KNOWLEDGE APPLICATION LESSONS

Engaging Students in Cognitively Complex Tasks

THE **MARZANO COMPENDIUM** OF INSTRUCTIONAL STRATEGIES

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INTRODUCTION

In 2007, Dr. Robert J. Marzano published *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction.* The framework, composed of three lesson segments, ten design questions, and forty-one elements, was based on research showing that teacher quality is one of the strongest influences on student achievement—that is, an effective teacher can positively and significantly impact student learning. As such, *The Art and Science of Teaching* sought to identify specific action steps teachers could take to improve their effectiveness.

In 2015, Dr. Marzano updated *The Art and Science of Teaching* framework to reflect new insights and feedback. The Marzano Compendium of Instructional Strategies is based on this updated model, presenting forty-three elements of effective teaching in ten categories. Each folio in the series addresses one element and includes strategies, examples, and reproducible resources. The Compendium and its folios are designed to help teachers increase their effectiveness by focusing on professional growth. To that end, each folio includes a scoring scale teachers can use to determine their proficiency with the element, as well as numerous strategies that teachers can use to enact the element in their classrooms. Indeed, the bulk of each folio consists of these strategies and reproducibles for implementing and monitoring them, making the Compendium a practical, actionable resource for teachers, instructional coaches, teacher mentors, and administrators.

ENGAGING STUDENTS IN COGNITIVELY COMPLEX TASKS

The teacher engages students in complex tasks (for example, decision-making, problem-solving, experimental-inquiry, investigation, and invention tasks) that require them to generate and defend conclusions. Research has shown that these types of tasks, when done effectively, help students understand principles and apply knowledge. Cognitively complex tasks require students to question their current knowledge and adjust it to accommodate their findings.

Monitoring This Element

There are specific student responses that indicate this element is being effectively implemented. Before trying strategies for the element in the classroom, it is important that the teacher knows how to identify the types of student behaviors that indicate the strategy is producing the desired effects. General behaviors a teacher might look for include the following.

- Students are clearly working on complex tasks that require them to generate and test hypotheses and defend conclusions.
- When asked, students can explain the conclusions they have generated.
- When asked, students can defend their conclusions.
- Student artifacts indicate that they can engage in decision-making, problem-solving, experimental-inquiry, invention, or investigation tasks.

Desired behaviors such as these are listed for each strategy in this element.

Teachers often wonder how their mastery of specific strategies relates to their mastery of the element as a whole. Successful execution of an element does not depend on the use of every strategy within that element. Rather, multiple strategies are presented within each element to provide teachers with diverse options. Each strategy can be an effective means of implementing the goals of the element. If teachers attain success using a particular strategy, it is not always necessary to master the rest of the strategies within the same element. If a particular strategy proves difficult or ineffective, however, teachers are encouraged to experiment with various strategies to find the method that works best for them.

Scoring Scale

The following scoring scale can help teachers assess and monitor their progress with this element. The scale has five levels, from Not Using (0) to Innovating (4). A teacher at the Not Using (0) level is unaware of the strategies and behaviors associated with the element or is simply not using any of the strategies. At the Beginning (1) level, a teacher attempts to address the element by trying specific strategies, but does so in an incomplete or incorrect way. When a teacher reaches the Developing (2) level, he or she implements strategies for the element correctly and completely, but does not monitor their effects. At the Applying (3) level, a teacher implements strategies for the element and monitors their effectiveness with his or her students. Finally, a teacher at the Innovating (4) level is fluent with strategies for the element and can adapt them to unique student needs and situations, creating new strategies for the element as necessary.

Scale for Engaging Students in Cognitively Complex Tasks

4 **Innovating**	3 **Applying**	2 **Developing**	1 **Beginning**	0 **Not Using**
I adapt behaviors and create new strategies for unique student needs and situations.	I engage students in cognitively complex tasks, and I monitor the extent to which my actions affect students.	I engage students in cognitively complex tasks, but I do not monitor the effect on students.	I use the strategies and behaviors associated with this element incorrectly or with parts missing.	I am unaware of strategies and behaviors associated with this element.

