

High School Science Lesson Plan: Biology

Introduction

Each lesson in the Adolescent Literacy Toolkit is designed to support students through the reading/learning process by providing instruction before, during, and after reading/learning.

Note that lessons incorporate the *gradual release of responsibility* model. When this model is used within a single lesson and over several lessons, students are provided with enough instruction and guidance to use the literacy strategies on their own. The following lesson includes some examples of explicit instruction and modeling, guided practice, and independent practice, but students need more practice and feedback than is possible within the context of a single lesson.

Bold print indicates a direct link to the *Content Area Literacy Guide* where readers will find descriptions of literacy strategies, step-by-step directions for how to use each strategy, and quadrant charts illustrating applications across the four core content disciplines.

The following lesson plan and lesson narrative show biology teachers how they can incorporate the use of literacy strategies to support high school students to learn biology content and concepts. The lesson is designed for one block period (80–90 minutes) or two traditional classes (50 minutes).

Instructional Outcomes

ISTE Standards: 2.02 Investigate and describe the structure and function of cells.

Content Learning Outcome: Students will learn a strategy for developing and recalling vocabulary using contextual information, producing definitions in their own words, and creating visuals or mnemonic memory devices to recall the terms related to *mitosis*.

Literacy Support Strategies and Instruction

Before reading/learning: **Triple-Entry Vocabulary Journal** (teacher modeling)

- Materials: Template for **Triple-Entry Vocabulary Journal** with example for *mitosis*, computer, clay or dough, Smart Board or overhead projector

During reading/learning: **Triple-Entry Vocabulary Journal** (guided practice)

- Materials: Text chapter explaining the process and seven stages of *mitosis*; Web site <http://www.cellsalive.com/mitosis.htm> to view animation of animal cell *mitosis*; microscope and prepared slides of *mitosis* phases; and **Triple-Entry Vocabulary Journal** for review of the animal cell *mitosis* phases.

After reading/learning: **Quick Write** (individual practice)

- Materials: **Triple-Entry Vocabulary Journal**

Before Reading/Learning (25 minutes)

Literacy outcome: Students will learn how to develop conceptual understanding of biology terminology through explicit instruction and modeling by the teacher of a **Triple-Entry Vocabulary Journal**.

Teacher facilitation:

- 1) Introduce *mitosis* by demonstrating the process by slowly pulling a ball of clay or dough apart to form two identical balls from the original ball.
- 2) Project the animation of the phases of *mitosis* found at http://www.biology.arizona.edu/Cell_bio/tutorials/cell_cycle/cells3.html
- 3) After watching the video clip, guide the students in a group brainstorm to identify what they believe is occurring from the beginning of cell division to the final stage of two new identical cells. List the observations the students perceive to be occurring.
- 4) Introduce the key terms critical to understanding the phases of *mitosis* students will be looking up in the text.
 - Words to include are *mitosis*, *interphase*, *prophase*, *metaphase*, *anaphase*, *telophase*, and *cytokinesis*.
 - Using a computer-generated *Word Splash*, pronounce the words for the students and have them locate the words in the text selection and record the page numbers.

Example of Word Splash format:

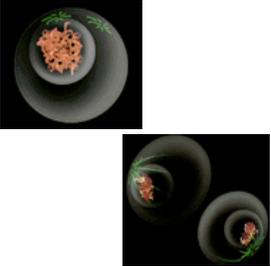


- 5) Introduce the **Triple-Entry Vocabulary Journal** by giving students a template with the page split into three columns labeled *Word in Context*, *Definition in My Own Words*, and *Picture, Memory Aid, Phrase*.
 - Model how to create the **Triple-Entry Vocabulary Journal** by drawing three columns on the board and label as in the template distributed to students. Look at the page in the chapter where *mitosis* is introduced. In the first column, jot down the page number and the sentence that has the term *mitosis*.
 - Read any surrounding sentences, picture captions, or diagram explanations to further understand the meaning of the word.
 - Explain what clues you see in the text explanation that help you write a definition of the term in your own words. Stress that “in my own words” means in words that I can understand; but, in biology, these words must always be

precise and accurate.

- Jot a phrase that helps you connect with the meaning of the word. Draw a picture that helps you recall the definition. Stress to students that several things happen between these two stages and it is important to learn the vocabulary to understand exactly what occurs during the process of *mitosis*.

