



EXPEDITIONARY  
LEARNING

# **Grade 7: Module 4A: Unit 1: Lesson 3**

## **Comparing Text to Multimedia: Understanding How the Brain Changes**



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**Long-Term Targets Addressed (Based on NYSP12 ELA CCLS)**

I can compare and contrast different media versions of informational text (written vs. audio vs. film vs. staged, etc.). (RI.7.7)

I can analyze impact of the techniques unique to each medium. (RI.7.7)

I can cite several pieces of text-based evidence to support an analysis of informational text. (RI.7.1)

**Supporting Learning Targets**

- I can compare a text-only version of “The Child’s Developing Mind” to the multimedia version of that text.
- I can analyze the impact of the techniques unique to text and multimedia.
- I can analyze the main idea and supporting details in “Teens and Decision Making.”

**Ongoing Assessment**

- Neurologist’s notebook #2 (from homework)
- Neurologist’s notebook #3
- “The Child’s Developing Mind”: Comparing Text to Multimedia



Agenda	Teaching Notes
<ol style="list-style-type: none"> <li>1. Opening               <ol style="list-style-type: none"> <li>A. Entry Task: Self-Assessment (5 minutes)</li> <li>B. Adding to Anchor Chart (5 minutes)</li> </ol> </li> <li>2. Work Time               <ol style="list-style-type: none"> <li>A. Analyzing Main Idea in “Teens and Decision Making” (15 minutes)</li> <li>B. Comparing Text to an Interactive Version of Text (19 minutes)</li> </ol> </li> <li>3. Closing and Assessment               <ol style="list-style-type: none"> <li>A. Previewing Homework (1 minute)</li> </ol> </li> <li>4. Homework               <ol style="list-style-type: none"> <li>A. Read the end of the article “What You Should Know about Your Brain.” Start at the section titled “The Limbic System: Your Emotional Core.” Complete neurologist’s notebook #4 only for the section “Dopamine: Feeling Good Makes You Learn.”</li> </ol> </li> </ol>	<ul style="list-style-type: none"> <li>• Students return to the article “Teens and Decision Making” for the final time in this lesson. Continuing their learning around RI.7.1 and scaffolding toward SL. 7.2, they analyze the main idea and supporting details of this text by completing a neurologist’s notebook entry. This is a difficult assignment, and time is given for students to amend and deepen their thinking. If you collect the neurologist’s notebook entry today, be sure to have it ready to return in Lesson 4, as students will need it to complete the homework for that lesson.</li> <li>• This lesson opens with students self-assessing their ability to analyze the main idea and supporting details in their homework. Although students have worked with main idea throughout the year, this genre of scientific writing poses a unique challenge. All of the articles are divided by subheadings, and finding the common thread between them can be difficult. Students may need encouragement to think of the main idea as a large, summative statement that is general enough to encompass the subheadings but not so general that it says nothing (e.g., “this is about the brain”). It needs to be just specific enough to capture what the article is really about and should be articulated in a statement—not just a phrase.</li> <li>• If students are struggling at this point, you may want to extend the Opening and do this lesson in two class periods instead of one. Both texts in Work Times A and B have plenty of material that could be extended. Alternatively, you could have students revisit the homework from Lesson 1 or Lesson 2 in pairs or triads. All of these texts are building the students’ background knowledge of the physiology of the brain, and the subject is complex enough to warrant multiple reads.</li> <li>• During the Opening, students are introduced to the last column on the Brain Development anchor chart. This column will be stressed in the second half of Unit 1 and throughout Unit 2. Today is a brief introduction and an invitation for students to start making inferences about the implications of the brain research. When you add to the last column of the class chart, the lesson instructions prompt you to use an “if/then” construction. This is intentional. The students will be prompted to make “if/then” statements throughout Unit 1 and Unit 2. This will help students develop good reasoning for the position paper in Unit 3. Again, take more time if you wish, and be sure to let the anchor chart reflect the class discussion. The model is provided for your reference.</li> </ul>



Agenda	Teaching Notes (continued)
	<ul style="list-style-type: none"><li>• The second half of this lesson centers on RI. 7.7, which asks students to compare two versions of the same text. This will be new learning for many of the students and will be part of their mid-unit assessment in Lesson 5.</li><li>• For homework tonight, students read the last half of an excellent article by Dr. Judy Willis. The students will be held accountable only for the dopamine section because it fits best with the focus of the module. The article is presented in its entirety because the other information and vocabulary is useful to know and provides a way for you to differentiate learning for your stronger students. You may assign it if you wish; however, information that is not in the dopamine section will not be emphasized.</li><li>• In advance:<ul style="list-style-type: none"><li>– Review the upcoming Mid-Unit 1 Assessment to help shape the discussion in Work Time B.</li><li>– Ready the interactive feature at: <a href="http://www.nytimes.com/interactive/2008/09/15/health/20080915-brain-development.html">http://www.nytimes.com/interactive/2008/09/15/health/20080915-brain-development.html</a>.</li></ul></li><li>• Post: Learning targets.</li></ul>