The following examples describe what each level of the scale might look like in the classroom.

Not Using (0): A teacher does not engage her students in cognitively complex tasks. She does engage students in practicing skills and procedures, but does not create activities that encourage students to apply their knowledge.

Beginning (1): A teacher asks his students to conduct an experimental-inquiry task. However, he decides to make the task simpler by providing his students with a hypothesis to examine and sharing the correct results of the experiment with his students before they begin the task. Because he shares the expected results of the experiment, his students are able to easily discover when they make a mistake during the procedure, but they do not genuinely predict, revise their thinking, or come to new conclusions while performing the task.

Developing (2): A teacher presents her students with a problem and asks them to brainstorm possible solutions to the problem. The teacher encourages the students to logically predict which solution might be the best and to test out each possible solution to see what happens. The students try out their solutions, but the class period ends before the class can discuss their conclusions and problem-solving methods. The teacher does not come back to the discussion during the next class, so she is not sure how well students applied their knowledge or how their learning progressed as a result.

Applying (3): A teacher asks his class to design a rocket that uses Alka-Seltzer as fuel. He begins by helping students plan and generate ideas for the construction and materials needed for the rocket. He then allows the students to work in small groups to put together their rockets. On the last day of the unit, each group shows the class how its rocket works. After the presenta-

tions, the class discusses what they learned from making the rockets, observing the rockets, and listening to their classmates talk about their rockets' construction.

Innovating (4): A teacher asks her students to investigate a specific time period as part of a unit on world history. The teacher instructs each student to design an investigation question to help them learn more about the cultural, social, and technological aspects of the time period and place they are examining and then predict what they will find out during their research. The teacher creates a step-by-step procedure for students who are struggling with the investigation project as well as a number of prompts to help them generate ideas about their topic. Students then create a presentation that incorporates a visual component (such as a poster, PowerPoint presentation, or a diorama) to illustrate the complexity of that time period and culture. After the presentations, the teacher holds a group discussion in order to learn how students' perceptions of certain time periods were changed.

STRATEGIES

Each of the following strategies describes specific actions that teachers can take to enact this element in their classrooms. Strategies can be used individually or in combination with each other. Each strategy includes a description, a list of teacher actions, a list of desired student responses, and suggestions for adapting the strategy to provide extra support or extensions. Extra support and extensions relate directly to the Innovating (4) level of the scale. Extra support involves steps teachers can take to ensure they are implementing the strategy effectively for all students, including English learners, special education students, students from low socioeconomic backgrounds, and reluctant learners. Extensions are ways that teachers can adapt the strategy for advanced students. In addition, some strategies include technology tips that detail ways teachers can use classroom technology to implement or enhance the strategy. Finally, each strategy includes further information, practical examples, or a reproducible designed to aid teachers' implementation of the strategy.

Experimental-Inquiry Tasks

The teacher uses experimental-inquiry tasks to teach students how to make predictions, test them, examine the results, evaluate the results, and reflect on the process to come to a defensible conclusion. Observations, experiments, surveys, and interviews are all appropriate data-collection techniques for this type of task. The teacher can ask students to answer the following questions as they engage in experimental-inquiry tasks.

- What is my prediction?
- How will I test my prediction?
- What do I expect to see if my prediction is correct?
- What actually happened?
- Did my prediction come true?
- How has my thinking changed?
- What conclusions can I defend?

Teacher Actions

- Asking students to make predictions, test them, and evaluate the results of their experimental-inquiry tasks
- Asking students to reflect on the process they used for their experimental-inquiry tasks

Desired Student Responses

- Making predictions, testing them, and evaluating the results of their experimental-inquiry tasks
- Explaining what they learned from their experimental-inquiry tasks
- Defending their conclusions

Extra Support

- Creating a diagram (with pictures and words) that shows the process that should be followed for an experimental-inquiry task and posting it in the classroom

Extension

- Asking students to research other experiments done on the same topic as their own task and compare their results with others'

Technology Tips

- Have students search the Internet for evidence that supports their predictions and then ask them to catalog and annotate the evidence that they have found using social bookmarking tools (such as Diigo or Delicious) and share their findings with their classmates by posting updates on the class website.
- Ask students to use online survey tools (such as SurveyMonkey) or social media tools (such as Twitter, Edmodo, Blendspace, or Facebook) to gather data from peers or other Internet users.

