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The Art and Science of Teaching the Common Core State Standards

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The Art and Science of Teaching (Marzano, 2007) is a research-based framework designed to enhance the pedagogical skills of teachers through self-reflection (Marzano, 2012a) and coaching (Marzano & Simms, 2013a). Additionally, the framework can be used to supervise (Marzano, Frontier, & Livingston, 2011) and evaluate (Marzano & Toth, 2013) teachers in a manner that is focused on teacher development as well as more effective measurement (see Marzano, 2012b). It can also be used to implement the pedagogical shifts implicit in the Common Core State Standards (CCSS). Explicit connections between instructional strategies in the Art and Science of Teaching and the CCSS are described in a number of works (see Marzano & Heflebower, 2012; Marzano, Yanoski, Hoegh, & Simms, 2013; Marzano & Simms, 2013b).

This handout briefly outlines three adaptations that can be made to the Art and Science of Teaching model to align it more specifically with the instructional shifts in the CCSS.

Adaptation 1: Use Seven Elements More Frequently

The Art and Science of Teaching includes 41 elements (i.e., categories of instructional strategies) that are organized into nine broader categories (A through I in Table 1) which themselves are organized into three lesson segments (I. Routine Strategies, II. Content Strategies, and III. Strategies Enacted on the Spot). In the service of the CCSS, seven of the 41 elements in the model should become staples of instruction. These elements are highlighted in Table 1.

Table 1: Elements of the Art and Science of Teaching Model

I. Routine Strategies
A. *Communicating Learning Goals and Feedback*
1.   Providing clear learning goals and scales (rubrics)
2.   Tracking student progress
3.   Celebrating success
B. *Establishing Rules and Procedures*
4.   Establishing classroom routines
5.   Organizing the physical layout of the classroom
II. Content Strategies
C. *Helping Students Interact With New Knowledge*

6.   Identifying critical information

7.   Organizing students to interact with new knowledge

8.   Previewing new content

9.   Chunking content into "digestible bites"

10.   Helping students process new information

11.   Helping students elaborate on new information

12.   Helping students record and represent knowledge

13.   Helping students reflect on their learning

D.   *Helping Students Practice and Deepen New Knowledge*

14.   Reviewing content

15.   Organizing students to practice and deepen knowledge

16.   Using homework

17.   Helping students examine similarities and differences

18.   Helping students examine errors in reasoning

19.   Helping students practice skills, strategies, and processes

20.   Helping students revise knowledge

E.   *Helping Students Generate and Test Hypotheses*

21.   Organizing students for cognitively complex tasks

22.   Engaging students in cognitively complex tasks involving hypothesis generation and testing

23.   Providing resources and guidance

III. Strategies Enacted on the Spot

F.   *Engaging Students*

24.   Noticing when students are not engaged

25.   Using academic games

26.   Managing response rates

27.   Using physical movement

28.   Maintaining a lively pace

29.   Demonstrating intensity and enthusiasm

30.   Using friendly controversy

31.   Providing opportunities for students to talk about themselves

32.   Presenting unusual or intriguing information

G.   *Recognizing Adherence to Rules and Procedures*

33.   Demonstrating "withitness"

34.   Applying consequences for lack of adherence to rules and procedures

	35.	Acknowledging adherence to rules and procedures
H.	*Establishing and Maintaining Effective Relationships With Students*	
	36.	Understanding students' interests and backgrounds
	37.	Using verbal and nonverbal behaviors that indicate affection for students
	38.	Displaying objectivity and control
I.	*Communicating High Expectations for All Students*	
	39.	Demonstrating value and respect for low-expectancy students
	40.	Asking questions of low-expectancy students
	41.	Probing incorrect answers with low-expectancy students

The CCSS require more clarity in the progressions of knowledge being addressed in class, more application of knowledge by students along with more and deeper inferential thinking, and the creation of sound evidence for conclusions and claims. Finally, the CCSS require students to constantly evaluate the validity and accuracy of their thinking and beliefs. The seven elements highlighted in Table 1 are instruments to these ends.

