

Questions That Self-Regulated Learners Ask Themselves <i>(adapted from Schraw, 1998 and Tanner, 2012)</i>			
	Metacognition (also Elaborative Rehearsal)	Meta-emotional	Environmental
Planning before a learning or performance task (task analysis)	<p>What kind of a task is this?</p> <p>What is my goal? How will I know I have reached it?</p> <p>What do I already know about the topic?</p> <p>What additional information, if any, will I need?</p> <p>What strategies should I use? (actively listening, taking notes, outlining, visually representing the material, occasionally self-quizzing, reviewing, or writing a summary)</p> <p>What strengths can I bring to the task?</p> <p>What are my weaknesses and how can I make up for them?</p>	<p>How interested and motivated am I to do the task, and how can I increase my interest and motivation if they are low?</p> <p>What's the value or relevance of what I'll be learning?</p> <p>How confident am I in my ability to learn this material? If not very, how can I increase my belief in my ability to learn it, without becoming over-confident? What similar tasks can I recall doing well in the past?</p>	<p>What is the best environment for the task that I can create?</p> <p>Am I in a good physical place and position to do this task?</p> <p>Is the temperature right for me? How about the back-ground sounds?</p> <p>Have I had enough sleep? Have I had the right amount of coffee today?</p> <p>Have I put potential distractions far, far away?</p> <p>How much time and what resources will I need? Are these resources handy?</p>
Monitoring during a learning or performance task	<p>Am I sure I know what I am doing?</p> <p>Does my approach to the task make sense?</p> <p>Am I making good progress toward my goal?</p> <p>How focused am I? Am I getting tired? If so, how can I keep myself focused and alert?</p> <p>How well are my strategies</p>	<p>If my interest and motivation are sagging, how is what I'm learning relevant to my experience or my future?</p> <p>What material is challenging what I've thought about</p>	<p>Should I try another environment to see if it works better?</p> <p>How about another physical position?</p> <p>How are the temperature and background sounds working out?</p>

	<p>working?</p> <p>What changes in approach or strategies should I make, if any?</p> <p>What material is the most important?</p> <p>What material am I having trouble understanding?</p> <p>How does what I am learning relate to what I already know?</p> <p>How is my thinking on the topic changing?</p>	<p>the subject? Am I resisting it?</p> <p>Am I starting to get discouraged or give up? Am I thinking I'm just no good at this subject? How can I change this negative thinking?</p> <p>What similar tasks can I recall doing well in the past?</p>	<p>Am I staying away from distractions? If not, I have to get further away from them.</p> <p>Do I need a short break to refresh my mind and body?</p>
Evaluating after a learning or performance task	<p>How well did I achieve my goal or master what I set out to learn?</p> <p>What can I recall and what do I need to review?</p> <p>What were the most important points I learned?</p> <p>Can I see and organize the interrelationships among them?</p> <p>What am I still having trouble understanding?</p> <p>What questions do I have to ask my instructor?</p> <p>How does what I learned relate to other things I've been learning or have experienced?</p> <p>How has my thinking on the topic changed?</p> <p>Which approaches and strategies worked well?</p> <p>Which didn't?</p> <p>What do I need to do differently next time I take on a similar task?</p>	<p>How am I reacting emotionally to my evaluation of my learning?</p> <p>Being pleased reinforces a learner's motivation and other positive emotions she generated about the material and her ability to learn it.</p> <p>Being disappointed may lead either to improving her learning strategies or her defensively withdrawing her energy from task.</p> <p>This last reaction in turn undermines the positive emotions needed to begin the next learning or performance task.</p>	<p>How well did I avoid distractions and stay on task?</p> <p>If not that well, how can I avoid distractions more effectively in the future?</p> <p>Do I need to experiment more with different physical factors to find the best working environment and break schedule for myself?</p>

Reading and Discussion on “Learning” and “Thinking”

Learning (Your First Job), by Robert Leamnson (2002) at
<http://www.udel.edu/CIS/106/iaydin/07F/misc/firstJob.pdf>

12-page essay on the brain biology of learning; the difference between “understanding” and “remembering”; how to listen actively to a lecture and take notes; how to develop an interest in a subject; how to use out-of-class time productively; the difference between “knowledge” and “information” and how to use the former to make sense out of the latter; and how to prepare for and take exams. Leamnson gives wise, research-based advice on how to study and effectively drives home the point that learning involves work and effort for all students but can be very rewarding.