Sample of a Triple-Entry Vocabulary Journal Template

Word in Context	Definition in My Own Words	Picture, Memory Aid, Phrase
<p><i>Mitosis</i> is the process in which a cell duplicates its chromosomes to generate two identical cells.</p> <p>interphase prophase metaphase anaphase telophase cytokinesis</p>	<p><i>Mitosis</i> happens when a cell divides perfectly to form two new cells that are exactly alike.</p>	<p>Connection: I think of bread dough rising, and the one ball becomes two when I divide the ball of dough into two balls.</p> <p>Graphic:</p> 

- 6) Begin the discussion of cell division by stressing the importance of understanding the vocabulary associated with the phases of *mitosis*. Provide guided practice to better understand how to use the **Triple-Entry Vocabulary Journal** strategy effectively by completing an entry for *interphase* and *prophase* together as a class.
- Remind students to begin by locating the text explanation and recording it in the left column.
 - Stress that writing a definition in one's own words means it must be paraphrased while still retaining the same meaning as the text definition.
 - Have students Turn and Talk about how they would define the word before asking for suggestions for the sample entry.
 - Encourage students to create their own memory aids and share in small groups or with the whole class.
 - Invite two students to add the two words, definitions, connection phrases, and pictures to the **Triple-Entry Vocabulary Journal** on the board. Having additional examples will help students when they begin to work in pairs or independently to complete entries for the remaining words.

During Reading/Learning (45 minutes)

Literacy outcome: Students will discuss and synthesize textbook definitions using visualization and personal connections to deepen understanding of how to define and retain new vocabulary.

Teacher facilitation:

- 1) Continue to use the **Triple-Entry Vocabulary Journal** that already has the completed entries for *mitosis*, *interphase*, and *prophase*. Have students add the following terms: *metaphase*, *anaphase*, *telophase*, and *cytokinesis*.
- 2) Ask students to read the text pages in pairs, using their *Word Splash* notes with page numbers to locate the terms.
 - Tell students to make connections with the words to be studied.
 - Answer student questions as they arise.
- 3) Have pairs complete the **Triple-Entry Vocabulary Journal** with the remaining words.
 - Have students discuss the words and explain their memory aids.
 - Encourage students to use precise drawings and graphic visualizations to depict the particular phase of *mitosis*.
- 4) Tell students that throughout the unit on cells, they will continue to add new terms to their **Triple-Entry Vocabulary Journal**.
- 5) Set up stations in the science lab for students to organize prepared slides that show the different phases of cell division in the appropriate sequence.
- 6) After the lab work, have students make changes or additions to their **Triple-Entry Vocabulary Journals** the lab activity clarified about the process of *mitosis*.

After Reading/Learning (15 minutes)

Literacy outcome: Students will write to synthesize their learning about the process of *mitosis*.

Teacher facilitation:

- 1) Ask students to complete a **Quick Write** that shows their understanding of the sequence of the *mitosis* process discussed in the lesson.
 - Encourage the students to think of the sequence of what happens from the first to the final stage of *mitosis*.
 - Tell the students they should use their own definitions from the **Triple-Entry Vocabulary Journal** for the vocabulary connected with the phases of *mitosis*.
 - Explain that the **Quick Write** should be about one half page in length.
 - Clarify that a **Quick Write** is focused on quickly conveying content and ideas rather than writing conventions, grammar, or spelling.
- 2) Collect students' **Quick Writes** to read and assess. Like all student-completed literacy strategies, the completed **Quick Writes** provide valuable data for teacher reflection. This writing should not be graded. The student responses should be used to assess student learning and make decisions about next steps in teaching.

Suggested Subsequent Lessons

Continue to use the **Triple-Entry Vocabulary Journal**, consistently modeling at least one vocabulary term and having students practice a few together before assigning other terms. Establish the habit that students will continue to add words to the journal throughout the semester during class and when doing homework.

To quickly assess students' understanding of the words, you may ask them to complete **Quick Writes**, **Exit Slips**, Question of the Day, or add words to the **Interactive Word Wall** to further their understanding of the vocabulary.

High School Biology Lesson Narrative: Phases of *Mitosis*

Teachers: As you read the lesson narrative, think about the following questions. You may want to discuss them with fellow biology/science teachers.

