her motivation tends to decrease.

“Homework doesn’t prepare me for the exams.” ➔ Doesn’t bother doing the homework.

“Lectures just leave me more confused.” ➔ Skips lectures.
Is the system fair and reasonable?

Students will be more motivated if they believe that hard work will be rewarded, for example, if they feel that:

- The grading structure is fair
- The professor’s expectations are reasonable
- The project is feasible
- Help is available
- Teammates (on group projects) will pull their weights
Q. How can we help students see the value of our courses, assignments, etc?

Q. How can we promote students’ expectations of success?
PRINCIPLE 3: STRATEGIES FOR TEACHERS

Establish value
- Connect material to students' interests
- Provide authentic real-world tasks
- Show relevance to students' academic lives
- Show relevance of generalizable to future professional lives
- Identify and reward what you (as the instructor) value
- Radiate enthusiasm
Build positive expectancies

- Ensure alignment of course goals, objectives, assessments and instructional strategies
- Identify and set an appropriate level of challenge
- Help students build success spirals with early challenges
- Articulate your expectations
- Provide rubrics
- Provide targeted feedback
- Be fair
- Help students attribute success and failure appropriately
- Discuss effective study strategies
PRINCIPLE 3: STRATEGIES FOR TEACHERS

Addressing Value and Expectancies

- Provide flexibility and control
- Give students opportunity to reflect
To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned.
PRINCIPLE 4: DEVELOPING MASTERY

As mastery develops and students gradually gain competence within a domain, they first gain and then lose conscious awareness of the skills and capabilities they are exercising.
Expert Blind Spot

Expert blind spot occurs when expert instructors are blind to the learning needs of novice students, e.g.,
- Not seeing the steps/pieces students must learn
- Mis-predicting where students will have difficulty
- Under-estimating how long students will take
- Over-estimating how much students can handle
PRINCIPLE 4: DEVELOPING MASTERY

Expertise

- An asset for working in our field
- A liability for teaching
Q. How can we expose and reinforce component skills?

Q. How can we facilitate integration?

Q. How can we facilitate application?
Goal-directed **practice** coupled with targeted **feedback** enhances the quality of students’ learning.

**Practice**: any activity in which students engage their knowledge or skills

**Feedback**: any information given to students about their performance that guides future behaviour
PRINCIPLE 4: STRATEGIES FOR TEACHING

Expose component skills:
- Map out your own expert blind spot
- Enlist help from those with mere conscious competence
- Talk to others in your discipline
- Talk to others outside your discipline
- Explore available educational materials

Reinforce component skills
- Focus students’ attention on the key aspects of the task
- Diagnose weak or missing component skills
- Provide isolated practice of those skills.
PRINCIPLE 4: STRATEGIES FOR TEACHERS

Build fluency and facilitate integration of skills
- Give students practice exercises explicitly to increase fluency
- Temporarily constrain the scope of the task
- Explicitly include integration in performance criteria

Facilitate transfer
- Discuss conditions of applicability of skill
- Give exercises explicitly about conditions of applicability
- Provide opportunities to practice in diverse contexts
- Ask students to generalize to abstract principles
- Identify deep features using comparisons
- Prompt students to retrieve relevant knowledge
Goal-directed practice coupled with targeted feedback enhances the quality of students' learning.
What makes practice effective?

- A specific goal or criterion
  - Students learn more when they read with a specific goal
  - Students perform better with clear performance criteria (e.g. rubric)

- An appropriate level of challenge
  - Too hard: students flounder (plus low motivation)
  - Too easy: goal is achieved, so they are not striving
Targeted Feedback

1. Constructive: identifies what students are doing well as well as where they can improve
2. Actionable: offers concrete guidance on what to do
3. Timely: provided when students can use it

Plus, when feedback is focused on a specific goal:
Less likely to overwhelm students
Less likely to overwhelm you
Targeted Feedback

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Establish goals
- Be explicit about course goals, and phrase them in terms of capabilities rather than knowledge
- Use a rubric to communicate performance criteria
- Give contrasting examples of high and low quality work
- Progressively refine goals & performance criteria