These efforts on the part of the teacher should disclose a clear sequence or progression of facts, details, and lower-order skills to more robust generalizations, principles, and processes. At the end of a lesson, students should be able to describe how the details of the lesson build to support bigger ideas and processes.

- Element 6, *identifying critical information*, articulates the responsibility of the teacher to continually highlight the important information that is being addressed in class.

- Element 11, *helping students elaborate on new information*, describes the requirement that students are continually asked to make inferences about the information addressed in class. Equally important, students are asked to provide evidence and support for their inferences.

- Element 12, *helping students record and represent knowledge*, points to the need for students to create representations of the information and processes with which they are interacting. The CCSS highlight the need to expand the types of representations elicited from students to include mental models, mathematical models, and other more abstract representations of content.

- Element 17, *helping students examine similarities and differences*, is a strategy that can be applied to all types of information and processes to help students create distinctions regarding their defining characteristics.

Students must continually be provided the opportunity and guidance to examine their own reasoning as well as that of others.

- Element 18, *helping students examine errors in reasoning*, is at the core of instructional changes explicit in the CCSS.

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- Element 20, *helping students revise knowledge*, refers to the need for students to constantly update their understanding of information and effectiveness at executing processes.

- Element 22, *engaging students in cognitively complex tasks involving hypothesis generation and testing*, might be considered the "centerpiece" strategy of a CCSS classroom. Students are constantly asked to make predictions and provide support for the logic of their predictions. Additionally, they are provided opportunities (some brief and some extended) to test out the efficacy of their predictions.

In summary, in a traditional classroom, Elements 6, 11, 12, 17, 18, 20, and 22 are commonly associated with specific types of lessons. However, in the context of the CCSS, these elements are more frequently deployed in every lesson.

Adaptation 2: Expect More Rigor and Depth Within Each Element

In addition to using the seven elements listed above on a more frequent basis, each of the 41 elements can be modified to produce more rigor and depth of processing on the part of students. These modifications are listed in the third column of Table 2 for each of the 41 elements in the model.

Table 2: Modifications for Rigor and Depth of Processing

I. Routine Segments		
A. Communicating Learning Goals and Feedback		
Element	**Traditional Classroom**	**Modifications for More Rigor and Depth**
1. Providing clear learning goals and scales (rubrics)	The teacher provides or reminds students about a specific learning goal and the scale that accompanies that goal.	Learning goals are more rigorous in nature to reflect the demands of the CCSS. Scales for learning goals include the application of knowledge.
2. Tracking student progress	Using formative assessment, the teacher helps students chart their individual and group progress on a learning goal.	Students are involved in and take some responsibility for providing evidence for their progress on the scale.
3. Celebrating success	The teacher helps students acknowledge and celebrate their current status on learning goals as well as knowledge gain.	Students are involved in and take some responsibility for celebrating their individual status and growth and that of the whole class.
B. Establishing Rules and Procedures		
Element	**Traditional Classroom**	**Modifications for More Rigor and Depth**
4. Establishing and maintaining classroom rules and procedures	The teacher reminds students of a rule or procedure or establishes a new rule or procedure.	Routines focus more on students working individually or in small groups as opposed to whole-class instruction.
5. Organizing the physical layout of the classroom	The teacher organizes materials, traffic patterns, and displays to enhance learning.	The physical layout of the classroom is designed to support long-term projects by individual students and groups of students.
II. Content Strategies		
C. Helping Students Interact With New Knowledge		
Element	**Traditional Classroom**	**Modifications for More Rigor and Depth**
6. Identifying critical information	The teacher provides cues as to which information is important.	The teacher continuously identifies and highlights the information that is critical for students and, by the end of the lesson, these

