

Reflective activities in Calculus: Using short writing exercises to improve metacognition and self-assessment

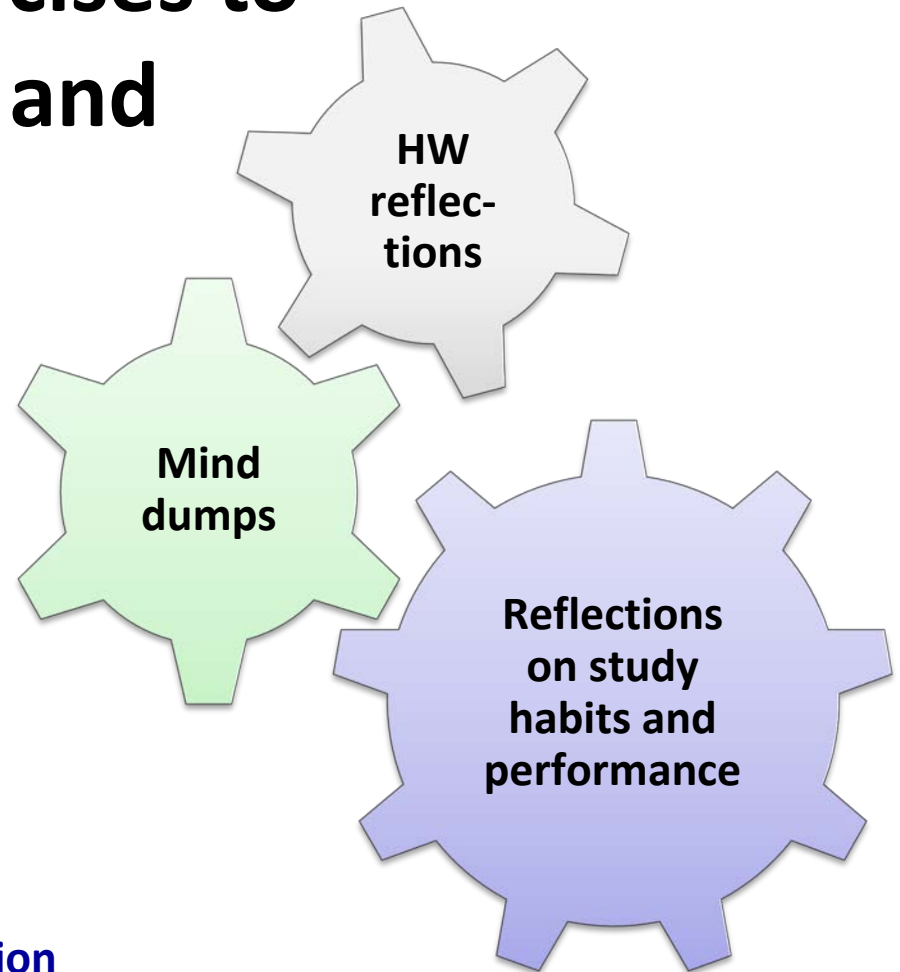
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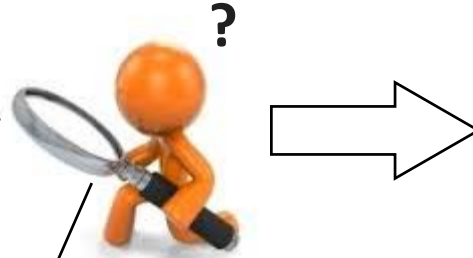
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Materials available at:

