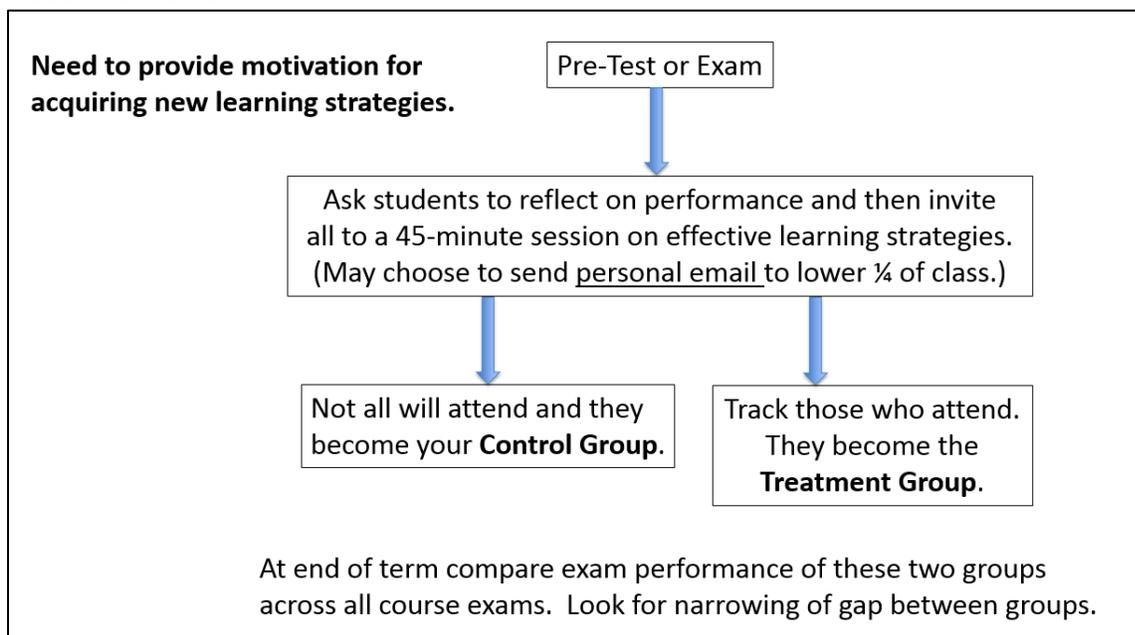# The Nuts & Bolts of Integrating Metacognitive Learning Strategies into STEM Courses

Kathy Koenig (kathy.koenig@uc.edu)
Paul Nodzak (nodzakpl@ucmail.uc.edu)
Dan Waddell  (waddeldl@ucmail.uc.edu)

**Problem:**  The *learning* strategies and behaviors that many college students continue to use are those that were successful in high school. However, they often do not lead to success in the typical college setting.  Many students are not aware that there are better strategies that they could be using and instead engage in the same patterns of study used in high school even when they prove ineffective.

**Solution:**  Teach your students metacognitive learning strategies to increase the efficiency and effectiveness of their learning habits.

**Possible Action Plan:**

**Need to provide motivation for acquiring new learning strategies.**

Pre-Test or Exam

Ask students to reflect on performance and then invite all to a 45-minute session on effective learning strategies. (May choose to send personal email to lower ¼ of class.)

Not all will attend and they become your **Control Group**.

Track those who attend. They become the **Treatment Group**.

At end of term compare exam performance of these two groups across all course exams.  Look for narrowing of gap between groups.

## Lessons Learned:

- Collaborate with colleagues - share resources and ideas, compare data, etc.
- Know your audience!
  - o Survey your students and learn their study behaviors.
  - o Recognize that some students won't be ready to hear your message.  Integrating metacognitive learning strategies into daily/weekly teaching across term may be better than a one-time session.
- Some Tips!  Start interventions early in the term. Personally invite students to engage in metacognitive learning strategies.  Tailor strategies to YOUR course and be as concrete as possible.  This includes modifying the "plan for success" grid on the back of this page.

**Extra resources:**  Read Saundra McGuire's book ("Teach Students How to Learn") or watch her videos on Youtube.  Contact Ted Clark, Dept of Chemistry, Ohio State (clark.789@osu.edu).

**Handout for students:**

## Metacognitive Learning Strategies

Use the grid below and make a plan to improve your chance of success in your courses.

# What is your plan for success?

| | Before Class | Class | After Class | Preparing for Exams |
|---|---|---|---|---|
| **Best** | Active reading, Take notes, Sample problems. | Treat class as a self-test. Address weaknesses | Reach mastery. Teach the material. | Work with classmates, write and share exam questions. |
| **Better** | Active reading | Mental Review. Coordinate class notes & book. | Review first, then use homework a self-test | Consolidate and review notes. Use practice test as self-test. |
| **Good** | Preview and map material | Identify Objectives & Problem-solving strategies | Identify and learn from mistakes | Use practice tests to identify objectives, learn from mistakes |
| **Typical** | Nothing | Attend every class | Complete homework (the last day) | Read class slides, Look at homework problems. |

**Preview and map material in the textbook** –Look at the section titles and figures and get a sense of what is there (*mapping the material* could be writing out an outline/concept map or merely thinking through in your head) – as quick as 2 minutes!

**Active reading** –Read one paragraph at a time and summarize it in light of the prior paragraph (either on paper or in your head – the latter works fine if the material is not new for you).

**Sample Problems** – Do the example problems in the chapter but cover up the solutions!  Only peak when you are ready to check your answer.  If incorrect, try to figure it out before looking at the solution itself.

**Tip:**  You may understand something read in the text or said by the instructor but unless reviewed and repeated (practiced) frequently and in multiple contexts, that *chunk of developing information/knowledge* becomes disconnected or disappears within 24 hours!  Do homework soon after class even if it isn't due until many days later.

## Action Plan for Embedding Metacognitive Learning Strategies into Existing Courses:

What problem/issue are you trying to address here?

What course will you be working with?  _____

Which colleagues might you recruit for this project?  _____

Outline the approach you will use to educate students on metacognitive learning strategies.  That is, will you sprinkle ideas across classes or use a single 45-minute session or a combination of both?  Will you use a pre-test or the first exam to motivate students to engage with your ideas?

Describe the data which will be collected to determine whether or not the project is successful.
(ex. exam scores, surveys)