Experimental-Inquiry Notes Template

The question I am investigating is _____

_____

My hypothesis is that if _____ then

_____ will occur because

of_____.

To test my hypothesis I will do the following things:

1.

2.

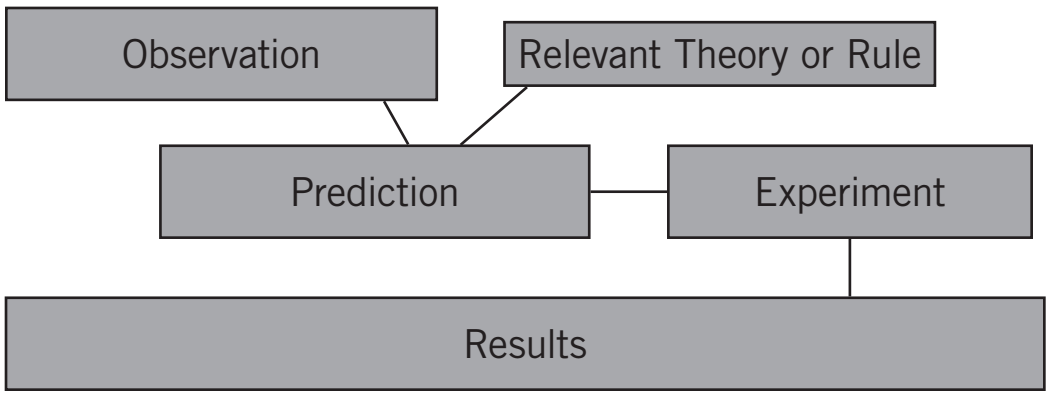
3.

As I conduct my experiment I notice:

The results of my experiment show:

My observations and results lead me to these conclusions:

Experimental Inquiry Model



Problem-Solving Tasks

The teacher uses problem-solving tasks to teach students how to set a goal, identify obstacles or constraints to reaching that goal, find solutions, predict which solution is most likely to work, test their prediction, examine the results, evaluate the results, and reflect on the process. The teacher asks students to answer the following questions as they engage in problem-solving tasks.

- What is the goal?
- What obstacle or constraint makes it difficult to accomplish the goal?
- What are some ways I might overcome the obstacle or the constraint?
- Which solution do I predict will work best and why?
- What actually happened?
- Do the results fit with my original prediction?
- If not, how should my thinking change regarding the problem?
- What are my conclusions?

Teacher Actions

- Asking students to identify obstacles or constraints to achieving goals, find solutions, and predict the effectiveness of different solutions for problem-solving tasks
- Asking students to reflect on the process they used for their problem-solving tasks

Desired Student Responses

- Identifying obstacles or constraints to achieving goals, finding solutions, and predicting the effectiveness of different solutions for their problem-solving tasks
- Explaining what they learned from their problem-solving tasks

Extra Support

- Creating a diagram (with pictures and words) that shows the process that should be followed for a problem-solving task and posting it in the classroom

Extension

- Asking students to research other problems similar to their own, and having them compare their results with the results of others

Technology Tips

- Have students search the Internet for background information about problems they wish to study and solve. The student then uses a class website to share progress or uses social bookmarking tools like Diigo or Delicious to catalog and annotate online resources.

Problem-Solving Map

Name: _____

Problem or Goal:

Possible Solution 1	Possible Solution 2	Possible Solution 3
Advantages & Disadvantages	Advantages & Disadvantages	Advantages & Disadvantages

Which solution do I predict will work best?

