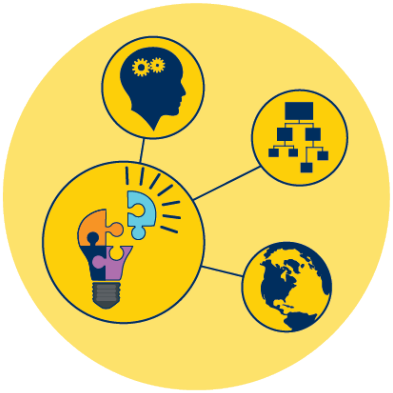
ICMed Teaching and Learning Handouts

Center for Research on Learning and Teaching in Engineering
UNIVERSITY OF MICHIGAN

Science of Learning

Knowledge is constructed (not acquired) by the learner in a social context. Below are some important points about the science of learning that will help you in your role as an instructor.[1]



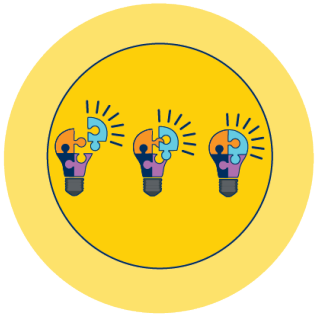
We remember new knowledge better when we

- **connect** it to something we already know
- place it in a **larger context** (the big picture)
- think it is **important**

We learn best by **doing** …

and **teaching**!

We may experience **cognitive conflict** when we learn (if new information is different from the models in our head).



Application, repetition and goal-directed practice strengthen memory and connections.

We become better learners when we ***examine how*** we learn (**metacognition**)

- Reflect on our process

We learn better when we have a **sense of belonging**

[1] Ambrose, *et al.* (2010); Doyle & Zakrajsek (2013)

Strategies for Facilitating Learning

"In the Learning Paradigm … a college's purpose is not to transfer knowledge but to create environments and experiences that bring students to discover and construct knowledge for themselves, to make students members of communities of learners that make discoveries and solve problems."[2]

1. Create an **inclusive climate** where all students feel safe to learn. Students' feeling of social belonging are strongly correlated with an ability to learn.
   a. Get to know your students, and help them get to know each other.
   b. Emphasize that we learn from mistakes.
   c. Challenge all students to improve, and encourage them as they make progress.

"Instead of something scary that is wielded—'power, control, clout, the last word'--authority [in the classroom] could be seen as gaining someone's trust, a relationship to be earned, nurtured or maintained."[3]

2. Establish and maintain **classroom authority** by **demonstrating your commitment** to teaching and student learning. It is much more difficult for students to show disrespect when they know that the GSI/IA cares about them.
   a. Come to class on time and well prepared
   b. Clarify your expectations and guidelines (make sure they are consistent with course policies)
   c. Explain the reasoning for assignments
   d. Develop relationships with your students

"We learn mostly by connecting new information to relevant cognitive structures in long term memory - No relevant structures -> No learning"[4]

3. **Explain concepts** in multiple ways. Use visuals, analogies
   a. Start with a concrete example, then generalize
   b. Ask students to explain concepts to each other in their own words
   c. Check for understanding frequently
   d. Help students **connect** new knowledge
      i. to what they already know (prior knowledge)
      ii. to their interests
      iii. to the big picture

4. Promote **metacognition** (examining how we learn), and help students become self-directed, independent learners.
   a. Share and model strategies that you use (e.g. for solving problem, for debugging, to study or to learn new content and skills).
   b. Provide students with a menu of strategies.
   c. Ask students to describe and share the strategies they use. Encourage them to evaluate such strategies and adopt better ones when they have continued failure despite strong effort.
      i. "Tell me about your approach to this task."
      ii. "Can you think of a different way to approach this problem?"
      iii. "Let me try to understand your strategy."
      iv. "That strategy seemed to work well for you. "

5. Provide **feedback** that is:
   a. **Balanced** - give both positive feedback (what students are doing well and should keep doing) and suggestions for improvement.
   b. **Specific** and **goal-directed** – help students move towards achieving the learning objectives
   c. **Timely** - the sooner the students get feedback, the better they can connect it with their work and improve

