Reflection and Metacognition Series

PART 3: Activities to Promote Reflection for Students

Just as instructors can reflect on teaching practice, students can also grow from reflecting on their learning. The more that students know about their own learning, the better they are able to match learning strategies to contexts, and the more they are able to regulate it for success. Instructors can also systematically integrate metacognitive exercise into already established instructional activities and assessments, as opposed to prompting students with isolated or scattered questions for reflection.

This part describes some tangible and engaging examples of integrated reflection to promote student learning.

- For routinized *quick* reflection in commonly used activities, or as described by Millis (2016), "action-oriented opportunities," see Tables 1a – 1c
- For more *complex* sustained models that can be maximized as structured, routinized, integrated, and institutionalized regular parts of the course, opportunities for reflection:
    - Before teaching a unit (Table 2)
    - While teaching a unit (Table 3)
    - After teaching a unit (Table 4)

It is worth remembering that reflective exercise is like any other; the more it is practiced, the stronger the students' metacognition becomes and the greater the benefits, to not only their learning, but also to instructors' practice.

Quick Activities

Table 1a: *The Minute Paper*

What is it?	What are some sample prompts?
This is a brief reflective activity to be used in the concluding minutes of class. Instructors give students 2-3 minutes to write on an index card their responses to the posted prompt/s. This guides students in reflecting on their understanding of a finite amount of material, such as a single lecture or class (Millis, 2016; Tanner, 2013).	What was the most important thing you learned during this session? What important questions remain unanswered? How did what you learned today apply to lab/section?

Table 1b: *The Muddiest Point*

What is it?	What are some sample prompts?
Instructors use this at the closing of class (2-3 minutes). Asking students to reflect on the day's class not only engages them in their own metacognition, but also establishes a tone that confusion is a part of learning. Also, this aggregated feedback from students can help the instructor plan their next class session with the explicit goal of clearing up the confusion or can be shared with TA's to integrate into their planning for discussion sections or labs (Tanner, 2012).	What was most confusing to me about the material we explored in class today? What was one point today that is not clear to you?

Table 1c: *Support a Statement*

What is it?	What are some sample prompts?
Instructors provide students with a general statement from lectures, readings, or informed	Who makes these claims?

experts. They then ask students to justify support, rather than just citing it. This simple adaptation requires students to think at a different level, reflecting on what they either do or do not know (Millis, 2016).	Are they a credible source? Why or why not? What evidence is (or arguments are) used to support these claims?

More Complex Activities

Table 2: *Before Teaching a Unit*

What is it?	What are some sample prompts?
Knowledge Surveys Instructors use these before beginning the unit as a metacognitive instrument for students. Instead of an actual pre-test of content knowledge, they gauge students' perceptions of their knowledge of topics without having to "prove" it. Students reflect on their confidence in their ability to answer given questions or perform skills (Millis, 2016). (Additionally, the same survey can be given at multiple points in the class and/or the end to measure what students learned or what skills they acquired.)	Provide students with a series of 3 responses and prompt them to mark one for each substantive question/problem. • Mark 1 if you are fairly certain you can answer question or perform skill indicated • Mark 2 if you know at least 50% of the answer or if you know exactly where to find the information to answer it • Mark 3 if you don't know how to answer the question or perform the skill

Table 3: *While Teaching a Unit*

What is it?	What are some sample prompts?
Clickers (Personal Response Systems) These have become increasingly prevalent in classes to check for student understanding. Instructors pose questions, usually with multiple-choice options. Students are given a few moments to think and arrive at their answers or to solve a problem. Instructors are able to assess how well students demonstrate an understanding. This type of learning activity can also be combined with pair or group discussion. Once students have reflected and answered independently, instructors can direct them discuss the same questions in groups and to once again respond to the question after collaboration. Research has shown that the peer interactions are the mechanism for learning and metacognition. To see a demonstration of this type of activity in a live classroom, watch this brief clip of Harvard professor, Eric Mazur, leverage the impact of clickers (Millis, 2016).	Share how you thought about what the question was asking. Share the process you used to arrive at an answer you wanted to choose. What was your main reason for choosing your answer, and what were the main reasons you did not choose the others? How did your ideas compare with your neighbor's ideas? What was most confusing to you about this question? How confident are you in your answer? Why? What else would you need to know to increase your confidence?
Learning Log/Reflective Journal This can be a more formal way for students to reflect and can be integrated into other activities such as active learning tasks, homework assignments, or exam preparation. With regular reflecting and writing about their learning, students are better able to see patterns and to diagnose their own strengths and weaknesses. Instructors can then coach them in prescribing solutions and monitoring their own learning. This helps students to take responsibility and to become independent and self-directed. This strategy for requiring metacognition is appropriate across levels and within varied contexts of	**Applied to Active Learning Tasks or Homework Assignments** Pose three questions that you had about the concepts you explored in your assignment that you still cannot answer. What enabled you to learn the most in this assignment? How was the way you approached completing this assignment different compared with the last time we had an assignment like this?