Lesson Vocabulary	Materials
<p>compare, impact, abstract thinking, maturity, unrestrained</p>	<ul style="list-style-type: none"><li>• Self-assessment (one per student and one to display)</li><li>• Document camera</li><li>• Brain Development anchor chart—student version (begun in Lesson 2)</li><li>• Informational Text Structure Map graphic organizer (from Lesson 1)</li><li>• Informational Text Structure Map graphic organizer (model, for teacher reference; from Lesson 1)</li><li>• Brain Development anchor chart (begun in Lesson 2)</li><li>• Model Brain Development anchor chart (for teacher reference)</li><li>• Neurologist’s notebook #3 (one per student)</li><li>• Neurologist’s notebook #3 (answers, for teacher reference)</li><li>• “Teens and Decision Making: What Brain Science Reveals” (from Lesson 1)</li><li>• “The Child’s Developing Mind”: Comparing Text to Multimedia (one per student)</li><li>• “The Child’s Developing Mind”: Comparing Text to Multimedia (answers, for teacher reference)</li><li>• “The Child’s Developing Mind”: Comparing Text to Multimedia interactive feature (multimedia; <a href="http://www.nytimes.com/interactive/2008/09/15/health/20080915-brain-development.html">http://www.nytimes.com/interactive/2008/09/15/health/20080915-brain-development.html</a>)</li><li>• Interactive white board or computer screen/projector (to display interactive feature)</li><li>• “What You Should Know about Your Brain” (one per student)</li><li>• Neurologist’s notebook #4 (one per student)</li><li>• Neurologist’s notebook #4 (answers, for teacher reference)</li></ul>



Opening	Meeting Students' Needs
<p><b>A. Entry Task: Self-Assessment (5 minutes)</b></p> <ul style="list-style-type: none"> <li>• Distribute the <b>Self-assessment</b> and instruct students to work on it individually.</li> <li>• After a few minutes, display a copy of the Self-assessment on a <b>document camera</b>. Ask students to raise their hand if they thought Version 1 was more successful at capturing the main idea. Repeat for Version 2.</li> <li>• Acknowledge that Version 1 was better. Briefly explain the strengths of Version 1 (the main idea is general and encompasses the whole article; the supporting idea/details summarize the main points) and the weaknesses of Version 2 (the main idea is too specific; the supporting idea/details are pieces of evidence and not a summary of a major idea).</li> </ul>	<ul style="list-style-type: none"> <li>• Developing self-assessment and reflection supports all students, but research shows it supports struggling learners most.</li> </ul>
<p><b>B. Adding to the Anchor Chart (5 minutes)</b></p> <ul style="list-style-type: none"> <li>• Direct the students to retrieve their <b>Brain Development anchor chart—student version</b> from Lesson 2 and <b>Informational Text Structure Map graphic organizer</b> from Lesson 1.</li> <li>• Display the Informational Text Structure Map graphic organizer. Point out that the students have now read several conclusions. Ask:             <ul style="list-style-type: none"> <li>* “What did the conclusions of ‘Teens and Decision Making’ and ‘What’s Going On in Your Brain?’ have in common?”</li> </ul> </li> <li>• Briefly discuss the purpose of a conclusion. As needed, refer to the <b>Informational Text Structure Map graphic organizer (model, for teacher reference)</b> from Lesson 1 for guidance.</li> <li>• Point out that a conclusion often answers the questions “What does this information mean to me, the reader?” or “So what?” Display the Brain Development anchor chart that the class has been working on together. Point out the “So what?” column on the anchor chart.</li> <li>• Briefly model how to complete the last column of the class <b>Brain Development anchor chart</b> to support students in filling in their own anchor chart. Refer to the <b>Model Brain Development anchor chart (for teacher reference)</b> as needed. Your model may look like this:             <ul style="list-style-type: none"> <li>– Circle one of the pieces of information on the anchor chart that says the prefrontal cortex is the last to mature. Draw a line to the “So what?” column and write: “So <u>if</u> the PFC is not as efficient, <u>then</u> teens may make decisions without fully realizing long-term consequences. <u>If</u> they do that, <u>then</u> this can be good (they take daring risks) and bad (they take dangerous risks).”</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Graphic organizers and recording forms engage students more actively and provide the necessary scaffolding that is especially critical for learners with lower levels of language proficiency and/or learning.</li> </ul>