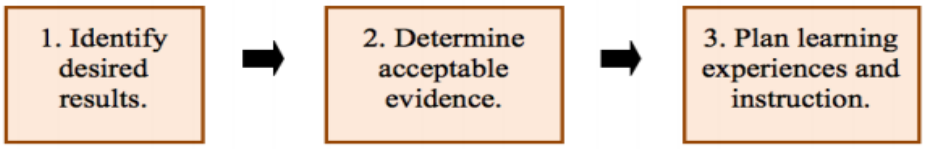
[2] Barr and Tagg (1995)
[3] *Identity and Authority Handout 1* (2017), CRLT
[4] Felder and Brent (2016)

"Questioning is considered by many to be the most important tool that teachers have for helping students build understanding and to encourage students to think about and act upon the material"[5]

6. Ask **specific questions**:
   a. To **engage** students and **monitor** their progress
   b. To **elevate student thinking** (see Bloom's taxonomy in Page 5 of this packet)
      i. To make students think more deeply about what they are doing and why.
7. After asking a question, use **wait-time** (count to 10 in your head) to allow students to process the question in their minds.
8. **Value each student's contribution**, even if the answer is wrong. Maintain eye contact, nodding, making affirming verbal comments or sounds, or asking a student to continue with additional clarifying remarks to encourage more participation
   a. **Find out more about their thought process** and use further discussion of the answer as a teaching moment: "That's an interesting answer." Why do you say that?"
   b. If some **part** of the answer **is correct, acknowledge that:** "You're right about X, great job, but let's talk more about Y."
   c. If a student's answer represents a **common misconception**, use the opportunity to **clarify**: "Thanks for that answer. A lot of people believe that, but let's see why that might not be the case."
   d. **Thank** the student for trying, **invite more answers**, and then piece together the correct responses: "Thanks for sharing that. Does anyone else have thoughts on this question?"
9. When **answering** student **questions:**
   a. **Listen** to the student actively.
      i. Use non-verbal signals such as facial expressions, a nod, eye contact, sitting forward
      ii. Ask clarifying questions like: "Here's what I hear you saying. Is that right?"
   b. **Paraphrase** or **Repeat** the question so that the whole class can hear it before you answer it.
   c. **Commend/Appreciate:** It takes courage to ask a question. When a student asks a question, compliment it with "That's an excellent question" or "I'm glad you asked that."
   d. Try to understand how they think (**make their thinking visible**).
      i. When you say ____, do you mean ____?
      ii. Tell me more …
      iii. How did you know to do that?
      iv. What assumptions did you make?
   e. **Be Honest.** If you don't know the answer, **don't give out incorrect answers**. Let the person know that you will find out and respond later, either to the class or by email.
   f. **Do not give out solutions** to homework or exercises that are meant for students to complete on their own (this deprives them from the opportunity to learn!). Redirect the student with a guiding question that moves them forward.
10. Consider **using technology** to assess student understanding. Tools like the ones listed below can be used to **collect student feedback** and quickly identify concepts that need clarification or follow-up after the lesson.
    a. Canvas - https://umich.instructure.com/courses/85440/pages/what-counts-as-an-assignment-in-canvas
    b. SurveyMonkey - https://www.surveymonkey.com/
    c. Socrative - https://www.socrative.com/
    d. Poll Everywhere - https://www.polleverywhere.com/
    e. Piazza - https://piazza.com/

[5] Hunt, Gilbert, *et al.* (2009)

Lesson Planning Template



Learning Objectives *(Direct the lesson and practice)*	**Classroom Assessment** *(Are students getting it?)*
At the end of the lesson students will be able to … *1.* *2.* *3.*	*Questions to check for student understanding.*

Connections *(How does the lesson connect to prior knowledge, to the big picture, to student interests and concerns?)*

Learning Activities *(What are you teaching? How will the students engage with the content as you teach?)*

Conclusion *(Recap the objectives in different words, preview what's to come)*

[6] Wiggins, G. P., McTighe, J. (2005).

