

Teaching the Metacognition Learning Goal in CSB/SJU Integrations Curriculum

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Agenda

- ▶ Introduction to:
 - ▶ Metacognition
 - ▶ CSBSJU metacognitive learning goal
- ▶ Teaching metacognition
- ▶ Metacognition learning goal in your courses
- ▶ DEAL prompt for metacognitive learning goal

(Zoom chat) What learning difficulties do students typically encounter in your discipline/classes?

- ▶ “I know the material. But I get low scores on your exams.”
- ▶ “I study so much, but I just can’t do this!”
- ▶ “I get A’s in all my classes except this one.”
- ▶ “Why did I lose points on this answer?”
- ▶ “Can I schedule a meeting with you before Thursday’s exam?”
- ▶ “No offense, but I learn better from professors who lecture.”

Metacognition: “Thinking about thinking”¹

- ▶ The ability to^{1,2}
 - ▶ think about one's own thinking;
 - ▶ be consciously aware of oneself as a problem solver;
 - ▶ monitor, plan, and control one's mental processing; and
 - ▶ accurately judge one's level of learning.
- ▶ *“When students employ metacognition, they become consciously aware of themselves as problem solvers, which enables them to actively seek solutions to any problems they may encounter, rather than relying on others to tell them what to do or to answer their questions.”²*

1. Flavell, 1976 2. McGuire & McGuire, 2015

Self-regulated learning and Inclusivity

- ▶ Self-regulation includes monitoring & managing cognitive processes (metacognition) + awareness and control over³:
 - ▶ emotions,
 - ▶ motivations,
 - ▶ behavior, and
 - ▶ environment.
- ▶ Inclusivity^{4,5}
 - ▶ Explicit structure and instruction in learning process and metacognition
 - ▶ Counteract fixed mindset
 - ▶ Explicit care for students

3. Nilson, 2013; 4. Tanner, 2013; 5. Penner, 2018

Two components: Knowledge vs Regulation^{6,7,8}

- ▶ Knowledge: what learners know about learning approaches, application of approaches, and their own thinking.
 - ▶ declarative (what strategies?), procedural (how?), and conditional (when?)⁹
 - ▶ required for learning, but not sufficient for learning
 - ▶ ex: distinguish concepts that they know/don't know, identify study strategies
- ▶ Regulation: actively regulate thinking for the purpose of learning.
 - ▶ 3 skills:
 - ▶ planning: pre-task; selecting individual strategies and designing study plans for learning task
 - ▶ monitoring: during task; considering how well strategies/approaches are working in real time
 - ▶ evaluating: post-task; were individual strategies and overall study plans effective?

6. Brown, 1978; 7. Flavell, 1979; 8. Pintrich, 2002; 9. Schraw and Dennison, 1994

CSB/SJU Integrations Curriculum Learning Goal

METACOGNITION: Optimize one's own thinking and learning processes.

- ▶ Beginner: Students identify their intellectual abilities and dispositions, problem solving processes, and learning strategies.
- ▶ Intermediate: Students reflect on the weaknesses and strengths of their intellectual abilities and dispositions, effectiveness of their problem solving processes, and efficiencies of their learning strategies.
- ▶ Advanced: Students apply their metacognitive knowledge to improve their problem solving processes, and to strengthen learning strategies.

<https://csbsju.edu/integrations-curriculum/faculty-resources/resources/key-components/the-learning-goals>

(breakout) Consider the classes you teach.

What aspects of metacognitive development are reasonable to expect of students entering those courses?

What metacognitive skills are required for success in those courses?

CSBSJU metacognition learning goals

Metacognitive components	CSBSJU metacognition goal
Metacognitive knowledge	Beginner: Students identify their intellectual abilities and dispositions, problem solving processes, and learning strategies.
Metacognitive knowledge Metacognitive regulation	Intermediate: Students reflect on the weaknesses and strengths of their intellectual abilities and dispositions, effectiveness of their problem-solving processes, and efficiencies of their learning strategies.
Metacognitive regulation	Advanced: Students apply their metacognitive knowledge to improve their problem-solving processes, and to strengthen learning strategies.

Table 1. Integrations Curriculum Map

This chart shows where the learning outcomes will be assessed.