Opening (continued)	Meeting Students' Needs
<ul style="list-style-type: none"> <li>– Circle one of the pieces of information that says that synaptic pruning occurs based on the behavior of an individual, and draw a line to the “So what?” column. Write the phrase: “So <u>if</u> synapses are being pruned or strengthened by the activities that teens spend their time on, <u>then</u> teens can shape their brain. And <u>if</u> activities shape one’s brain, <u>then</u> one should be mindful about the activities one is doing. As Dr. Willis says, ‘Practice makes permanent.’”</li> <li>• Explain that students will encounter “if/then” phrases in their homework tonight and that they should pay special attention to what this means. (You may want to preview the homework at this time.)</li> <li>• Encourage students to start asking themselves, “So what?” as they learn more information about the brain.</li> </ul>	
Work Time	Meeting Students' Needs
<p><b>A. Analyzing Main Idea in “Teens and Decision Making” (15 minutes)</b></p> <ul style="list-style-type: none"> <li>• Distribute <b>neurologist’s notebook #3</b>. Invite students to get out their copy of “<b>Teens and Decision Making</b>” (from Lesson 1) and briefly skim over the article. Remind them that this the third time they have interacted with this article.</li> <li>• Ask students to turn and talk with their partner:             <ul style="list-style-type: none"> <li>* “Now that you have read the entire article, try to sum it up in one sentence. What is the main idea?”</li> </ul> </li> <li>• After a few minutes, call on pairs to share their ideas. Guide the class to understand that the main idea should be very general and encompass the entire article. Refer to <b>neurologist’s notebook #3 (answers, for teacher reference)</b> as needed.</li> <li>• Direct the students to fill in the “brief background” box and four of the “supporting idea/details” boxes. Remind students to use the subheadings as a guide. Circulate to ensure that students’ supporting details are valid. Use probing questions such as:             <ul style="list-style-type: none"> <li>* “How can you say that in one sentence?”</li> <li>* “What is the most important information from this section?”</li> <li>* “Does that match the subheading?”</li> </ul> </li> <li>• After 5 minutes, direct the pairs to stand up, bring their neurologist’s notebook entries with them, and form a group of four with another pair to discuss their ideas. Circulate to ensure that the supporting details are valid.</li> </ul>	<ul style="list-style-type: none"> <li>• Giving students time to amend their original answers promotes deeper thinking and self-assessment.</li> </ul>



Work Time (continued)	Meeting Students' Needs
<ul style="list-style-type: none"> <li>• After a few minutes, tell the students to return to their seats.</li> <li>• Give them a few minutes to silently amend their neurologist's notebooks #3 as needed. You may wish to collect this to help you identify struggling students.</li> </ul>	
<p><b>B. Comparing Text to an Interactive Version of Text (19 minutes)</b></p> <ul style="list-style-type: none"> <li>• Distribute <b>“The Child’s Developing Mind”: Comparing Text to Multimedia</b> to each student.</li> <li>• Ask a student to read the learning targets aloud.             <ul style="list-style-type: none"> <li>* “I can compare a text-only version of ‘The Child’s Developing Mind’ to the multimedia version of that text.”</li> <li>* “I can analyze the impact of the techniques unique to text and multimedia.”</li> <li>* “I can analyze the main idea and supporting details in ‘Teens and Decision Making.’”</li> </ul> </li> <li>• Discuss the words <i>compare</i> and <i>impact</i>. Explain to students that they will be thinking about how different versions of the same text can deepen their learning about a subject.</li> <li>• Ask students to follow along as you read “The Child’s Developing Mind”: Comparing Text to Multimedia aloud.</li> <li>• Pause after you have completed the reading and answer any questions about vocabulary. You may wish to point out <i>abstract thinking</i>, <i>maturity</i>, and <i>unrestrained</i>.</li> <li>• Give students time to answer Questions 1 and 2 from “The Child’s Developing Mind”: Comparing Text to Multimedia.</li> <li>• Ask students to turn and talk with a partner about their answers.</li> <li>• Invite the students to share out their ideas. Lead off by pointing out this text clearly answers the question “So what?” by linking brain maturity to behavior. Also point out that although the readings from the previous lessons clearly said that behavior can shape the brain, this text is saying that the brain also shapes behavior. Clearly the brain is a complex organ and many factors contribute to how it works. Refer to <b>“The Child’s Developing Mind”: Comparing Text to Multimedia (answers, for teacher reference)</b> as needed.</li> <li>• After a few minutes, invite students to add to their original answers at the end of “The Child’s Developing Mind”: Comparing Text to Multimedia.</li> <li>• Next project the <b>“The Child’s Developing Mind”: Comparing Text to Multimedia interactive feature</b> using an <b>interactive white board or computer screen/projector</b>. You may find it here: <a href="http://www.nytimes.com/interactive/2008/09/15/health/20080915-brain-development.html">http://www.nytimes.com/interactive/2008/09/15/health/20080915-brain-development.html</a>.</li> </ul>	<ul style="list-style-type: none"> <li>• Careful attention to learning targets throughout a lesson engages, supports, and holds students accountable for their learning. Consider revisiting learning targets throughout the lesson so that students can connect their learning with the activity they are working on.</li> </ul>