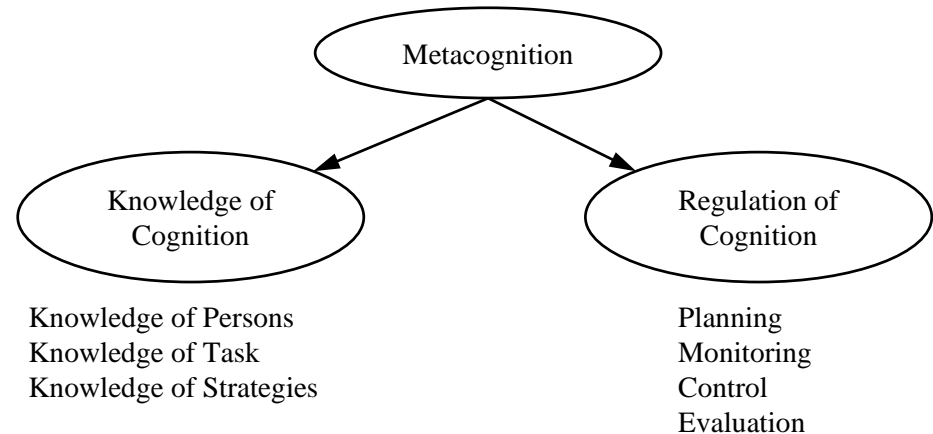
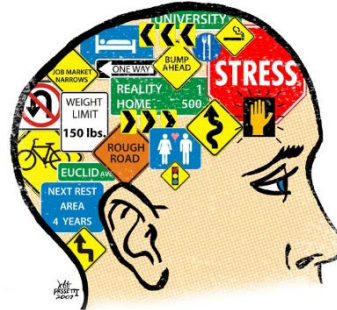
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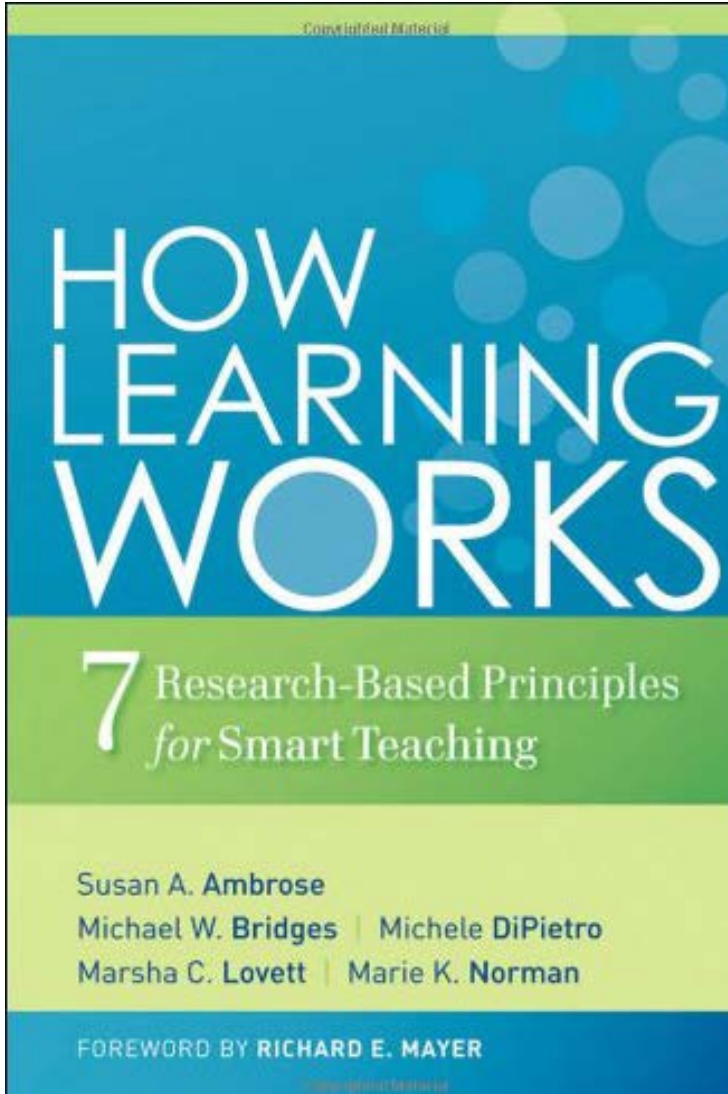
Reflective thinking can deepen student learning, but students need guidance and practice to develop it.