Learning Outcome	Learning Foundations	CSD:I	Theo 1	Learning Explorations	Thematic Focus	CSD:S	Theo 2	Learning Integration
Analyzing Texts			1		2			
Collaboration		1			2			
Common Good			1			2		3
Gender		1				2		
Information Literacy	1			1	2			
Metacognition	1			1		2		3
Quantitative Reasoning*								
Race and Ethnicity		1				2		
Religious Engagement			1				2	
Speak		1						2
Theological Reasoning			1				2	
Write	1			2			2	3

* Quantitative Reasoning is a designation that could be added to any course in a major or program. Both levels 1 & 2 of Quantitative Reasoning will be met in the same class.

"Integrations Curriculum: Engaged Learning in the Liberal Arts & Sciences" (dated 3/27/18; p. 16) <https://www.csbsju.edu/integrations-curriculum/faculty-resources>

Learning Foundations course development guidelines

Faculty will help students begin to understand the role and benefit of metacognition. Since this is the first stage of the Metacognition requirement, the focus should be on helping students realize that individual approaches differ, and that reflecting on how they learn is beneficial.

- ▶ This may be achieved through tools similar to those currently used in the College Success course, or
- ▶ it may be facilitated by the faculty member asking students to examine their problem-solving processes and learning strategies.
 - ▶ Example, instructors may assign a short written reflection asking students to identify different learning styles and strategies and their own preferences.

<https://www.csbsju.edu/integrations-curriculum/faculty-resources/draft-course-proposal-forms>

Metacognitive regulation is important for:

- ▶ learning,
- ▶ academic performance, and
- ▶ transfer of learning to new contexts...

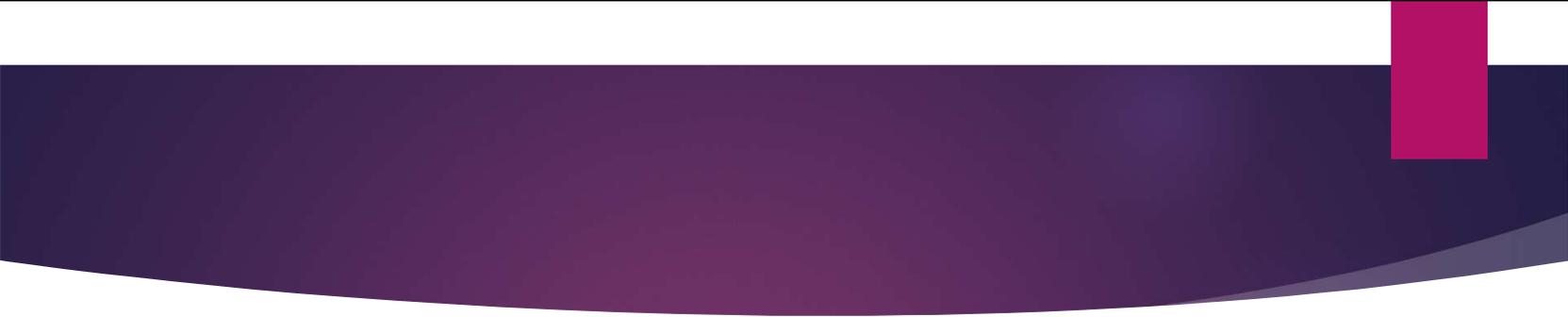
...but, metacognitive interventions generate varied results.^{10,11,12,13}

- Explicit instruction
- Student practice
- Reflective assignments
- Metacognitive prompts
- Discussions
- Modeling
- Visual assignments (concept mapping, etc.)

10. Niefeld and Schraw, 2002; 11. Thiede et al., 2003; 12. Zohar and Barzilai, 2013; 13. Langdon et al., 2019

(Zoom chat) How do you respond when students encounter learning difficulties?

- ▶ “I know the material. But I get low scores on your exams.”
- ▶ “I study so much, but I just can’t do this!”
- ▶ “I get A’s in all my classes except this one.”
- ▶ “Why did I lose points on this answer?”
- ▶ “Can I schedule a meeting with you before Thursday’s exam?”

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- ▶ “What, exactly, do you do when you study?”
 - ▶ “When do you study?”
 - ▶ “What do you mean when you say that you ‘go over’ the material?”
 - ▶ “You should be to be critical of yourself (in a good way) when you study.”
 - ▶ “Get out a blank piece of paper and draw out an explanation using only your brain for reference.”
 - ▶ “Here is one way of putting all the material together into one picture...”
 - ▶ “This is like soccer practice. You want to identify and focus practice on your weaknesses, not your strengths.”
 - ▶ **“You need to actively engage your brain rather than passively receive information when you study. Try to change the information in some way.”**

Effective metacognition requires:

- ▶ Explicit awareness⁸
- ▶ Construction (connection to old skills) and embedded in context¹⁴
- ▶ Development over time
- ▶ Automaticity
- ▶ Students must¹⁵:
 - ▶ assess the demands of the task,
 - ▶ evaluate their own knowledge and skills,
 - ▶ plan their approach,
 - ▶ monitor their progress, and
 - ▶ adjust their strategies as needed.

