



ENGAGING IN COGNITIVELY COMPLEX TASKS

CLASSROOM TECHNIQUES TO
HELP STUDENTS GENERATE
& TEST HYPOTHESES
ACROSS DISCIPLINES

Deana Senn
Robert J. Marzano

With Carla Moore and Penny L. Sell



Table of Contents

About the Authors	v
Introduction	1
Engaging in Cognitively Complex Tasks	5
Instructional Technique 1	
Investigating	17
Instructional Technique 2	
Problem Solving	33
Instructional Technique 3	
Decision Making	47
Instructional Technique 4	
Experimental Inquiry	63
Instructional Technique 5	
Inventing	81
Instructional Technique 6	
Student-Designed Tasks	97
Conclusion	107
References	109

Introduction

This guide, *Engaging in Cognitively Complex Tasks: Classroom Techniques to Help Students Generate & Test Hypotheses Across Disciplines*, is intended as a resource for improving a specific aspect of instructional practice: helping students utilise their knowledge.

Your motivation to incorporate this strategy into your instructional toolbox may have come from a personal desire to improve your instructional practice through the implementation of a research-based set of strategies (such as those found in the Marzano instructional framework) or a desire to increase the rigour of the instructional strategies you implement in your classroom so that students meet the expectations of the demanding standards of the Australian Curriculum F–10 and the Senior Secondary Curriculum.

This guide will help teachers of all year levels and subjects improve their performance of a specific instructional strategy: engaging in cognitively complex tasks. Narrowing your focus on a specific skill, such as cognitively complex tasks, permits you to concentrate on the nuances of this instructional strategy to deliberately improve it. This allows you to intentionally plan, implement, monitor, adapt and reflect on this single element of your instructional practice. A person seeking to become an expert displays very distinctive behaviours, as explained by Marzano and Toth (2013):

- breaks down the specific skills required to be an expert
- focuses on improving those particular critical skill chunks (as opposed to easy tasks) during practice or day-to-day activities
- receives immediate, specific and actionable feedback, particularly from a more experienced coach
- continually practises each critical skill at more challenging levels with the intention of mastering it, giving far less time to skills already mastered

This series of guides will support each of the previously listed behaviours, with a focus on breaking down the specific skills required to be an expert and giving day-to-day practical suggestions to enhance these skills.

Building on the Marzano Instructional Model

This series is based on the Marzano instructional framework, which is grounded in research and provides educators with the tools they need to connect instructional practice to student achievement. The series uses key terms that are specific to the Marzano model of instruction. See Table 1, Glossary of Key Terms.

Table 1: Glossary of Key Terms

Term	Definition
AC	The Australian Curriculum, which sets out consistent content descriptions and achievement standards developed by the Australian Curriculum, Assessment and Reporting Authority (ACARA) designed to provide a base for future learning, growth and active participation in the Australian community.
Desired result	The intended result for the student(s) due to the implementation of a specific strategy.
Monitoring	The act of checking for evidence of the desired result of a specific strategy while the strategy is being implemented.
Instructional strategy	A category of techniques used for classroom instruction that has been proven to have a high probability of enhancing student achievement.
Instructional technique	The method used to teach and deepen understanding of knowledge and skills.
Content	The knowledge and skills necessary for students to demonstrate standards.
Scaffolding	A purposeful progression of support that targets cognitive complexity and student autonomy to reach rigour.
Extending	Activities that move students who have already demonstrated the desired result to a higher level of understanding.

Engaging in Cognitively Complex Tasks

The cognitively complex tasks referred to in the title of this book demand higher-level thinking skills from your students, skills that ultimately lead to the generation and testing of hypotheses about knowledge they have acquired in your classroom. These types of challenging tasks require that students make decisions, solve problems, experiment or investigate, and teachers do not readily observe these skills in classrooms (Marzano & Toth, 2014).

For students, the core of effectively engaging in cognitively complex tasks is the ability to produce and support claims. You and your students must master a structured and rigorous method for producing and supporting claims that includes these steps: 1) state a claim, 2) establish grounds, 3) provide backing and 4) frame qualifiers to include describing counterarguments as well as identifying one or more of the four types of thinking errors (faulty logic, errors of attack, weak reference or misinformation). Once students are familiar with the vocabulary and thinking processes necessary for producing and supporting claims in sources and content the teacher provides, they will be ready to tackle the more demanding task of generating and testing their own hypotheses about prior knowledge using techniques such as decision making and problem solving.

If you have not previously taught your students how to formally state and support claims, an earlier book in this series, *Examining Reasoning*, describes several techniques in which students learn how to support claims and assertions with evidence, produce and defend claims related to content, identify and analyse claims in an author's work, and judge reasoning and evidence in an author's work. These techniques lay the foundation by showing students how to engage in the thinking process of producing and supporting claims as a critical aspect of understanding and deepening their content knowledge. They prepare students for the rigour required for a new level of thinking: producing their own claims about content as well as generating and testing original hypotheses related to their content knowledge.

Table 1.4: A Planning Template for a Year Nine History Lesson

Steps	Teacher's Notes
Identify the learning target	The learning targets for this example are to: Process and synthesise information from a range of sources for use as evidence in an historical argument (ACHHS170); and Evaluate the reliability and usefulness of primary and secondary sources (ACHHS171).
Determine the topic	Students will investigate, using multiple conflicting primary sources, how conditions in the trenches influenced the daily lives of World War I (WWI) soldiers.
Decide on the type of investigation	This is a historical investigation.
Identify questions or prompts	The teacher asks the following question: <i>How did the conditions in the trenches influence the daily lives of WWI soldiers?</i>
State a claim	Students explain and give examples of how they think conditions in trenches influenced the daily lives of WWI soldiers.
Identify what is already known	Students read examples from multiple primary sources of how conditions influenced the daily lives of WWI soldiers.
Identify confusion or contradictions	Students respond to the prompt: <i>Find a difference between the two sources and explain that difference.</i>
Develop a plausible resolution	Students answer a question: <i>Does that make one more right than the other? Explain why. Justify your answer using details from the text.</i> Students analyse the information in the sources to draw conclusions about how trench warfare had an impact on soldiers' lives.
Reflect on the initial claim	Students revisit their initial claims and explain whether the evidence they compiled supports their claims.

Description of a Classroom Scenario Based on the Planning Template

A secondary school history class has been discussing causes, effects and conditions during World War I. The teacher wants to help students understand that when information from multiple sources is contradictory, they must integrate evidence from multiple relevant historical sources and interpretations into a reasoned argument about the past based on the learning target that was previously stated.

Instructional Technique 3

DECISION MAKING

The decision-making process in this technique is a formal process in which students use information they have acquired from critical content to select among various possible choices. Decision-making tasks require students to predict the best alternative and then analyse their thinking to judge that alternative based on pre-established criteria to confirm or disconfirm their original hypothesis of which alternative would meet the criteria.

How to Effectively Implement Decision Making

As with the earlier techniques, there are four steps to the effective implementation of decision making in your classroom: 1) use the planning template to walk through the various steps of the decision-making process, 2) teach and model the steps for how to make decisions in the context of cognitively complex decision making, 3) begin your decision-making lesson with a motivating prompt and 4) provide resources and guidance during the decision-making activity.

Use the Planning Template

Use the template in Table 3.1 to assist you in planning for the effective implementation of decision making in your classroom. If you already use activities that ask students to make decisions, use the template to help you adapt those tasks so that your students can attain the cognitive complexity of hypothesis generation and testing.