Work Time (continued)	Meeting Students' Needs
<ul style="list-style-type: none"> <li>• Move the slider bar from 6 years old to 13 years old to 17 years old. Note for the students that the text is the same. Reread the text as it appears in the interactive feature.</li> <li>• Ask students to answer Questions 3–7 on “The Child’s Developing Mind”: Comparing Text to Multimedia.</li> <li>• After a few minutes, invite them to turn and talk with a partner about their ideas.</li> <li>• Invite them to share out their ideas. As you discuss how being able to visualize the information makes it easier to understand, point out that writers often try to help their readers visualize something by using metaphors. In “Teens and Decision Making,” the prefrontal cortex was a “blinking red warning light.” In “What’s Going On in Your Brain?” the author compared the brain to a roadmap. And in “The Teen Brain—It’s Just Not Grown Up Yet,” myelin was compared to insulation on electric wires.</li> <li>• As time permits, feel free to explore this interactive feature.</li> </ul>	
Closing and Assessment	Meeting Students' Needs
<p><b>A. Previewing Homework (1 minute)</b></p> <ul style="list-style-type: none"> <li>• Distribute “<b>What You Should Know about Your Brain</b>” and <b>neurologist’s notebook #4</b>. Answer any clarifying questions.</li> </ul>	
Homework	Meeting Students' Needs
<ul style="list-style-type: none"> <li>• Read the end of the article “What You Should Know about Your Brain.” Start at the section titled “The Limbic System: Your Emotional Core.” Complete neurologist’s notebook #4 only for the section “Dopamine: Feeling Good Makes You Learn.” There is no vocabulary for this notebook entry but lots of rich vocabulary for you to learn on your own.</li> </ul>	<ul style="list-style-type: none"> <li>• This homework is an opportunity to challenge your stronger students. Consider assigning them the entire article.</li> </ul>



EXPEDITIONARY  
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# Grade 7: Module 4A: Unit 1: Lesson 3

## Supporting Materials



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Self-Assessment

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Entry Task: Self-Assessment**

Directions: Please complete this task individually. Read through the two models for neurologist’s notebook #2. Then answer the questions below.

Version #1

Version #2

<p><b>Main idea:</b> Your brain is still developing. This means that your actions can influence your development and your actions are influenced by your forming brain.</p>		<p><b>Main idea:</b> Your brain is like a map. Through synaptic pruning, some roads are turning into highways and others are disappearing.</p>	
<p><b>Brief background:</b> The brain is a mass of cells, and each part serves a different function. Your brain grows synapses in childhood.</p>	<p><b>Supporting detail:</b> During the teen years, your brain is synaptic pruning—or getting rid of the ones you don’t need based on what you are using them for.</p>	<p><b>Brief background:</b> The brain is a mass of cells, and it is the boss of you.</p>	<p><b>Supporting detail:</b> Teens want to do things like bungee jump.</p>
<p><b>Supporting detail:</b> Pruning is good because it helps the synapses that are left be more efficient. Myelin wraps the ones that are not pruned.</p>	<p><b>Supporting detail:</b> Even if synapses are pruned, they are not gone forever because they can regrow if you need them.</p>	<p><b>Supporting detail:</b> If you play guitar, your fine-motor synapses will grow.</p>	<p><b>Supporting detail:</b> Everyone has about 99 percent of the same synapses.</p>
<p><b>Supporting detail:</b> The limbic system is one of the first to fully develop and is out of sync with the prefrontal cortex. Therefore, a teen can control her/his emotions more and feel things more deeply, but sometimes make poor decisions because the teen “felt” like it.</p>	<p><b>Supporting detail:</b> You should do things to take care of your brain, like exercise, sleep, and avoid harmful substances.</p>	<p><b>Supporting detail:</b> Synaptic pruning peaks at about age 12 or 13 but continues until age 24.</p>	<p><b>Supporting detail:</b> The limbic system is out of sync with the prefrontal cortex.</p>



**Self-Assessment**

**Which version is more successful at capturing the main ideas and supporting details? Why?**

**Which entry is most similar to yours? Why?**

**What did you struggle with in last night's reading? How can I help you be more successful?**



Model Brain Development Anchor Chart

Note: This chart is filled out in different lessons. The bolded items are added in this lesson.