- Rest
- Exercise
- Study Location
- Study Group
- Study Strategies



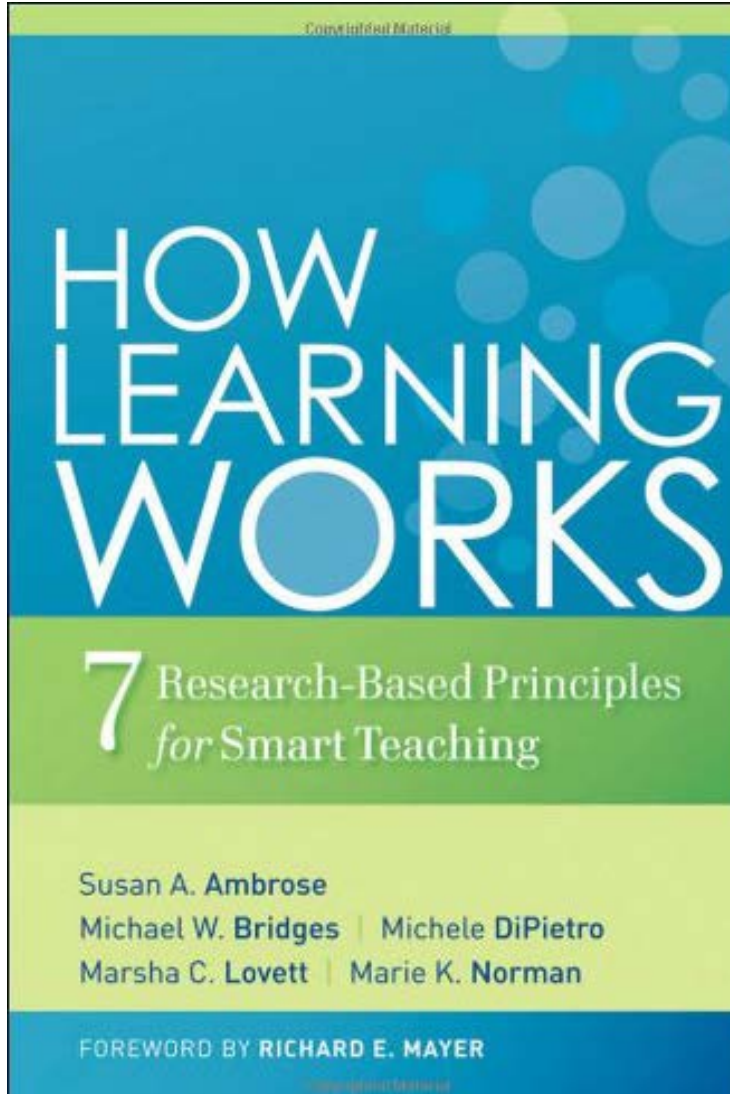
Many researchers have written about the benefits of structured reflection in courses.



“It is important to give students an opportunity to reflect on assignments. Facilitating their reflection with specific questions can help structure the process to support motivation.”

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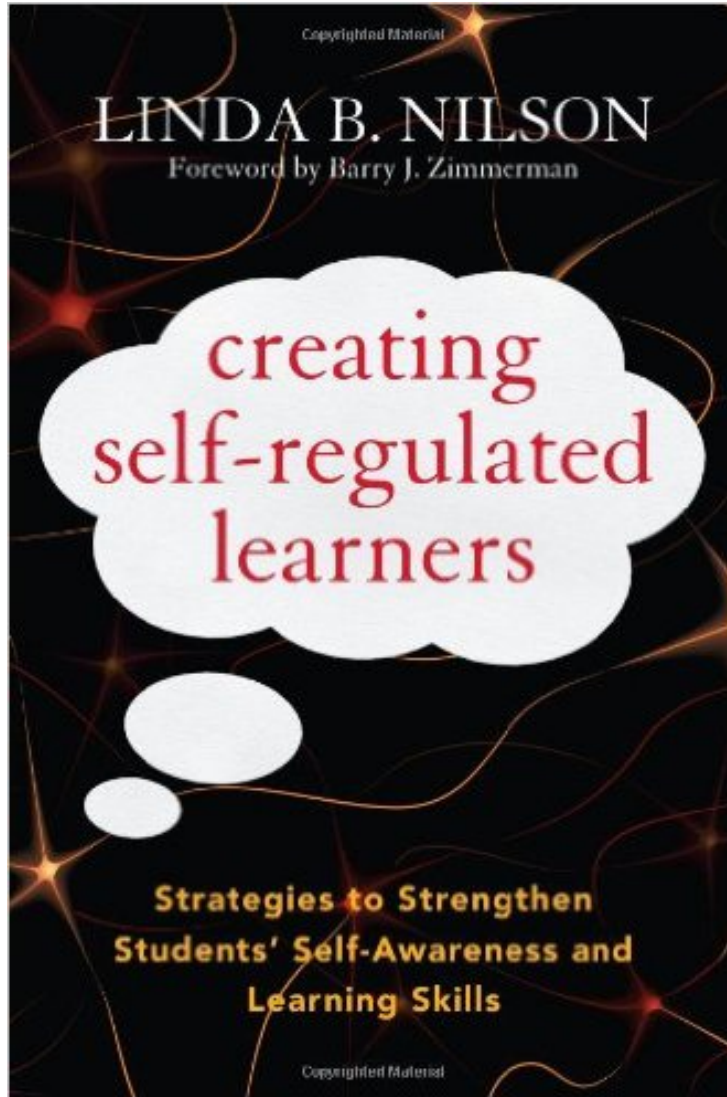
Many researchers have written about the benefits of structured reflection in courses.