Tips for Grading

1. Have a set of **guidelines** for turning in assignments, regrades, and grades in general. These guidelines should be included in the syllabus given to the students on the first day of class. In general, the professor will provide these guidelines. Sample guidelines could include:
    a. All regrades must be turned into the GSI/IA within one week.
    b. All regrades must have a written explanation of grading error.
    c. Late homework not accepted.
2. Have a **rubric** - clearly define in writing the point values associated with each problem or part of a project. Ideally, rubrics should be given to students along with the assignment.
    a. This will help students develop an understanding of what skills are important for them to develop and demonstrate in the class. These skills should be strongly related to the course learning objectives.
    b. This will also alleviate the "How much is this problem worth?" questions.
3. Before grading, **briefly skim through a portion of problems or essays**.
    a. This gives an idea of average student performance, common mistakes and misconceptions, and how to handle partial credit.
    b. Modify the rubric if needed.
4. Be **consistent/fair** with grading policies.
    a. When possible, grade **without looking at names** of students.
    b. Grade one problem on each paper until all papers have been completed. It can help to practice grading with your rubric on the first several papers before grading all papers.
    c. What you do for one student, you must do for all students, so be careful when dealing with extra points or late homework submission, etc.
5. Provide **effective written feedback** to students.
    a. Effective feedback is:
        i. **detailed/specific:** "good job" and "not quite right" do not tell the student where to focus future effort, or what to change vs. what to keep doing
        ii. **timely -** the closer to the completion of the assignment, the better
        iii. **balanced** - highlighting just mistakes can discourage further effort, whereas a balance of things done well and suggestions for improvement promotes student growth
    b. This will save you time as it will reduce the number of students asking: "*Why did I lose points on this problem?*"
    c. It will provide a tool for the students to learn from their mistakes.
    d. Do not devote unlimited time to this. A detailed rubric can accomplish some of this work. Talk to previous IAs/GSIs/graders of the course for a time estimate for grading.
6. **Try not to take things personally.**
    a. Grading issues can cause students a significant amount of anxiety for students. They may express anger or despair over their grade. You do not need to be a student's buddy or enemy when it comes to grading. If you have a method for grading and re-grading, stick to it and try to remain impartial.
7. When in doubt or if you feel uncomfortable with an interaction pertaining to grading, **involve the professor** on all judgment calls, or issues where you are uncertain of the University's accepted protocol.
    a. It is best to keep the professor aware of any and all grade issues that arise between you and a student.

Resources

CRLT-engin website crlte.engin.umich.edu

- ➔ Programs and Workshops -> EIATO (for orientation materials, e.g. an **electronic version of this document**)
- ➔ Resources (for videos of professors and GSIs teaching, links to inclusive teaching resources, etc)
- ➔ Request a Service -> GSI & IA Request (to contact an Engineering Teaching Consultant)

Ajlen, Ronit, *et al*, editors. "**Guidebook for University of Michigan Graduate Student Instructors**." The Center for Research on Learning and Teaching, University of Michigan, Ann Arbor, MI 2017. Also available online at https://crlt.umich.edu/gsis/gsi_guide.php

- Legal Issues Impacting Classroom Teaching, GSI Guidebook pages 15-16, online at https://crlt.umich.edu/sites/default/files/resource_files/GSI_Guidebook/GSI_Guidebook_15-16.pdf
- Sample Laboratory Rubrics, GSI Guidebook pages 121-122, online at https://crlt.umich.edu/sites/default/files/resource_files/GSI_Guidebook/GSI_Guidebook_121-122.pdf
- Active Learning, GSI Guidebook pages 86-87, online at http://www.crlt.umich.edu/sites/default/files/resource_files/GSI_Guidebook/GSI_Guidebook_86-87.pdf
- Classroom Assessment Techniques (CAT), GSI Guidebook page 88, online at http://www.crlt.umich.edu/sites/default/files/resource_files/GSI_Guidebook/GSI_Guidebook_88.pdf
- Strategies for Managing Discussions with Groups in the Laboratory Class, GSI Guidebook page 88, online at http://www.crlt.umich.edu/sites/default/files/resource_files/GSI_Guidebook/GSI_Guidebook_115-116.pdf

Managing groups effectively http://www.crlt.umich.edu/gsis/p4_1_5

Icebreakers http://www.crlt.umich.edu/blog/breaking-ice-your-students

Classroom Challenge: Handling Wrong Answers. http://www.crlt.umich.edu/node/712

Rubrics: http://gsi.berkeley.edu/gsi-guide-contents/grading-intro/grading-rubrics/

- Sample Rubrics: file:///G:/Team%20Drives/CRLT-Engin%20%20%20Staff%20&%20Collaborators/Teaching%20Orientations/EIATO/Grading%20-%20Policy,%20How%20to,%20and%20Tips/rubrics.html

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