You might want to explore shorter (but less comprehensive and in-depth) readings such as these:

<https://www.missiontolearn.com/improve-concentration-focus-attention/>

<https://ww2.kqed.org/mindshift/2013/12/05/age-of-distraction-why-its-crucial-for-students-to-learn-to-focus/>

https://www.mindtools.com/pages/article/newHTE_78.htm

If you assign this kind of reading, leave time for in-class or online **discussion** the date it is due. The discussion may start out with some recall (recitation) questions that warm up students’ minds to the material, but a good *discussion* is an exchange of experiences and viewpoints, so it relies on asking questions with multiple correct answers, like these:

- What was the most important insight you gained from the reading?
- What surprised you most in the reading?
- What did you already know?
- Have you been taught how to learn before? Where? What did you learn about learning?
- What will you do differently during a lecture, if anything, given what you read?
- How will you prepare differently for exams, given what you read?
- Can you think of other good learning practices that the reading didn’t mention?

Self-Assessment Instruments on Metacognitive Skills

The first, designed by Cooper and Sandi-Urena (2009), is the 27-item “**Metacognitive Activities Inventory**” (MCAI) at <http://pubs.acs.org/doi/abs/10.1021/ed086p240>.

While these researchers created it for chemistry students, it can measure metacognitive problem-solving skills in other STEM areas as well. A few sample items:

- When I do assigned problems, I try to learn more about the concepts so that I can apply this knowledge to test problems.
- Once a result is obtained, I check to see that it agrees with what I expected.
- I jot down things that I know might help me solve a problem before attempting a solution.
- I start solving problems without having to read all the details of the statement. (This item is phrased in reverse, like several others; agreeing indicates a lack of a metacognitive skill.

The second instrument, called the “**Metacognitive Awareness Inventory**” assesses general self-regulated learning skills across the disciplines and is accessible at

<https://www.harford.edu/~media/PDF/Student-Services/Tutoring/Metacognition%20Awareness%20Inventory.ashx>.

Schraw and Dennison (1994), it has 52 items that are classified by type of cognitive knowledge—declarative (DK), procedural (PK), and conditional (CK)—or by specific metacognitive process—planning (P), information management strategies (IMS), monitoring (M), debugging strategies (DS), and evaluation (E). Below are eight sample items, each representing a different classification:

- I have control over how well I learn. DK
- I am aware of what strategies I use when I study. PK
- I use my intellectual strengths to compensate for my weaknesses. CK
- I think about what I really need to learn before I begin a task. P
- I consider several alternatives to a problem before I answer. M
- I summarize what I’ve learned after I finish. E
- I draw pictures or diagrams to help me understand while learning. IMS
- I change strategies when I fail to understand. DS

Self-Regulated Learning References

- Academic Advising and Support Services, Loyola University, Chicago. (n.d.). Available at http://www.luc.edu/advising/pdfs/postexam_survey.pdf
- Achacoso, M. V. (2004). Post-test analysis: A tool for developing students' metacognitive awareness and self-regulation. In M. V. Achacoso & M. D. Svinivki, (Eds.), *New directions for teaching and learning, No. 100: Alternative strategies for evaluating student learning* (pp. 115-119). San Francisco: Jossey-Bass.
- American Association of Colleges and Universities. (2002). *Greater expectations: A new vision for learning as a nation goes to college*. Washington, DC: AACU.
- American Association of Colleges and Universities. (2007). *College learning for the new global century*. Washington, DC: American Association of Colleges and Universities.
- Azevedo, R., & Cromley, J. G. (2004). Does training on self-regulated learning facilitate students' learning with hypermedia? *Journal of Educational Psychology*, 96(3), 523-535.
- Barkley, E. F. (2009). *Student engagement techniques: A handbook for college faculty*. San Francisco: Jossey-Bass. Using post-test analysis to help students see correlation between effort and performance. Reprinted in *The Teaching Professor*, 23(10, December), 1.
- Bean, J. C. (2011). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom* (2nd ed.). San Francisco: Jossey-Bass.
- Bell, P., & Volckmann, D. (2011). Knowledge surveys in general chemistry: Confidence, overconfidence, and performance. *Journal of Chemical Education*, 88(11), 1469-1476. doi: 10.1021/ed100328c
- Boud, D. (1995). *Enhancing learning through self-assessment*. London: Kogan Page.
- Boud, D. (2000). Sustainable assessment: Rethinking assessment for the learning society. *Studies in Continuing Education*, 22(2), 151-167.
- Bradley, R. T., McCraty, R., Atkinson, M., Tomasino, D., Daughterty, A., & Auguelles, L. (2010). Emotion self-regulation, psychophysiological coherence, and test anxiety: Results from an experiment using electrophysiological measures. *Applied Physiology and Biofeedback*, 35(4), 261-283.
- Bransford, J. D., Brown, A. L., & Cocking, A. R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Research Council, National Academy Press.
- Brown, R., & Pressley, M. (1994). Self-regulated learning and getting meaning from text: The Transactional Strategies Instruction model and its ongoing validation. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 155-180). Hillsdale, NJ: Erlbaum.
- Brown, T., Kraft, K., Yu, S., Alabi, W., McGuire, S., & Myers, J. (2008). Early warning. Session presented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience, Carleton College, Northfield, MN, November 19-21. Available at http://serc.carleton.edu/NAGTWorkshops/metacognition/group_tactics/28891.html