8. Pintrich, 2002; 14. Zohar and David, 2008; 15. Ambrose, et al., 2010, p. 191

How to teach metacognition: “There’s no magic formula.”²

General recommendations:

- ▶ Frame learning as driven by student behavior vs. intrinsic ability
- ▶ Learning goals (intrinsic) > performance goals (extrinsic)
 - ▶ Study vs. learn
- ▶ Embedded
- ▶ Make metacognition explicit
 - ▶ Connect study strategies to learning science (process/mechanisms) and Bloom's
 - ▶ Explicit goals and explicit process (ex. instructor models thought steps and rationale)
- ▶ Student buy-in
 - ▶ May be more effective after an early formative assignment/assessment (motivation)
 - ▶ Incentivize
- ▶ Practice opportunities
- ▶ Student accountability

2. McGuire & McGuire, 2015

Prompts and language to use with students

- ▶ Study strategy vs. study plan
- ▶ Low-med-high utility
- ▶ Deep learning vs. surface learning
- ▶ Cognitively passive vs. cognitively active¹⁶
- ▶ Consider strategies NOT to use alongside strategies TO use¹⁷
- ▶ Study cycle²
 - ▶ “active learning”
 - ▶ efficiency (“power hour”)
- ▶ Practice and immediate trial—students will revert to old, automatic strategies

16. Stanger-Hall, 2012, Table 1; 17. Stanton et al., 2019; 2. McGuire and McGuire, 2015, pg. 39

How to teach metacognition

- ▶ Context considerations:
 - ▶ Level-specific
 - ▶ introductory vs. advanced (knowledge vs. regulation)¹³
 - ▶ Don't ignore discipline-specific considerations
 - ▶ overcome student resistance
 - ▶ Make language and habits part of classroom culture¹⁸
 - ▶ integrate reflection into coursework, invite confusions, model metacognition
- ▶ Resources:
 - ▶ McGuire chapter 11 + associated materials²
 - ▶ Learning Scientists: 6 strategies for effective learning (<https://www.learningscientists.org/downloadable-materials>)



13. Langdon et al., 2019; 18. Tanner, 2012; 2. McGuire and McGuire, 2015

Assignment examples

- ▶ Exam wrappers (reflection)
- ▶ Muddiest point
- ▶ Reflective Journals
- ▶ Think alouds
- ▶ Study plan/calendar
- ▶ Reflective assignment/exam questions
- ▶ See: learningscientists.org/downloadable-materials

Table 1. Sample self-questions to promote student metacognition about learning^a

Activity	Planning	Monitoring	Evaluating
Class session	<ul style="list-style-type: none"> What are the goals of the class session going to be? What do I already know about this topic? How could I best prepare for the class session? Where should I sit and what should I be doing (or not doing) to best support my learning during class? What questions do I already have about this topic that I want to find out more about? 	<ul style="list-style-type: none"> What insights am I having as I experience this class session? What confusions? What questions are arising for me during the class session? Am I writing them down somewhere? Do I find this interesting? Why or why not? How could I make this material personally relevant? Can I distinguish important information from details? If not, how will I figure this out? 	<ul style="list-style-type: none"> What was today's class session about? What did I hear today that is in conflict with my prior understanding? How did the ideas of today's class session relate to previous class sessions? What do I need to actively go and do now to get my questions answered and my confusions clarified? What did I find most interesting about class today?
Active-learning task and/or homework assignment	<ul style="list-style-type: none"> What is the instructor's goal in having me do this task? What are all the things I need to do to successfully accomplish this task? What resources do I need to complete the task? How will I make sure I have them? How much time do I need to complete the task? If I have done something like this before, how could I do a better job this time? 	<ul style="list-style-type: none"> What strategies am I using that are working well or not working well to help me learn? What other resources could I be using to complete this task? What action should I take to get these? What is most challenging for me about this task? Most confusing? What could I do differently midassignment to address these challenges and confusions? 	<ul style="list-style-type: none"> To what extent did I successfully accomplish the goals of the task? To what extent did I use resources available to me? If I were the instructor, what would I identify as strengths of my work and flaws in my work? When I do an assignment or task like this again, what do I want to remember to do differently? What worked well for me that I should use next time?
Quiz or exam	<ul style="list-style-type: none"> What strategies will I use to study (e.g., study groups, problem sets, evaluating text figures, challenging myself with practice quizzes, and/or going to office hours and review sessions)? How much time do I plan on studying? Over what period of time and for how long each time I sit down do I need to study? Which aspects of the course material should I spend more or less time on, based on my current understanding? 	<ul style="list-style-type: none"> To what extent am I being systematic in my studying of all the material for the exam? To what extent am I taking advantage of all the learning supports available to me? Am I struggling with my motivation to study? If so, do I remember why I am taking this course? Which of my confusions have I clarified? How was I able to get them clarified? Which confusions remain and how am I going to get them clarified? 	<ul style="list-style-type: none"> What about my exam preparation worked well that I should remember to do next time? What did not work so well that I should not do next time or that I should change? What questions did I not answer correctly? Why? How did my answer compare with the suggested correct answer? What questions did I not answer correctly? Why? What confusions do I have that I still need to clarify?
Overall course	<ul style="list-style-type: none"> Why is it important to learn the material in this course? How does success in this course relate to my career goals? How am I going to actively monitor my learning in this course? What do I most want to learn in this course? What do I want to be able to do by the end of this course? 	<ul style="list-style-type: none"> In what ways is the teaching in this course supportive of my learning? How could I maximize this? In what ways is the teaching in this course not supportive of my learning? How could I compensate for or change this? How interested am I in this course? How confident am I in my learning? What could I do to increase my interest and confidence? 	<ul style="list-style-type: none"> What will I still remember 5 yr from now that I learned in this course? What advice would I give a friend about how to learn the most in this course? If I were to teach this course, how would I change it? What have I learned about how I learn in this course that I could use in my future biology/science courses? In my career?