“To become self-directed learners, students must learn to assess the demands of the task, evaluate their own knowledge and skills, plan their approach, monitor their progress, and adjust their strategies as needed.”

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Many researchers have written about the benefits of structured reflection in courses.



“[W]rappers [...] designate activities and assignments that draw students’ attention to self-regulation before, during, or after regular course components. [...] Wrappers not only enhance students’ performance on the regular course components but also teach them how their mind works and how to make it learn and perform better.

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Rose-Hulman is part of the Consortium to Promote Reflection in Engineering Education (CPREE).



University of Washington -
Cindy Atman & Jennifer Turns, PIs



<http://cpree.uw.edu/>

- 1 – University of Washington
- 5 – Nearby institutions in Washington
- 1 – Stanford
- 5 – Institutions from across the country

Year 1	Mapping & Producing Reflective Field Guide
Year 2	Promoting & Assessing

Through CPREE, I am incorporating reflective activities into my Fall and Winter Calc II classes.

Context

- **Calculus at RHIT is taught in sections of 25-30 students, meeting 5 days/week for one class period/day.**
- **My sections are taught in a tablet room.**
- **Each day incorporates some active learning.**



Through CPREE, I am incorporating reflective activities into my Fall and Winter Calc II classes.

Overall Goals

- **Reflection for self-assessment and metacognition**
- **Transition to college**
- **Frequent reinforcement**
- **Student tools for the future**
- **Low workload – sustainable**



On each day's homework, the students are asked to write reflections.

- **Very short – one sentence before and after each problem**
- **Self-assessment of knowledge and skills**
- **Specifications graded (done/not)**
- **Preparing the way for reflection**



On each day's homework, the students are asked to write reflections.

MA112 Sections 05 and 06 Winter Quarter - 2015-16

[Dashboard](#) ▶ [MA](#) ▶ [1516W MA112-05](#) ▶ [Important Information about the Course](#) ▶ [Syllabus](#)

Syllabus



- Before each homework problem I would like you to write a brief sentence indicating how confident you are right after you read the problem. After each homework problem I would like you to write a brief sentence indicating how confident you are that you solved it correctly or why you think that you did not solve it correctly.

Once a week, students do a “Mind Dump” activity.

- 3-5 minutes of recall from previous week
- Self-assessment of memory
- Compare with classmates – peer feedback and community
- Specifications graded (acceptable/not)
- General feedback in class – 2-3 minutes/week
- Reinforcing reflection



Once a week, students do a “Mind Dump” activity.