- Brown, T., & Rose, B. (2008). Use of metacognitive wrappers for field experiences. Session presented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience, Carleton College, Northfield, MN, November 19-21. Available at <http://serc.carleton.edu/NAGTWorkshops/metacognition/tactics/28926.html>
- Candy, P. C. (1991). *Self-direction for life-long learning*. San Francisco: Jossey-Bass.
- Cooper, M. M., & Sandi-Urena, S. (2009). Design and validation of an instrument to assess metacognitive skillfulness in chemistry problem solving. *Journal of Chemical Education*, 86(2), 240-245. Available at <http://pubs.acs.org/doi/abs/10.1021/ed086p240>
- Costa, A. L., & Kallick, B. (2000). Getting into the habit of reflection. *Educational Leadership*, 57(7), 60-62.
- Ertmer, P. A., & Newby, T. J. (1996). The expert learner: Strategic, self-regulated, and reflective. *Instructional Science*, 24, 1-24.
- Evans, G. W., & Rosenbaum, J. (2008). Self-regulation and the income-achievement gap. *Early Childhood Research Quarterly*, 23(4), 504-514. doi: [10.1016/j.ecresq.2008.07.002](https://doi.org/10.1016/j.ecresq.2008.07.002)
- Fink, L. D. (2003). *Creating significant learning experiences: An integrated approach to designing college courses*. San Francisco: Jossey-Bass.
- Glenn, D. (2010, February 7). How students can improve by studying themselves. *Chronicle of Higher Education*. Available at <http://chronicle.com/article/Struggling-Students-Can-Imp/64004/>
- Griffiths, E. (2010). Clearing the misty landscape: Teaching students what they didn't know then, but know now. *College Teaching*, 58(1), 32-37.
- Learning Centre. (2008). Reflective writing. University of New South Wales. Available at <http://www.lc.unsw.edu.au/onlib/reflect.html>
- Lovett, M. C. (2008, January). Teaching metacognition. Presented at the annual meeting of the Educause Learning Initiative (ELI). Available at <http://net.educause.edu/upload/presentations/ELI081/FS03/Metacognition-ELI.pdf> and <http://www.educause.edu/Resources/TeachingMetacognition/162556>
- McDaniel, M.A., Howard, D.C., & Einstein, G.O. (2009). The Read-Recite-Review study strategy: Effective and portable. *Psychological Science*, 20(4), 516-522.
- Mezeske, B. (2009). *The Graduate* revisited: Not “plastics” but metacognition. *The Teaching Professor*, 23(9), 1.
- Mischel, W., & Ayduk, O. (2002). Self-regulation in a cognitive-affective personality system: Attentional control in the service of the Self. *Self and Identity*, 1(2), 113-120. doi: [10.1080/152988602317319285](https://doi.org/10.1080/152988602317319285)
- Mischel, W., Shoda, Y., & Peake, P. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of Personality and Social Psychology*, 54, 687-696.
- Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of gratification in children. *Science*, 244, 933-938.
- Nilson, L. B. (2013). *Creating self-regulated learners: Strategies for strengthening students' self-awareness and learning skills*. Sterling, VA: Stylus.

Nilson, L. B. (2013, October 18). The top ten reasons why we have to teach our students how to learn. Invited StylusPub blog posting. Available at <http://styluspub.wordpress.com/2013/10/18/the-top-ten-reasons-why-we-have-to-teach-our-students-how-to-learn/>

Nuhfer, E. B., & Knipp, D. (2003). The knowledge survey: A tool for all reasons. *To Improve the Academy*, 21, 59-78.

Roediger, H. L., III, & Karpicke, J. D. (2006). The power of testing memory: Basic research and implications of the educational practice. *Perspectives on Psychological Science*, 1(3), 181-210.

Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science*, 26, 113-125. Available at <http://www.springerlink.com/content/w884l0214g78445h/>

Schunk, D. H. (1999). Self-efficacy and achievement behaviors. *Educational Psychology Review*, 1, 173-208.

Schunk, D. H., & Zimmerman, B. J. (Eds.). (1998). *Self-regulated learning: From teaching to self-reflective practice*. New York: Guilford Press.