Element	Traditional Classroom	Modifications for More Rigor and Depth
		efforts portray a clear progression of information that leads to deeper understanding of the content.
7. Organizing students to interact with new knowledge	The teacher organizes students into dyads or triads to discuss small chunks of information.	Students are provided help regarding how to interact in a manner that will help them process new information. Additionally, students are provided guidance regarding how they might focus on one or more of the cognitive or conative skills (see Table 3).
8. Previewing new content	The teacher uses strategies such as KWL (Know, Want to Know, Learned), advance organizers, and preview questions.	The previewing activities allow for students to access and analyze information (i.e., the previewing activities allow for "flipped classroom" activities) as opposed to simply being presented with information.
9. Chunking content into "digestible bites"	The teacher presents content in small portions that are tailored to students' levels of understanding.	The content is chunked in such a way as to progress to a clear conclusion or "learning progression" about the new information.
10. Helping students process new information	After each chunk of information, the teacher asks students to summarize and clarify what they have experienced.	Group processing of information is focused on students generating conclusions about the new information.
11. Helping students elaborate on new information	The teacher asks questions that require students to make and defend inferences.	The teacher asks questions that not only require students to make inferences about the content but also require them to provide evidence for their inferences.
12. Helping students record and represent knowledge	The teacher asks students to summarize, take notes, or use nonlinguistic representations.	Activities that require students to record and represent knowledge emphasize student creation of a variety of types of models (e.g., mental, mathematical, visual, and linguistic) that organize and summarize the important content.
13. Helping students reflect on their learning	The teacher asks students to reflect on what they understand or what they are still confused about.	Reflection activities include consideration of selected cognitive and conative skills (see Table 3).

D.	Helping Students Practice and Deepen New Knowledge	
Element	**Traditional Classroom**	**Modifications for More Rigor and Depth**
14. Reviewing content	The teacher briefly reviews related content addressed previously.	The teacher reviews activities to ensure that students are aware of the "big picture" regarding the content.
15. Organizing	The teacher organizes students into	Students are provided guidance as to how to

students to practice and deepen knowledge	groups designed to deepen their understanding of information or practice skills.	interact in a manner that will help them practice and deepen their knowledge and are also provided guidance as to how they might focus on one or more cognitive or conative skills (see Table 3).
16. Using homework	The teacher uses homework for independent practice or to elaborate on information.	Homework activities allow students to access and analyze information as opposed to simply being presented with information (i.e., homework activities allow for aspects of a "flipped classroom").
17. Helping students examine similarities and differences	The teacher engages students in comparing, classifying, and creating analogies and metaphors.	Activities involving comparing, classifying, and creating analogies and metaphors address the "big ideas" and "conclusion" as well as specific details.
18. Helping students examine errors in reasoning	The teacher asks students to examine informal fallacies, propaganda, and bias.	Analysis of errors includes more efficient ways to execute processes as well as examining and critiquing the overall logic of arguments.
19. Practicing skills, strategies, and processes	The teacher engages students in massed and distributed practice.	Practice activities are designed to develop fluency and alternative ways of executing procedures.
20. Helping students revise knowledge	The teacher asks students to revise entries in notebooks to clarify and add to previous information.	Revision of knowledge involves correcting errors and misconceptions as well as adding new information. Additionally, it involves viewing knowledge from different perspectives and identifying alternative ways of executing procedures.

E.   Helping Students Generate and Test Hypotheses

Element	Traditional Classroom	Modifications for More Rigor and Depth
21. Organizing students for cognitively complex tasks	The teacher organizes students into small groups to facilitate cognitively complex tasks.	Students are not only provided with guidance as to how to interact in a manner that will help them generate and test hypotheses but are also provided guidance as to how they might focus on one or more cognitive or conative skills (see Table 3).
22. Engaging students in cognitively complex tasks involving hypothesis generation and testing	The teacher engages students in decision-making tasks, problem-solving tasks, experimental-inquiry tasks, and investigative tasks.	In addition to analyzing the accuracy of original hypotheses, students examine their own thinking and execution of the cognitively complex tasks.