Other developmental information	Prefrontal cortex	Neurons	Limbic system	So what?
<p>The brain needs sleep to take things from your short-term memory to your long-term memory (Knox)</p> <p>Your brain does not fully develop until the mid-20s (Scholastic)</p>	<p>Also called the “frontal lobe” (Knox)</p> <p>This area helps with insight and understanding the effect of your behavior on someone else (Knox)</p> <p>Matures later than other parts of the brain (Scholastic)</p> <p>Right behind your forehead (Scholastic)</p> <p>Helps with thinking ahead and sizing up risk and reward (Scholastic)</p>	<p>“White matter” is called myelin, and it coats the nerves and makes them “communicate” more effectively (Knox)</p> <p>In order for your brain to make a decision, tiny specialized cells “talk” with each other through a series of neurotransmitters, like a circuit in a computer. Then the whole network puts out a response, which becomes your outward behavior. (Scholastic)</p>	<p>Develops earlier than the PFC (Scholastic)</p> <p>Plays a central role in your emotional response (Scholastic)</p> <p>Associated with decisions made in feeling (Scholastic)</p> <p>When teens make decisions in emotionally charged situations—this one weighs in heavily (Scholastic)</p>	<p><b>So if the PFC is not as efficient, <u>then</u> teens may make decisions without fully realizing long-term consequences. If they do that, <u>then</u> this can be good (they take daring risks) and bad (they take dangerous risks).</b></p>



Model Brain Development Anchor Chart

Other developmental information	Prefrontal cortex	Neurons	Limbic system	So what?
		<p>Information travels from neuron to neuron by way of their axons and dendrites (Scholastic)</p> <p>The space between one neuron’s axon and the other neuron’s dendrites is called its synapse (Scholastic)</p> <p>To make the connection better, the axons wrap themselves in myelin through a process called myelination (Scholastic)</p> <p>Also, if a synapse isn’t used often, it is pruned through synaptic pruning. Then that energy is redirected into more active synapse. (Scholastic)</p> <p>Synaptic pruning occurs based on the choices, the behavior, and the environment of an individual (Scholastic)</p>		<p><b>So <u>if</u> synapses are being pruned or strengthened by the activities that teens spend their time on, <u>then</u> teens can shape their brain. And <u>if</u> activities shape one’s brain, <u>then</u> one should be mindful about the activities that one is doing. As Dr. Willis says, “Practice makes permanent.”</b></p>



Neurologist's Notebook #3:  
"Teens and Decision Making"

Name:

Date:

**Directions:** Use this note-catcher to get the gist of the reading. Remember that the main idea and supporting details are often not just a single sentence of the text; rather, they may involve multiple sentences.

Main idea:	
Brief background:	Supporting idea/detail:
Supporting idea/detail:	Supporting idea/detail:
Supporting idea/detail:	Supporting idea/detail:



Neurologist’s Notebook #3:  
“Teens and Decision Making”  
(Answers, for Teacher Reference)

**Directions:** Use this note-catcher to get the gist of the reading. Remember that the main idea and supporting details are often not just a single sentence of the text; rather, they may involve multiple sentences.

<p>Main idea:</p> <p><b>The teen brain is still maturing and changing in important ways. Therefore, it works a little differently than an adult when a teen is making decisions.</b></p>	
<p>Brief background:</p> <p><b>One’s thoughts and decisions are caused by neurons sending electrochemical messages back and forth.</b></p>	<p>Supporting idea/detail:</p> <p><b>One part of the brain that is still developing is the prefrontal cortex. This helps when one makes decisions because it sizes up risks and thinks ahead about the consequence.</b></p>
<p>Supporting idea/detail:</p> <p><b>The limbic system is more fully developed and the more emotional center of the brain. Therefore, when teens make decisions, they sometimes use this part more and think more about how they feel about those decisions and less about the long-term consequences.</b></p>	<p>Supporting idea/detail:</p> <p><b>The teen brain is also actively changing. It is pruning synapses that it doesn’t use and reinforcing the connection between neurons that it does use.</b></p>
<p>Supporting idea/detail:</p> <p><b>Teens can potentially influence which neurons are reinforced by their behavior and thoughts.</b></p>	<p>Supporting idea/detail:</p> <p><b>Stopping and thinking through a decision will give one’s PFC time to activate and will strengthen the neurons in the PFC.</b></p>



“The Child’s Developing Brain”:  
Comparing Text to Multimedia

**Direction:**

Please read these excerpts from “The Child’s Developing Brain,” an interactive feature published by the *New York Times* on September 15, 2008. Then answer the questions.

**Overview:**

Different areas of the brain mature at different rates, which helps explain many of the intellectual and emotional changes seen in children, teens and young adults. While no two children develop in exactly the same way, scientists have been able to link certain developmental milestones to changes in brain tissue, observed by MRI scans taken repeatedly over years.

**6 Years old**

REASON

The dappled yellow and the red areas of the prefrontal cortex indicate this part of the brain, which affects abstract thinking, reasoning skills and emotional maturity, has yet to develop. This lack of maturity is one reason young children can’t juggle a lot of information and throw tantrums when presented with too many choices.

**13 Years Old**

JUDGEMENT

The prefrontal cortex is among the last areas to mature. Until it does, children lack the ability to adequately judge risk and make long-term plans. Ask kids at this age what they want to be when they grow up and the answer is likely to change often.

EMOTION

Deep in the limbic system, a capacity for creating emotion increases. As yet, this capacity is unrestrained by the prefrontal cortex, which lags behind. That’s why some teens can seem emotionally out of control.