Schwartz, B., & Sharpe, K. (2012, February 19). Colleges should teach intellectual virtues. *Chronicle of Higher Education*. Retrieved February 20, 2012 from <http://chronicle.com/article/Colleges-Should-Teach/130868/>

Schwarzmueller, A. (2010, February). Engaging students in reflecting on their learning. Paper presented at the annual Lilly South Conference on College Teaching, Greensboro, NC.

Self-Regulated Learning Program, The. (n.d.). Available at <http://www.selfregulatedlearning.blogspot.com/>

Shoder, Y., Mischel, W., & Peake, P. (1990). Predicting adolescent cognitive and social competence from preschool delay of gratification, Identifying diagnostic conditions. *Developmental Psychology*, 26, 489-493.

Tanner, K. D. (2012). Promoting student metacognition. *Life Science Education*, 11, 113-120.

Tinnesz, C. G., Ahuna, K. H., & Kiener, M. (2006). Toward college success: Internalizing active and dynamic strategies. *College Teaching*, 54(4), 302-306.

Weimer, M. (2002). *Learner-centered teaching: Five key changes to practice*. San Francisco: Jossey-Bass.

Wilson, M., Wenk, L., & Mogk, D. (2008). Reflective writing to construct meaning. Session resented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience, Carleton College, Northfield, MN, November 19-21. Available at <http://serc.carleton.edu/NAGTWorkshops/metacognition/tactics/28928.html>

Winne, P. H. (2005). A perspective on state-of-the-art research on self-regulated learning. *Instructional Science*, 33, 559-565.

Winne, P. H., & Jamieson-Noel, D. L. (2002). Exploring students' calibration of self-reports about study tactics and achievement. *Contemporary Educational Psychology*, 27, 551-572.

Wirth, K. R. (2008a). A metacurriculum on metacognition. Opening keynote address presented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience,

Carleton College, Northfield, MN, November 19-21. Available at <http://serc.carleton.edu/NAGTWorkshops/metacognition/wirth.html>

Wirth, K. R. (2008b). Learning about thinking and thinking about learning: Metacognitive knowledge and skills for intentional learners. Session presented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience, Carleton College, Northfield, MN, November 19-21. Available at <http://serc.carleton.edu/NAGTWorkshops/metacognition/workshop08/participants/wirth.html>

Wirth, K. R. & Perkins, D. (2008a). Knowledge surveys. Session presented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience, Carleton College, Northfield, MN, November 19-21. Available at <http://serc.carleton.edu/NAGTWorkshops/assess/knowledgesurvey/>

Wirth, K. R., Lea, P., O'Connell, S., Han, J., Gosselin, D., & Ottenhoff, J. (2008). Finding meaning in the introductory science course. Session presented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience, Carleton College, Northfield, MN, November 19-21. Available at http://serc.carleton.edu/NAGTWorkshops/metacognition/group_tactics/28894.html

Yu, S., Wenk, L., & Ludwig, M. (2008). Knowledge surveys. Session presented at the National Association of Geoscience Teachers (NAGT) Workshops: The Role of Metacognition in Teaching Geoscience, Carleton College, Northfield, MN, November 19-21. Available at <http://serc.carleton.edu/NAGTWorkshops/metacognition/tactics/28927.html>

Zander, R. S., & Zander, B. (2000). *The art of possibility: Transforming professional and personal life*. Cambridge, MA: Harvard University Business Press.

Zimmerman, B. J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp.1-19). New York: Guilford.

Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: An overview and analysis. In B. J. Zimmerman & D. H. Schunk, (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (pp. 1-38). Mahwah, NJ: Lawrence Erlbaum Associates.

Zimmerman, B. J. (2002). Becoming a self-regulated learning: An overview. *Theory into Practice*, 41(2), 64-70.

Zimmerman, B. J., & Schunk, D. H. (2001). *Self-regulated learning and academic achievement: Theoretical perspectives*. Mahwah, NJ: Lawrence Erlbaum Associates.

Zimmerman, B. J., & Schunk, D. H. (2003). Albert Bandura: The scholar and his contributions to educational psychology. In B. J. Zimmerman & D. H. Schunk (Eds.), *Educational psychology: A century of contributions* (pp. 431-457). Mahwah, NJ: Lawrence Erlbaum Associates.

Zimmerman, B. J., Moylan, A., Hudesman, J., White, N., & Flugman, B. (2011). Enhancing self-reflection and mathematics achievement of at-risk students at an urban technical college. *Psychological Test and Assessment Modeling*, 53(1), 141-160.

Zull, J. E. (2011). *From brain to mind: Using neuroscience to guide change in education*. Sterling, VA: Stylus.