Element	Traditional Classroom	Modifications for More Rigor and Depth
23. Providing resources and guidance	The teacher makes resources available that are specific to cognitively complex tasks and helps students execute such tasks.	Resources include and emphasize the effective use of technology in the context of cognitively complex tasks.

III. Strategies Enacted on the Spot

F.   Engaging Students

Element	Traditional Classroom	Modifications for More Rigor and Depth
24. Noticing when students are not engaged	The teacher scans the classroom to monitor students' levels of engagement.	In addition to monitoring for student attention, the teacher monitors for cognitive engagement (i.e., students' interest in the content).
25. Using academic games	When students are not engaged, the teacher uses adaptations of popular games to reengage them and focus their attention on academic content.	Academic games focus on important concepts, generalizations, and principles as opposed to lower-level information.
26. Managing response rates	The teacher uses strategies such as response cards, response chaining, and voting technologies to ensure that multiple students respond to questions.	In addition to ensuring that all students respond, the teacher ensures that student responses are backed up by evidence.
27. Using physical movement	The teacher uses strategies that require students to move physically, such as *vote with your feet* and physical reenactments of content.	Frequent movement is facilitated by students leaving their desks to gather information, confer with others, use specific types of technology, etc.
28. Maintaining a lively pace	The teacher slows and quickens the pace of instruction in such a way as to enhance engagement.	Students are provided with adequate time to gather information, confer with others, use specific types of technology, etc.
29. Demonstrating intensity and enthusiasm	The teacher uses verbal and nonverbal signals to show that he or she is enthusiastic about the content.	The teacher demonstrates enthusiasm by sharing a deep level of knowledge of the content.
30. Using friendly controversy	The teacher use techniques that require students to take and defend a position about content.	Friendly controversy activities require students to provide evidence for their positions and address the sources of their evidence.
31. Providing opportunities for students to talk about themselves	The teacher uses techniques that allow students to relate content to their personal lives and interests.	Students are asked to relate the use of specific cognitive and conative skills (see Table 3) to their daily lives.

32. Presenting unusual or intriguing information	The teacher provides or encourages the identification of intriguing information about the content.	The unusual information demonstrates in-depth knowledge of the content.

G. *Recognizing Adherence to Rules and Procedures*

Element	Traditional Classroom	Modifications for More Rigor and Depth
33. Demonstrating "withitness"	The teacher is aware of variations in student behavior that might indicate potential disruptions and attends to them immediately.	In addition to awareness of behavioral issues, the teacher senses confusion about or lack of interest in the content and intervenes appropriately.
34. Applying consequences for lack of adherence to rules and procedures	The teacher applies consequences for lack of adherence to rules and procedures consistently and fairly.	The teacher links lack of adherence to rules and procedures to self-regulation strategies students might use.
35. Acknowledging adherence to rules and procedures	The teacher acknowledges adherence to rules and procedures consistently and fairly.	The teacher acknowledges adherence to rules and procedures and links such adherence to specific self-regulation strategies students have used.

H. *Establishing and Maintaining Effective Relationships With Students*

Element	Traditional Classroom	Modifications for More Rigor and Depth
36. Understanding students' interests and backgrounds	The teacher seeks out knowledge about students and uses that knowledge to engage in informal, friendly discussions with students.	The teacher relates content-specific knowledge to personal aspects of students' lives.
37. Using verbal and nonverbal behaviors that indicate affection for students	The teacher uses humor and friendly banter appropriately with students.	The teacher demonstrates and fosters respect for students' thinking.
38. Displaying objectivity and control	The teacher behaves in ways that indicate he or she does not take infractions personally.	The teacher demonstrates a commitment to academic rigor.