**17 Years Old**

ABSTRACT THOUGHT

The deep blue and purple of the maturing prefrontal cortex shows why the brains of older teenagers are capable of dealing with far more complexity than younger children. This development leads to a burst of the social interactions and emotions among older teens. Planning, risk-taking, and self-control become possible.

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**The Child's Developing Brain:**  
Comparing Text to Multimedia

1. What do these readings teach us about the prefrontal cortex and its link to developmental milestones?
2. Reread the introduction. Why do you think the authors included the information that “no two children develop in exactly the same way” before giving this information?

**Directions: Now look at the interactive feature that accompanies this text.**

3. What is different between the text and the interactive feature? How are they the same?
4. What are the advantages of the text-only version?
5. What are the advantages of the interactive version?
6. Reread what you wrote for Question 1. How is your understanding different after seeing the interactive feature?
7. What other image might the authors have used?



The Child's Developing Brain:  
Comparing Text to Multimedia  
(Answers, for Teacher Reference)

1. What do these readings teach us about the prefrontal cortex and its link to developmental milestones?

**Children reach development milestones as their prefrontal cortex develops. Their “outward” behavior correlates with the “inner” physical maturity of their brain.**

2. Reread the introduction. Why do you think the authors included the information that “no two children develop in exactly the same way” before giving this information?

**The authors want to remind us that this is not a simple relationship between the biology and the behavior. In fact, this is a very complex set of interactions and although we can make general statements about how children’s behavior relates to their brain biology, individuals can and do vary.**

**Directions: Now look at the interactive feature that accompanies this text.**

3. What is different between the text and the interactive feature? How are they the same?

**Answers may vary. They present the same facts and information, but the interactive feature is visual.**

4. What are the advantages of the text only version?

**Answers may vary. The reader can easily read the entry before and after for a quick comparison of the information.**

5. What are the advantages of the interactive version?

**Answers may vary. It is a very active and visual way of seeing the changes in the brain. It’s as if it is changing before your eyes. It makes it easy to compare the differences between a young child’s brain and an adolescent’s brain.**

6. Reread what you wrote for Question 1. How is your understanding different after seeing the interactive feature?

**Answers will vary.**

7. What other image might the authors have used?

**Answers may vary. The author could have included a picture of kids demonstrating the behavior or the development milestone—e.g. throwing a tantrum.**



“What You Should Know About Your Brain”

# What You Should Know About Your BRAIN



**Judy Willis**

**A**lthough the brain is an amazing organ, it's not equipped to process the billions of bits of information that bombard it every second. Filters in your brain protect it from becoming overloaded. These filters control the information flow so that only approximately 2,000 bits of information per second enter the brain.

**The Thinking Brain and the Reactive Brain**

Once sensory information enters the brain, it's routed to one of two areas: (1) The *prefrontal cortex*, what we might call the thinking brain, which can consciously process and reflect on information; or (2) the lower, automatic brain, what we might call the reactive brain, which reacts to information instinctively rather than through thinking. The prefrontal cortex is actually only 17 percent of your brain; the rest makes up the reactive brain.

When you are not stressed by negative emotions, you can control what information makes it into your brain. By calming your brain, you can control which sensory data from your environment your brain lets in or keeps out—and influence which information gets admitted to your prefrontal cortex.

When your stress levels are down and your interest is high,

the most valuable information tends to pass into your thinking brain. When you are anxious, sad, frustrated, or bored, brain filters conduct sensory information from the world around you into your reactive brain. These reactive brain systems do one of three things with the information: ignore it; fight against it as a negative experience (sending signals that may cause you to act inappropriately); or avoid it (causing you to daydream). If information gets routed to this reactive brain, it's unlikely your brain will truly process the information or remember it.

Three major brain elements help control what information your brain takes in: the reticular activating system, the limbic system, and the transmitter dopamine. Let's look at how you can help each one work in your favor.

**RAS: The Gatekeeper**

The first filter that data passes through when entering your brain is the reticular activating system (RAS). Located at the lower back of your brain (your brain stem), the RAS receives input from sensory nerves that come from nerve endings in your eyes, ears, mouth, face, skin, muscles, and internal organs and meet at the top of your spinal cord. These sensory messages must pass through the RAS to gain entry to your higher, thinking brain.

You will learn more successfully if you keep the RAS filter



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open to the flow of information you want to enter your prefrontal cortex. If you build your power to focus your attention on the sensory input that is most valuable and important to attend to at the moment, the important input will make it into your thinking brain. If you feel overwhelmed, your reactive brain will take over. Then, what you experience, focus on, and remember will no longer be in your control. It's the difference between *reflecting on* and *reacting to* your world.

➡ **What You Can Do**

A key to making your brain work optimally, then, is to keep yourself physically healthy and well rested and to develop awareness of—and some control over—your emotions. Then you can approach learning calmly and with positive emotions.