disciplines (Tanner, 2012; Barkley, 2010; Weimer, 2002).	What advice would you give yourself based on what you know now if you were starting this assignment all over again? **Applied to Preparation for Exam or Quiz** How do you plan on preparing for the upcoming exam? Why? What resources are available to support you? How will you make sure to use these? How does your strategy for exam preparation compare with at least three colleagues in your lab section? (go ask) What concepts have been most clear? What concepts have you found most confusing so far? Given that, how should you spend your study time in preparing for the exam? Based on your performance on the last exam, write a letter to yourself with advice about preparing for the upcoming exam.

Table 4: ***After Teaching a Unit***

What is it?	What are some sample prompts?
Critical Incident Questionnaire (CIQ) This metacognitive tool, administered in regular intervals, asks students to respond to the same five questions pertaining to critical moments or actions in learning. Patterns and trends emerge from results and can be addressed either explicitly or implicitly by the instructor. CIQs can be kept anonymous, if desired. Through implementation of CIQs, students become more aware and are encouraged to take a more active role in influencing class climate for their own learning. Collecting data on class environment helps instructors to understand their students' learning processes and adjust to maximize learning (Barkley, 2010; Metzger et al., 2018; Brookfield, 2005; Weimer, 2002).	At what moment in class or while doing your homework this week were you most engaged as a learner? At what moment were you most distracted as a learner? What action did anyone in class take this week that you found most affirming or helpful? What action did anyone take this week that you found most puzzling or confusing? What surprised you most about class this week?
SMASH Inventory paired with Exam Wrappers/Post-test Analysis *Part 1:* This two-step process begins once students complete an exam, but before they submit it. Instructors ask students to reflect and provide written analysis around a series of questions about their study strategies and effort. Metzger et al. (2018) designed a variation of this method by creating a 25-item instrument (SMASH Inventory Instrument) that more formally guides students to consistently practice self-reflection in conjunction with performance.	Predict your exam score. What supports this prediction? Rate your effort in studying for the exam on a scale of 1 (lowest) to 10 (highest) List the specific learning strategies you used to study for the exam (e.g., used flash cards to memorize definitions, rewrote/reviewed lecture notes, created outlines from readings, etc.) Identify what you found easiest and most difficult about the exam and why Adapted from SMASH Inventory Instrument: • The concepts on this assessment were difficult for me. (reflective thinking)

	• The concepts in this course have been difficult for me. (reflective thinking) • I use different study strategies for concepts that I find to be more difficult. (reflective thinking) • The strategies that I used to prepare for this exam worked well, and I will use them again next time. (systematic study habits) • I am confident in my ability to learn this material. (meta-emotional)
Part 2: Once exams are graded and returned, students are then asked to write about their emotional response, compare results to predictions, and engage in test item-analysis. Some refer to this as a post-assessment Writing, Reflection, and Planning (WRaP). Taken together, these become a metacognitive mechanism for both students and instructors to gain insight into the learning process. This can illuminate associations between preparation and results. It may also help students to see disparities between their perception and actual performance. Instructors might use results as a mechanism for early identification of gaps in understanding and intervention. (Barkley, 2010; Metzger et al., 2018; Millis, 2016; Weimer, 2002)	Did you earn the score you hoped on this exam? Explain. Do you plan to adjust your study habits based on this? If yes, how? Review the items you answered incorrectly. Do you notice any patterns in what you missed? Explain. Make corrections to the missed items. Provide the correct answer, explain why this is correct, and indicate the source for the correct information (e.g., readings, lectures, assignments) Please provide feedback on how I can help you prepare better next time. How can your peers help you prepare?

Citation

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