Solution 1 Results	Solution 2 Results	Solution 3 Results

Do my results match my prediction? Why or why not?

My conclusions:

Examining the Efficiencies of Multiple Methods of Problem Solving

The teacher asks students to use logic to evaluate multiple methods of problem solving. Students will determine which method is most effective or efficient by comparing aspects of each. This strategy is frequently used in mathematics, science, and the social sciences.

Teacher Actions

- Providing students with a task to complete using the methods of problem solving
- Providing students with directions or resources to help them use each method of problem solving
- Asking students to record their observations and results using graphic organizers or written summaries
- Asking students to explain why they think one method is better than another

Desired Student Responses

- Comparing the procedures and results of different problem-solving methods
- Recording their results using graphic organizers or written summaries
- Explaining why one method of problem solving is better than other

Extra Support

- Providing students with step-by-step directions for using each problem-solving method

Extension

- Asking students to compare how they evaluated multiple problem-solving methods with a classmate who examined the same methods

Teaching Students to Generate Logical Conclusions

Have students analyze their conclusions by asking themselves a series of questions that require them to reflect on why or how they got their results.

1. Is all of the information I started with correct?
2. Did I complete each method from start to finish?
3. Am I sure I performed all of the processes correctly?
4. Is there a clear cause-and-effect relationship, or am I assuming that one exists?
5. Do I have more experience with one method that makes it more likely that I would prefer it?
6. Would I come to the same conclusion if I evaluated each method again?
7. How would I explain my reasoning to a classmate? What evidence from my notes can I provide to defend my conclusion?

Decision-Making Tasks

The teacher uses decision-making tasks to teach students how to identify possible alternatives, outline the criteria on which each alternative will be judged, apply the criteria to each alternative, and select the most appropriate alternative. To complete these tasks, students can use a decision-making matrix, such as the one in the following example.

	Ways to Get to School			
Criteria 0–Does not meet the criterion at all 1–Meets criterion slightly 2–Meets criterion 3–Strongly meets criterion	*School Bus*	*Public Transportation*	*Car*	*Bike*
Inexpensive	3	2	0	2
Short commute time	1	1	2	0
Safe	2	2	1	1
Allows flexibility	0	1	3	1
Better for the environment	1	1	0	3
Involves little extra effort	3	2	2	0
TOTAL	10	9	8	7

In this example, a student compared different ways to get to school. The student's decision-making matrix revealed that the school bus would be the best option for commuting to and from school because it is inexpensive, convenient, and fairly safe. (For more detail about the decision-making process, see *The New Taxonomy of Educational Objectives* by Robert J. Marzano and John S. Kendall, 2008.)

Students answer the following questions as they engage in decision-making tasks.

- What alternatives am I considering?
- What criteria am I using to select among alternatives?
- What do I predict will be the best alternative?
- Which alternatives came out on top?
- Do the results fit with my original prediction?
- If not, how should my thinking change?
- What are my conclusions?

Teacher Actions

- Asking students to identify alternatives and judgment criteria, apply criteria to alternatives, and select appropriate alternatives during decision-making tasks
- Teaching students how to use a decision-making matrix
- Asking students to reflect on the process they used for their decision-making tasks

Desired Student Responses

- Identifying alternatives and judgment criteria, applying criteria to alternatives, and selecting appropriate alternatives during decision-making tasks
- Explaining what they learned from their decision-making tasks

Extra Support

- Creating a diagram (with pictures and words) that shows the process that should be followed for a decision-making task and posting it in the classroom

Extension

- Asking students to research other decisions made about the same topic as their own task, and having them compare their decisions with the decisions of others

Technology Tips

- Create interactive decision matrices using interactive whiteboard software or word processing software. First, fill in the critical elements of the matrices—include the items to be considered and the criteria by which to evaluate them. Next, have students discuss the extent to which each item meets each criterion.

Decision-Making Matrix Worksheet

Criteria	Alternatives			
0–Does not meet the criterion at all 1–Meets criterion slightly 2–Meets criterion 3–Strongly meets criterion				
Totals				

How do your totals compare with what you expected?