Practice focusing and observing yourself, for example, by taking a short break from work to check in with your emotions. Just take a few minutes to think about what you're feeling. If it's a good feeling, take time to enjoy it and consider how your good emotional state affects your thinking. Do you understand more and get ideas about what you might do with the information you're learning? If you don't like the way you're feeling, think about times you've felt a similar negative emotion (like anxiety or loneliness). What has helped you return to a better mood in the past?

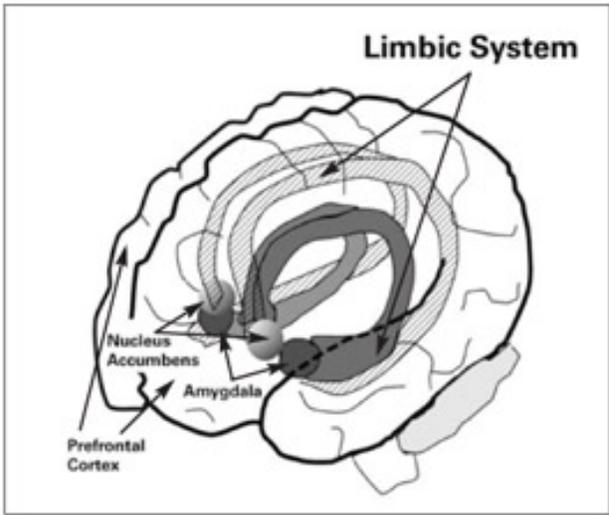
Even though you're not sleeping, you can think of such brain breaks as “syn-naps” because they let your brain replenish neurotransmitters like dopamine (which we'll discuss shortly). As you become aware of your emotions, you build brain networks that help you control your actions with your thinking brain. It also helps to do something active during a short break—such as toss a ball back and forth with a classmate, saying a word related to your lesson each time you catch the ball.

**The Limbic System: Your Emotional Core**

After the information coming in through your senses gets through the RAS, it travels to the sensory intake centers of your brain. New information that becomes memory is eventually stored in the *sensory cortex areas* located in brain lobes that are each specialized to analyze data from one of your five senses. These data must first pass through your brain's emotional core, the *limbic system*, where your *amygdala* and *hippocampus* evaluate whether this information is useful because it will help you physically survive or bring you pleasure.

**The Amygdala**

The amygdala is like a central train-routing station; it's a system for routing information based on your emotional state. When you experience negative emotions like fear, anxiety, or even boredom, your amygdala's filter takes up excessive amounts of your brain's available nutrients and oxygen. This



The shaded areas show major components of the limbic system deep within the brain.

puts your brain into survival mode, which blocks entry of any new information into your prefrontal cortex.

For example, suppose your day starts off badly. You overslept, had no time for breakfast, and have too many things to do before school. You're worried about whether your friends will sit with you at lunch and afraid that the mean kid in your class will say hurtful things to you.

It's not only your body that suffers on this kind of day: Your brain is also stressed. This stress closes off the pathways through the RAS and amygdala that direct information into your thinking brain and memory centers. Unless you restore a positive mood, you won't learn much on this particular school day. But if you can turn things around to become calm and focused, your amygdala will “decide” to send new information to your prefrontal cortex.

➡ **What You Can Do**

Slow down and take a moment to reflect instead of react when you take a test at school or face social conflicts with friends. You might take a deep breath and visualize yourself in a peaceful place. Another technique that helps you choose what to do with your emotions—something only humans can do—is to imagine you're directing yourself in a play. You are the director sitting in a balcony seat watching an actor (the emotional you) on stage below. What advice would you give the emotion-filled actor on the stage if he or she had been pushed by a classmate and wanted to hit back, for example? This technique helps you move away from using your reactive brain and tap your thinking brain, where memories that might help you are stored.

Your teachers play a role too. If your teachers set up lessons



to include some fun activities so that you feel good during a lesson, your amygdala will add a neurochemical enhancement, like a memory chip, that strengthens the staying power of any information presented in the lesson. People actually remember more of what they hear and read if they are in a positive emotional state when they hear or read it.

**The Hippocampus**

Next to the amygdala is the *hippocampus*. Here, your brain links new sensory input to both memories of your past and knowledge already stored in your long-term memory to make new *relational memories*. These new memories are now ready for processing in your prefrontal cortex.

Your prefrontal cortex contains highly developed nerve communication networks that process new information through what are called *executive functions*, including judgment, analysis, organizing, problem solving, planning, and creativity. The executive function networks can convert short-term relational memories into long-term memories. When you are focused and in a positive or controlled emotional state, your executive functions can more successfully organize newly coded memories into long-term knowledge.