^aInspired by Ertmer and Newby (1996), Schraw (1998), and Coutinho (2007).

Sample self-questions and assignment prompts¹⁸

Table 2. Sample prompts for integrating metacognition into course activities

Pair discussion after a clicker question	Active-learning tasks and/or homework assignments (e.g., case studies, concept maps, problem sets)	Preparation for quizzes or exams
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 each of the other answers? 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?	<p>Pose three questions that you had about the concepts you explored in your assignment that you still cannot answer. Describe at least two ideas related to this assignment that you found confusing. "I learned a lot in doing this assignment." To what extent do you agree? disagree? How was the way you approached completing this assignment different compared with the last time we had an assignment like this? What advice would you give yourself based on what you know now if you were starting this assignment all over again?</p>	<p>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 them!) What concepts have you found most confusing so far? What concepts have been most clear? Given that, how should you spend your study time in preparing for the exam? Based on your performance on the first exam, write a letter to yourself with advice about preparing for the next exam.</p>

18. Tanner, 2012

Block plan considerations

- ▶ Explicit strategies and benefits
 - ▶ immediacy (no time to catch up!)
 - ▶ build in time for students to practice each strategy
- ▶ Efficient and effective study time
- ▶ Reading
 - ▶ highlight strategies for deep comprehension
 - ▶ preview
 - ▶ ask questions
 - ▶ practice/demonstrate in class
 - ▶ discipline-specific “how to read” guide²