Mind dump

Front side of the page:

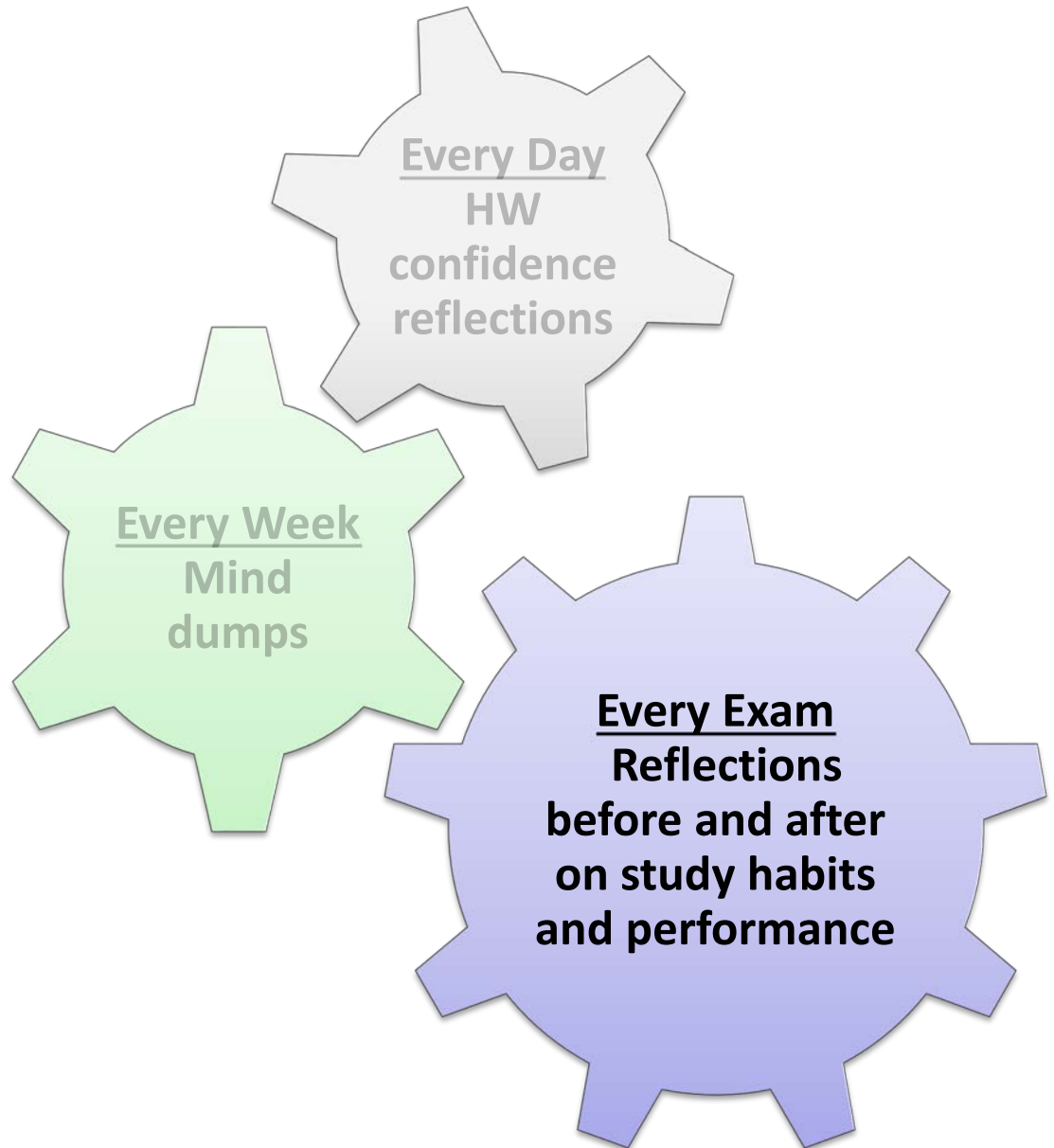
- Your name
- Without looking at your notes, what can you remember from last week?
 - general topics (i.e. section titles)
 - learning objectives, task
 - other?
- List as much as you can

Back side of the page:

- Work with someone you haven't worked with before
- Your name **and** your partner's name(s)
(_____ worked with _____)
- Things your partner(s) remembered that you didn't

Starting after the first exam, students fill out exam reflections.