How do your results reveal something new about the items you were examining?

Investigation Tasks

The teacher uses investigation tasks to teach students how to identify a concept, past event, or future hypothetical event to be investigated; identify what is already known about the subject of investigation; identify confusions or contradictions; and develop a plausible resolution to the confusions or contradictions. The teacher asks students to answer the following questions as they engage in investigation tasks.

- Am I focusing on something that has to be defined better, something that happened in the past, or something that might possibly happen?
- What do I think I will find out?
- What is known about my subject?
- What confusions or contradictions exist about my subject?
- What do I think is the resolution to these confusions and contradictions?
- Did my findings fit with my original prediction?
- If not, how should my thinking change?
- What are my conclusions?

Students can also use a graphic organizer such as the following to record information.

<table>
<tr><td colspan="2">Concept or Scenario:</td></tr>
<tr><td>Known or Agreed Upon:</td><td>Confusions or Contradictions:</td></tr>
<tr><td colspan="2">Resolution:</td></tr>
</table>

Teacher Actions

- Asking students to identify interesting concepts or events, research current knowledge about them, identify confusions or contradictions about them, and develop a resolution for the contradictions or confusions during investigation tasks
- Asking students to reflect on the process they used for their investigation tasks

Desired Student Responses

- Identifying interesting concepts or events, researching current knowledge about them, identifying confusions or contradictions about them, and developing a resolution for the contradictions or confusions during investigation tasks
- Explaining what they learned from their investigation tasks

Extra Support

- Creating a diagram (with pictures and words) that shows the process that should be followed for an investigation task and posting it in the classroom

Extension

- Asking students to research other investigations on the same topic as their own task and compare their results with others'

Technology Tips

- Have students search the Internet for resources or background information about issues they wish to study. For instance, they might search the archives of institutions such as the Smithsonian, the National Archives, the Library of Congress, or the American Museum of Natural History. Alternatively, students can search their local town, community, county, or state archives—such as those in libraries or state museums—to uncover evidence about events or people.
- Use online bookmarking tools to enhance students' collections of evidence during the investigation tasks. Students can use social bookmarking tools like Diigo or Delicious to catalog and comment on online resources that support their investigations, organize the resources based on relevance and usefulness, and share their bookmarks with classmates.

Types of Investigation Tasks

Historical: Students examine a historical event or period and try to define the contributing causes of that particular event or time period. For example, students may examine the period of westward expansion in the United States before the Civil War and describe how actions of the federal government, land speculators, and the press spurred Americans to move west.

Definitional: Students identify the definitional characteristics of a place, person, concept, time period, object, principle, or idea. For example, students might try to determine the definitional characteristics of a plant to help them classify a Venus flytrap as either a plant or an animal.

Projective: Students use research to answer a hypothetical question about future or possible past events. For example, students might consider what would happen if schools asked students to take all of their classes online. Students could research the possible positive and negative effects of this change and explain their reasoning in a short essay or presentation.

Invention Tasks

The teacher asks students to design a product that achieves a specific goal, solves a problem, or makes a task easier. Students consider what design will best suit the purposes and requirements of the task and then develop a prototype. Students then test the prototype in order to determine how effectively it meets their expectations and if it can be improved. This process may require multiple rounds of brainstorming, planning, creating, and troubleshooting. Ultimately, students should design a product, tool, or other invention that meets the standards of the task.