Encourage deliberate practice
- Assess prior knowledge to set an appropriate challenge
- Create many chances to practice
- Build scaffolding into assignments
- Set expectations about practice
PRINCIPLE 5: STRATEGIES FOR FEEDBACK

Targeted feedback

- Look for patterns of errors
- Use prioritized feedback to direct student efforts
- Give feedback on strengths and weaknesses
- Allow frequent opportunities for feedback
- Provide feedback at the group level, potentially in real-time
- Incorporate peer feedback on assignments
- Require students to describe how they incorporated feedback
Students' current level of development interacts with the social, emotional, and intellectual climate of the course to impact learning.
PRINCIPLE 6: STUDENT DEVELOPMENT & CLIMATE

Why care about student development and climate?

- We teach students, not just content!

- The social and emotional gains that students make during college are considerably greater than the intellectual gains over the same span of time.
Theories of Intellectual Development

- Various researchers have studied how people approach knowledge at different ages, in different contexts.

- General finding: Stage-like development over time.
Alas, many students never get here!

<table>
<thead>
<tr>
<th>Stage</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dualism</td>
<td>Answers are right or wrong, black or white. Knowledge is dispensed by experts and received by novices.</td>
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<tr>
<td>Multiplicity</td>
<td>Knowledge is a matter of opinion, evaluation is subjective. It’s all shades of gray.</td>
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<tr>
<td>Relativism</td>
<td>Not all opinions are equal; they must be evaluated according to evidence.</td>
</tr>
<tr>
<td>Commitment</td>
<td>Student commits to a particular point of view, but the commitment is informed and nuanced.</td>
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Q. What strategies can we use to help students progress to higher levels of intellectual development?

- Move past dualistic
- Move past multiplistic
PRINCIPLE 6: STRATEGIES FOR TEACHERS

Promote intellectual development
- Make uncertainty, ambiguity, and complexity safe
- Resist a single right answer
- Incorporate use of evidence into performance criteria

Promote social development
- Examine your assumptions about your students
- Be mindful of accidental cues regarding stereotypes
- Do not ask individuals to speak for an entire group
- Recognize students as individuals.
PRINCIPLE 6: STRATEGIES FOR TEACHERS

Promote an inclusive climate
- Be a model for inclusive language, behaviour, and attitudes
- Use multiple and diverse examples
- Establish and reinforce ground rules for interaction
- Make sure course content does not marginalize students
- Use the syllabus and first day of class to establish climate
- Set up processes to get feedback on the climate
- Anticipate and prepare for sensitive issues
- Address tensions early
- Turn discord and tension into a learning opportunity
- Facilitate and model active listening.
To become self-directed learners, students must learn to monitor and adjust their approaches to learning.
Q. How can we promote the development of self-directed learners so that they

- Assess the task?
- Evaluate their strengths and weaknesses?
- Plan an approach?
- Monitor progress along the way?
- Reflect on experience and adjust?
PRINCIPLE 7: STRATEGIES FOR TEACHERS

Assessing the task at hand

- Be more explicit about assignments than you think is necessary
- Tell students what you do not want
- Check students' understanding of the task in their own words
- Provide a rubric

Promote self-evaluation

- Give timely feedback
- Provide opportunities for self-assessment.
PRINCIPLE 7: STRATEGIES FOR TEACHERS

Promote planning
- Have students implement a plan you provide
- Have students implement their own plan
- Make planning the central goal of the assignment.

Promote self-monitoring
- Provide simple heuristic questions for self-correction
- Have students do guided self-assessments
- Require students to reflect on and annotate their own work
- Use peer review
PRINCIPLE 7: STRATEGIES FOR TEACHERS

Promote reflection and adjustment
- Prompt students to reflect on their performance
- Prompt students to analyze effectiveness of study skills
- Present multiple strategies
- Create assignments that focus on strategizing

Promote useful beliefs about intelligence and learning
- Address these beliefs directly
- Broaden students' understanding of learning
- Help students set realistic expectations

Promote metacognition
- Model your metacognitive process for your students
- Scaffold students in their metacognitive processes
SUMMARY: 7 PRINCIPLES

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Thank You!


Adapted from workshop by Dr Marsha Lovett  [http://vimeo.com/29799078](http://vimeo.com/29799078)