- “Worksheet” page with reporting and planning
- Self-assessment of preparation and expectations
- Very simple rubric – completeness and thought
- General feedback in class as part of exam review
- Showing value of reflection



Starting after the first exam, students fill out exam reflections.

Math 112: Fall 2015–2016

Name: _____ CM: _____ Hour: _____

Post-Exam Reflection

This activity is designed to give you a chance to reflect on your exam performance, and more importantly, on the effectiveness of your exam preparation. Please answer the questions sincerely. You will be graded on completeness, not on whether your answers make you look good. Your responses will be collected to inform the professor regarding students' experiences surrounding this exam and how we can best support your learning. You will get this completed assignment back before the next exam to inform and guide your preparation for that exam.

- How satisfied were you with your score on this exam?

very satisfied	satisfied	unsatisfied	very unsatisfied
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- Approximately how many hours did you sleep the night before this exam? _____
- When did you start preparing for this exam? _____
- Approximately how many hours did you spend preparing for this exam? _____
- What percentage of your test-preparation time was spent in each of the following activities (make sure the percentages add up to 100):

(a) Doing practice problems (practice homework, practice exam, or other)	_____
(b) Reading textbook sections for the first time	_____
(c) Rereading textbook sections	_____
(d) Reviewing your notes from class (DyKnow or other)	_____
(e) Reviewing the DyKnow notes posted on Moodle	_____
(f) Reading problem solutions (practice homework, practice exam, or other)	_____
(g) Other	_____
(Please specify: _____)	Total: 100%
- Now that you have looked over your graded exam, estimate the percentage of points you lost due to each of the following (make sure the percentages add up to 100):

(a) Not being clear on what the problem was asking	_____
(b) Trouble with basic principles	_____
(c) Trouble with remembering formulas	_____
(d) Trouble with remembering definitions	_____
(e) Not being able to put multiple concepts together	_____
(f) Careless mistakes	_____
(g) Ran out of time (if so, see Question 7)	_____
(h) Other	_____
(Please specify: _____)	Total: 100%

(The rest of the questions are on the back of this page.)

Math 112: Fall 2015–2016

- If you ran out of time, what could you do to increase your speed on the next exam? (For example: practice more, memorize more, pace yourself better.)
- Between your answers to parts (a) and (b) below you should list at least **four** items total.

Examples include: spending enough time studying overall, starting your studying sooner, spending enough time doing one of the activities on the previous page (if so, name it), having a specific good or bad study habit (if so, name it), working on a specific skill or a specific type of problem that will come up again on the next exam (if so, name it).

 - Based on your responses to the first three questions, name one to three things you feel you did well in preparing for this exam and should continue.
 - Based on your responses to the first three questions, name one to three things you could do differently in preparing for the next exam. (If you got 95% or better on the exam this question is optional.)
- Is there anything the professor might be able to do to help the plan that you have laid out above? If so, name one thing.

Starting after the first exam, students fill out exam reflections.

Post-Exam Reflection

1. How satisfied were you with your score on this exam?
2. Approximately how many hours did you sleep the night before this exam?
3. When did you start preparing for this exam?
4. Approximately how many hours did you spend preparing for this exam?
5. What percentage of your test-preparation time was spent in each of the following activities?
6. Now that you have looked over your graded exam, estimate the percentage of points you lost due to each of the following types of mistakes.
7. If you ran out of time, what could you do to increase your speed on the next exam?
8. (a) Based on your responses to the first three questions, name one to three things you feel you did well in preparing for this exam and should continue.
(b) Based on your responses to the first three questions, name one to three things you could do differently in preparing for the next exam.
9. Is there anything the professor might be able to do to help the plan that you have laid out above? If so, name one thing.

Assessment of the project is still in progress.

- **CPREE survey**
- **RHIT Course Evaluations**
- **Comparison of exam scores between quarters**

Anecdotally, students feel that at least the exam reflections were helpful.

Homework reflections were sometimes very superficial.

Mind Dumps elicited varying degrees of effort.

Thanks for listening!



Materials available at:

<http://www.rose-hulman.edu/~holden/Reflection>