Teacher Actions

- Giving students parameters for the invention task and a prompt to guide their prototype development
- Providing resources and guidance to assist students in the developing and testing stages of invention
- Asking students to evaluate the prototype and describe how well it meets task expectations

Desired Student Responses

- Identifying different designs that could help their invention meet the goal
- Explaining the potential issues or difficulties in developing a design
- Constructing an invention that fulfills the established purpose or goal
- Describing how the invention could be further improved

Extra Support

- Helping students identify errors or ways to improve their design before they develop a prototype and then allowing time for students to revise based on the suggestions

Extension

- Asking students to improve their prototype after providing them with additional criteria to meet

Process for Invention Tasks

1. **Set a goal for the task.** Teachers should set a specific goal for the task and describe how that goal relates to the current learning target or learning progression. Make the goal specific and attainable for students, so that they have a way to measure their progress towards the goal. For example, a teacher might ask students to create a mousetrap-powered car that can travel at least five meters as part of a physics unit.
2. **Establish rules and specific criteria for the task.** Teachers should explain what specifically students should or should not do when designing their inventions. For example, teachers might want to outline which materials students are allowed to use, which general processes or calculations they should consider when completing their project, and what students will need to do to succeed on the project. To make criteria

explicit, teachers can create a scale or rubric to show how students' inventions will be evaluated.

3. **Help students brainstorm first steps.** Teachers should lead students in a discussion of what their first steps will be. Students might begin by sketching or describing an initial design for the project or several possible designs for a project. Encourage students to use graphic organizers and lists to compare different components, materials, and designs they might use for their prototypes.

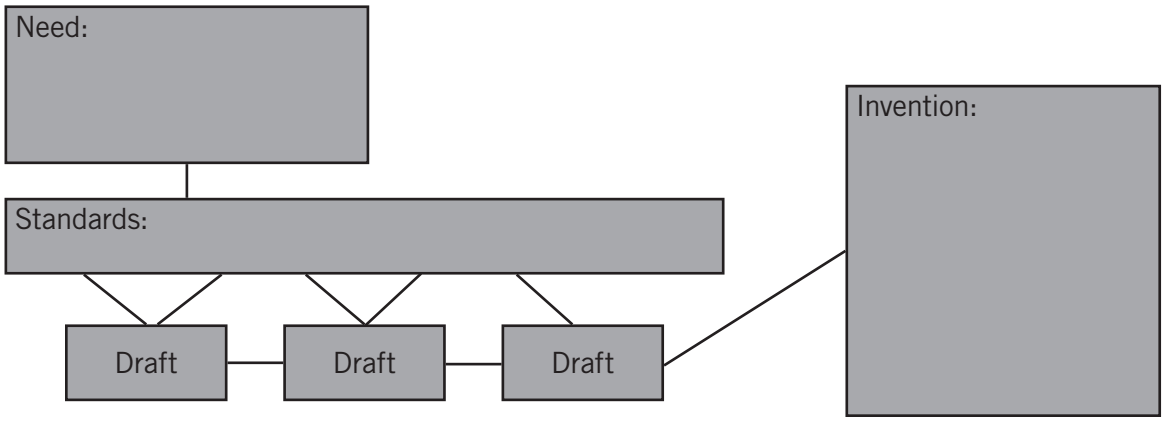
4. **Ask students to create a list of their next steps.** Once students think they have identified a suitable design and the materials they will need, ask them to describe what specific steps they will take to make sure they complete the task successfully and on time. Students can set deadlines for each step. Remind students to consider any measurements or calculations they need to do before they construct their prototype, and encourage them to give themselves extra time to test out the invention before the project's due date.

5. **Facilitate development of the invention.** Teachers can provide time in class for students to work on their inventions and ask questions about their progress. Additionally, teachers can set up extra resources to guide students in their development of their prototypes. For example, teachers can create an online forum where students ask and answer each other's questions about steps in the invention process, address commonly asked questions in class, or meet one-on-one with students who are struggling with the assignment.

6. **Have students demonstrate the use of their invention.** At the end of the project, have students show what their invention does and explain how it meets the criteria of the assignment. Allow the class to ask questions about the invention after each student's presentation.

7. **Ask students to reflect on their work and what could be improved.** Have students explain what they learned through the invention process and what, if anything, they would do differently if they were to do the project again. Additionally, teachers can ask students to explain what changes could make their prototypes more effective and what they learned by listening to other students talk about their process and inventions.