2. McGuire and McGuire, 2015, pg. 43-52

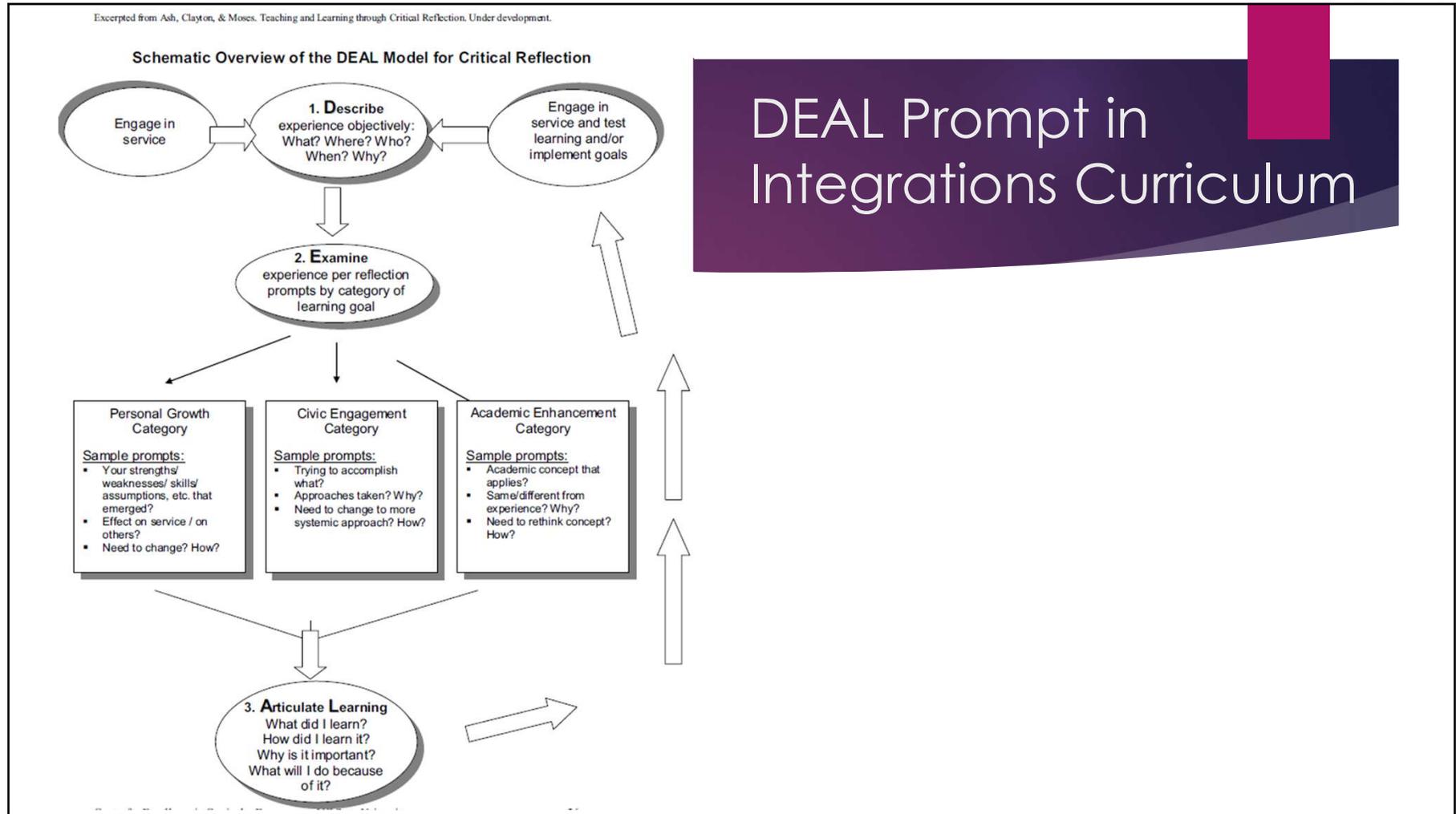
Resources

Teaching metacognition

- ▶ <https://www.learningscientists.org/> ***
- ▶ <https://www.lsu.edu/cas/earnbettergrades/vlc/virtualllearningcenter.php> ***
- ▶ <https://cft.vanderbilt.edu/guides-sub-pages/metacognition/> ***
- ▶ <https://cetl.kennesaw.edu/metacognition-key-self-directed-learning>
- ▶ <https://ctl.columbia.edu/resources-and-technology/resources/metacognition/>

Pedagogy/tool ideas

- ▶ <https://resources.depaul.edu/teaching-commons/teaching-guides/learning-activities/Pages/activities-for-metacognition.aspx>
- ▶ <https://ciel.viu.ca/teaching-learning-pedagogy/designing-your-course/how-learning-works/ten-metacognitive-teaching-strategies>
- ▶ <https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/metacognitive>



DEAL Prompt in Integrations Curriculum

DEAL Prompt for metacognition

Metacognition reflection prompt

- ▶ <https://www.csbsju.edu/integrations-curriculum> → “Faculty Resources” → Course proposal forms → “Metacognition DEAL Reflection Prompt”

(breakout)

How can you integrate metacognition instruction & assessment, including the DEAL prompt, in your Integrations Curriculum courses?

Measuring metacognition

- ▶ Metacognitive awareness inventory (MAI)⁹
- ▶ Motivated Strategies for Learning Questionnaire (MSLQ) (Metacognitive) Self-Regulation sub-scale¹⁹
- ▶ Approaches and Study Skills Inventory for Students (ASSIST)²⁰
- ▶ Student Metacognition Affect and Study Habits (SMASH) survey²¹
- ▶ Dye and Stanton post-exam assignment²²

9. Schraw and Dennison, 1994; 19. Pintrich and DeGroot, 1990; 20. Brown et al., 2015; 21. Metzger et al., 2018; 22. Dye and Stanton, 2017

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