I.	Communicating High Expectations for All Students		
Element	**Traditional Classroom**	**Modifications for More Rigor and Depth**
39. Demonstrating value and respect for low-expectancy students	The teacher demonstrates the same positive, affective tone with low-expectancy students as with high-expectancy students.	The teacher exhibits respect for and understanding of low-expectancy students' thinking regarding the content.
40. Asking questions of low-expectancy students	The teacher asks questions of low-expectancy students with the same frequency and level of difficulty as with high-expectancy students.	The teacher asks questions that require conclusions from low-expectancy students.
41. Probing incorrect answers with low-expectancy students	The teacher inquires into incorrect answers with low-expectancy students with the same depth and rigor as with high-expectancy students.	The teacher asks low-expectancy students to provide evidence for their conclusions and examine the sources of their evidence.

Adaptation 3: Directly Teach and Foster Specific Mental Skills and Processes

A third adaptation implied by the CCSS is that specific mental skills and processes are directly taught to students and fostered in the context of regular classroom instruction. These skills are implicit in the Standards for Mathematical Practice and in the College and Career Readiness anchor standards. They can be categorized into two broad categories referred to as cognitive and conative skills (Marzano & Heflebower, 2012; Marzano, Yanoski, Hoegh, & Simms, 2013) and are listed in Table 3. Cognitive skills are those that people use to analyze and process information effectively. Conative skills are those people use to combine what they know with how they feel to better function in society. Those skills that are explicit to the Art and Science of Teaching model have an asterisk next to them in Table 3. Those that are not already explicit in the Art and Science of Teaching model are shaded in Table 3.

Table 3: Cognitive and Conative Skills Implicit in the Standards for Mathematics Practice and the College and Career Readiness Anchor Standards

Cognitive Skills	Conative Skills
*Generating conclusions involves combining known information to form new ideas.	Becoming aware of the power of interpretation involves becoming aware that one's thoughts, feelings, beliefs, and actions are influenced by how one interprets situations.
*Identifying common logical errors involves analyzing information to determine how true it is.	Cultivating a growth mindset involves building the belief that each person can increase his or her intelligence and abilities.
*Presenting and supporting claims involves providing evidence to support a new idea.	Cultivating resiliency involves developing the ability to overcome failure, challenge, or adversity.
Navigating digital sources involves using electronic resources to find credible and relevant information.	Avoiding negative thinking involves preventing one's emotions from dictating one's thoughts and actions.
*Problem solving involves accomplishing a goal in spite of obstacles or limiting conditions.	Taking various perspectives involves identifying the reasoning behind multiple (and often conflicting) perspectives on an issue.
*Decision-making involves using criteria to select among alternatives that initially appear to be equal.	Interacting responsibly involves being accountable for the outcome of an interaction.
*Experimenting is the process of generating and testing explanations of observed phenomena.	Handling controversy and conflict resolution involves reacting positively to controversy or conflict.
*Investigating involves identifying confusions or contradictions about ideas or events and suggesting ways to resolve those confusions or contradictions.	

*Identifying basic relationships between ideas involves consciously analyzing how one idea relates to others.	
Generating and manipulating mental images involves creating a picture of information in one's mind in order to process it more deeply.	

While the Art and Science of Teaching model explicitly includes all but two of the cognitive skills, it does not explicitly include the conative skills. One adaptation to the Art and Science of Teaching model is to explicitly teach students the procedures necessary to execute the cognitive skills and processes that are already explicit in the model, as opposed to having students simply use these skills and processes. That is, instead of simply providing activities that require students to present and support claims (a cognitive skill explicit in the Art and Science of Teaching), the teacher would also instruct students on a procedure for presenting and supporting claims. For those cognitive and conative skills and processes not explicit in the model, the teacher would have to explicitly teach the skills and processes as well as find places where they naturally fit. The third column in Table 2 identifies where those non-explicit cognitive and conative skills might be placed.

For more information about The Art and Science of Teaching Common Core State Standards and aligned school leader and district leader evaluation models, please visit MarzanoCenter.com or call 1.877.411.7114.

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