Invention Model



Student-Designed Tasks

The teacher asks students to design a task that deepens their understanding of a topic that interests them and relates to the class's learning target or unit. Students should be comfortable performing cognitively complex tasks independently before a teacher implements this strategy. Students will need to set a goal for their task, explain how it relates to content, and determine the best method for meeting their goal. The teacher can guide students in their tasks by setting up parameters or expectations for the completed product.

Teacher Actions

- Providing resources and guidance to help students succeed in their cognitively complex task
- Providing timelines and expectations for the final product
- Asking students to explain how their task relates to the learning goal or scale for a unit

Desired Student Responses

- Identifying different topics that interest them and relate to content
- Identifying a goal for the cognitively complex task
- Designing an experimental-inquiry, problem-solving, decision-making, investigation, invention, or other cognitively complex task they could complete to explore a topic of interest
- Explaining how their task relates to the learning goal or scale for a unit

Extra Support

- Providing students with several options or processes for their cognitively complex tasks

Extension

- Asking students to explain the reasoning behind each step of their cognitively complex tasks

Student Planning Guide for Cognitively Complex Tasks

What question or problem will your cognitively complex task address?

What kind of cognitively complex task will you use to find a solution or learn more information?

What do you predict you will learn about this topic?

What steps will you take to complete this task? Please outline the process you will use and your schedule for completing those steps.

Will you need any materials or support to complete your project?

How will you make sure your task meets the expectations for this project?

REPRODUCIBLES

Teachers can use the following reproducibles to monitor their implementation of this element. The reproducible titled Tracking Progress Over Time helps teachers set goals related to their proficiency with this element and track their progress toward these goals over the course of a unit, semester, or year. Tracking Teacher Actions and Tracking Student Responses allow observers in classrooms to monitor specific teacher and student behavior related to this element. Teachers themselves can also use the Tracking Student Responses reproducible to document instances of student behaviors during class. The Strategy Reflection Log provides teachers a space to write down their thoughts and reflect on the implementation process for specific strategies related to this element. Finally, this section provides both a student survey and a teacher survey, the results of which provide feedback about teachers' proficiency with this element.

Tracking Progress Over Time

Use this worksheet to set a goal for your use of this element, make a plan for increasing your mastery, and chart your progress toward your goal.

Element: _____

Initial Score: _____

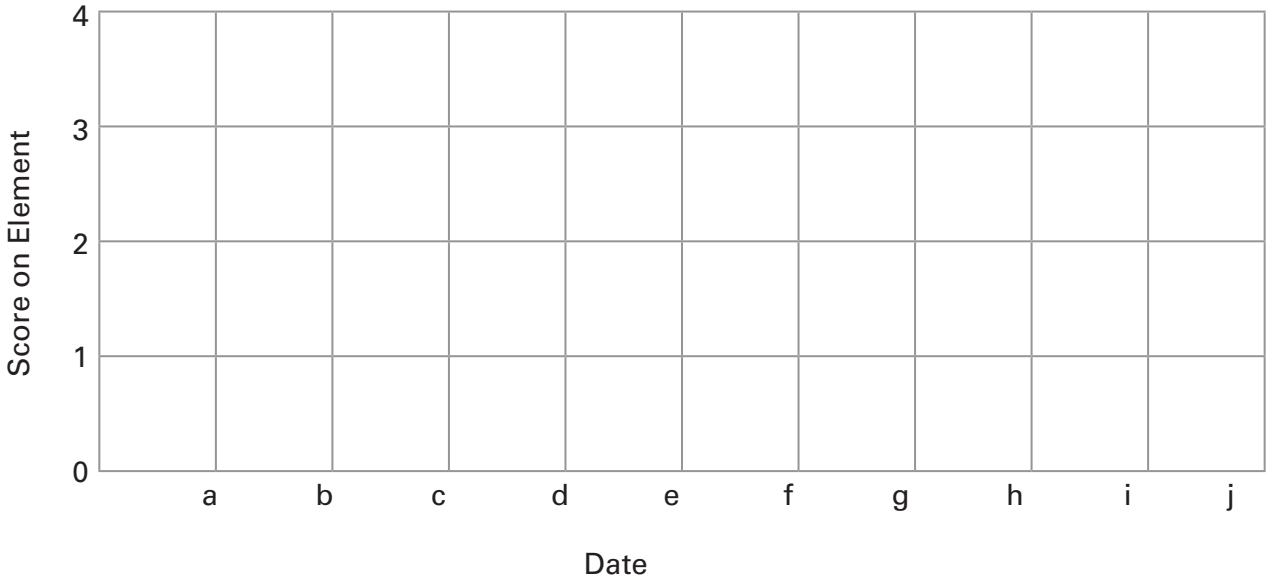
Goal Score: _____ by _____ (date)