➡ **What You Can Do**

Reviewing and practicing something you've learned helps. Nerve cells (neurons) forge information into memories by sending messages to other neurons through branches—called axons and dendrites—that almost touch the branches of each neighboring neuron. It takes lots of connections between neurons to relate each neuron's tiny bit of information to that of other neurons so that all the bits add up to a complete memory. When you review or practice something you've learned, dendrites actually grow between nerve cells in the network that holds that memory.

Each time you review that knowledge, this mental manipulation increases activity along the connections between nerve cells. Repeated stimulation—for example, studying the times tables many times—makes the network stronger, just like muscles become stronger when you exercise them. And that makes the memory stay in your brain. Practice makes permanent.

When you review new learning through actions, using the knowledge to create something, solve problems, or apply it to another subject (such as using the times tables to measure the areas of paintings for framing them), this mental manipulation strengthens the neural pathways and your brain becomes even more efficiently wired.

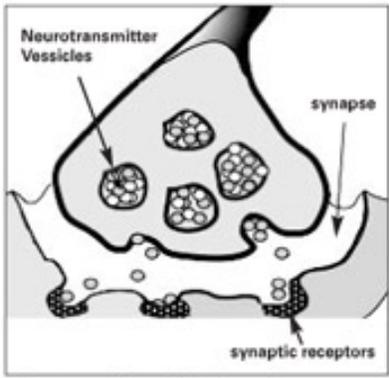
**“What You Should Know About Your Brain”**

**Dopamine: Feeling Good Helps You Learn**

Dopamine is one of the brain's most important *neurotransmitters*. Messages connected to new information travel from neuron to neuron as tiny electrical currents. Like electricity, these messages need wiring to carry them. But there are gaps, called *synapses*, between the branches that connect nerve cells and there's no wiring at these gaps. Chemical neurotransmitters like dopamine carry electrical messages across the gap from one neuron to another. This transmission is crucial to your brain's capacity to process new information.

Your brain releases extra dopamine when an experience is enjoyable. As positive emotions cause dopamine to travel to more parts of your brain, additional neurons are activated.

Thus a boost in dopamine not only increases your own sense of pleasure, but also increases other neurotransmitters, such as acetylcholine, that enhance alertness, memory, and executive functions in the prefrontal cortex.



Neurotransmitters like dopamine carry messages across the synapse.

➡ **What You Can Do**

Certain activities, such as interacting with friends, laughing, physical activity, listening to someone read to you, and acting kindly increase dopamine levels. You'll boost your learning if you get them into your day.

Experiencing pride at accomplishing something is also correlated with higher dopamine. It will increase your learning power if you pursue activities that give you a sense of accomplishment. Think about your personal strengths, such as artistic ability, leadership, helping classmates resolve conflicts, athletic skill, or even qualities like optimism, kindness, and empathy. Use these skills to do projects you want to do—and do them well—and you'll find you can use your brain power more successfully to make judgments and solve problems.

You now have the power to use your most powerful tool to achieve the goals you choose. Congratulations on the dendrites you've grown along the way!

**Judy Willis, MD**, practiced neurology for 20 years; she currently teaches at Santa Barbara Middle School in California and conducts professional development workshops. She is the author of *Teaching the Brain to Read: Strategies for Improving Fluency, Vocabulary, and Comprehension* (ASCD, 2008); [www.RADTeach.com](http://www.RADTeach.com); [jwillisneuro@aol.com](mailto:jwillisneuro@aol.com).

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**Neurologist's Notebook #4:**  
"Dopamine: Feeling Good Helps You Learn"

**Name:**

**Date:**

**Directions:** Use this note-catcher to get the gist of the reading. Remember that the main idea and supporting details are often not just a single sentence of the text; rather, they may involve multiple sentences.

Main idea:	
Brief background:	Supporting idea/detail:
Supporting idea/detail:	Supporting idea/detail:
Supporting idea/detail:	Supporting idea/detail:



**Neurologist’s Notebook #4:**

“Dopamine: Feeling Good Helps You Learn”  
(Answers, for Teacher Reference)

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Directions:** Use this note-catcher to get the gist of the reading. Remember that the main idea and supporting details are often not just a single sentence of the text; rather, they may involve multiple sentences.

<p>Main idea:</p> <p><b>Dopamine is an important neurotransmitter. Through your behavior, you can boost your dopamine levels.</b></p>	
<p>Brief background:</p> <p><b>A neurotransmitter is something that helps take the message across the synapse.</b></p>	<p>Supporting idea/detail:</p> <p><b>The brain releases extra dopamine when an experience is pleasurable.</b></p>
<p>Supporting idea/detail:</p> <p><b>Dopamine is enjoyable for you and makes it easier for neurons to be activated.</b></p>	<p>Supporting idea/detail:</p> <p><b>If you can get dopamine-boosting activities into your day, you’ll learn better.</b></p>
<p>Supporting idea/detail:</p> <p><b>Some of the things that boost dopamine are laughing, physical activity, being kind, and feeling a sense of accomplishment.</b></p>	<p>Supporting idea/detail:</p>