Specific things I am going to do to improve: _____

_____

_____

_____



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____ j. _____

Tracking Teacher Actions

During an observation, the observer can use this form to record the teacher's usage of strategies related to the element of engaging students in cognitively complex tasks.

Observation Date and Time: _____ Length of Observation: _____

Check Strategies You Intend to Use	Strategies	Description of What Was Observed
	Experimental-Inquiry Tasks	
	Problem-Solving Tasks	
	Examining the Efficiencies of Multiple Methods of Problem Solving	
	Decision-Making Tasks	
	Investigation Tasks	
	Invention Tasks	
	Student-Designed Tasks	
	Other:	
	Other:	

Tracking Student Responses

A teacher or observer can use this worksheet to record instances of student behavior to inform planning and implementation of strategies associated with engaging students in cognitively complex tasks. Any item followed by an asterisk is an example of undesirable behavior related to the element; the teacher should look for a decrease in the number of instances of these items.

Observation Date and Time: _____ Length of Observation: _____

Behavior	Number of Instances
Generating a hypothesis	
Defining a problem to be solved	
Explaining a hypothesis	
Testing a hypothesis	
Researching a hypothesis	
Conducting experiments	
Explaining if a hypothesis was proved or disproved	
Describing conclusions gained from complex tasks	
Presenting a solution to a problem	
Choosing between multiple valid possibilities	
Explaining how they could improve a procedure	
Other:	
Other:	

Strategy Reflection Log

Use this worksheet to select a strategy, set a goal, and reflect on your use of that strategy.

Element: _____

Strategy: _____

Goal: _____

_____

_____

Reflection Log

Date	How did it go?

Student Survey for Engaging Students in Cognitively Complex Tasks

1. **My teacher asks me to make predictions and test them to see if they are true.**

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree

2. **I know the difference between decision-making, problem-solving, experimental, invention, and investigation tasks.**

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree

3. **My teacher asks me questions to help me figure out what kind of task is most appropriate for me.**

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree

4. **When I am working on a task that involves generating and testing a hypothesis, I can explain what my hypothesis is and what I am doing to test it.**

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree

5. **The products that I create during tasks that involve generating and testing a hypothesis show that I have deepened my learning about a topic.**

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree

6. **At the end of a task that involves generating and testing a hypothesis, I can explain if my hypothesis was proved or disproved and why.**

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree

Teacher Survey for Engaging Students in Cognitively Complex Tasks

1. **I ask students to generate hypotheses.**

Often Sometimes Rarely Never I don't know

2. **I ask students to test their hypotheses.**

Often Sometimes Rarely Never I don't know

3. **I ask students to choose between multiple valid options.**

Often Sometimes Rarely Never I don't know

4. **I ask students to independently investigate information related to class lessons.**

Often Sometimes Rarely Never I don't know

5. **I ask students to invent procedures or tools in order to solve a problem or meet a goal.**

Often Sometimes Rarely Never I don't know

6. **I ask students to evaluate multiple methods of problem solving.**

Often Sometimes Rarely Never I don't know

7. **I ask students to explain how the results of a task support or do not support a hypothesis.**

Often Sometimes Rarely Never I don't know

8. **I ask students to generate and defend conclusions based on cognitively complex tasks they have performed.**

Often Sometimes Rarely Never I don't know