- *What does the teacher do to support students' literacy development and content learning before, during, and after reading/learning?*
- *What challenges do you anticipate if you were to implement this lesson in your own classroom? How would you prepare to meet these challenges?*
- *How would you make improvements to this lesson?*

Ms. Pritchett knew her students were experiencing difficulty understanding the vocabulary of the biology text. She tried asking the students to maintain a vocabulary notebook with the glossary definitions of the biology terms, but they were not successful on tests and could not seem to explain some of the science processes they had studied. How could she better help students connect vocabulary with understanding of science concepts? She knew it must move beyond memorization and writing of definitions. She decided to use the **Triple-Entry Vocabulary Journal** because it would give students the opportunity to develop a personal definition based on their understanding of the word used in context, and they would have the opportunity to draw representative diagrams along with writing their own memory aids or connections to the term.

Before Reading/Learning

Ms. Pritchett began the class by simply taking a large mass of dough and slowly breaking it apart at the center to form two new balls of dough. She asked the students, "What just happened?" Terry blurted, "You are playing like a kindergartener. Why are we playing with dough? Isn't this a biology class?" Ms. Pritchett chuckled and moved forward with her questioning. "Seriously, what happened?" Josh raised his hand and said, "It's simple. You just made two balls out of one!" "Yes, that's it. Today we will begin to study a biology process that is very similar. We will learn about a process called *mitosis* and begin to understand the phases of *mitosis* by exploring the meaning of the terms or vocabulary."

Ms. Pritchett knew it was important to help build the students' background knowledge before introducing the complex vocabulary. So she decided to use a brief computer animation and brainstorm activity to help connect the students with the new words.

"Before we look at the vocabulary, we will view a brief animation of *Animal Cell Mitosis*." Ms. Pritchett noticed several of the students, who often put their head down not long after entering class, were actually watching the animation. She wanted to keep one student in particular engaged with the lesson, so she asked Martin what he observed during the animation. Martin shrugged his shoulders and said, "I saw a bunch of squiggly things moving apart and dividing." Ms. Pritchett said, "Exactly," and wrote his observation on a transparency.

"Now, let's carry this further by breaking it down into sequences or phases. What did you see happening at the beginning of the animation?" Billy stated, "There was a single object that began to stretch apart." "Great! Did you see any similarity to the ball of dough?" Several students nodded their head. Ms. Pritchett wrote Billy's observation on the transparency. "What else did you notice?" Mary said, "It looked as though the further the ball stretched, the thinner it got in the center." Ms. Pritchett jotted the observation down. Johnson said, "When it stretched so far, the ball actually divided and formed two new balls that look the same, just smaller." Ms. Pritchett recorded the last observation on the transparency.

Ms. Pritchett said, “The animation of animal cell division you just observed is a process called *mitosis*. Before we begin our study of *mitosis*, we need to work with the vocabulary so it has meaning to you.” The students groaned because they knew this usually meant looking up and writing several definitions.

Ms. Pritchett chuckled as she handed out a template for the **Triple-Entry Vocabulary Journal**, which had three columns labeled *Word in Context*, *Definition in My Own Words*, and *Picture, Memory Aid, Phrase*. She said, “We will be using this journal format today to help you as you record and learn new vocabulary related to cell division, or *mitosis*. Let’s actually start by using the word *mitosis*.”

“Turn in your book to the section on *mitosis*. Listen as I read the definition aloud, *Mitosis is the process in which a cell duplicates its chromosomes to generate two identical cells*. Hmm,” Ms. Pritchett said as she thought aloud. “I think duplicate means making a copy of something, like making a copy of a picture on a copier. So I know *mitosis* has something to do with making copies of chromosomes before it actually generates, or makes, two new cells.” Using the board, Ms. Pritchett guides the students with writing the meaning of *mitosis* as it is used in context. “But, I want a simpler definition I can understand. What do you think about this one? *Mitosis happens when a cell divides perfectly to form two new cells that are exactly alike*.” Several students nodded and said, “Yeah, that sounds right.” So she wrote her own definition in the column, *Definition in My Own Words*. “In the last column, I want to write a statement that will help me remember what is happening, so I connect it with bread dough rising, which I divide into two identical balls of dough. Notice that I found clip art to help me identify what happens when *mitosis* occurs, but you can draw a diagram that helps you to remember the definition.”

“Before you begin working with a partner, I’d like you to look at the words connected with the phases of *mitosis*.” She projected a Word Splash visual using WordArt of the six vocabulary words, *interphase*, *prophase*, *metaphase*, *anaphase*, *telophase*, and *cytokinesis*. She pronounced each of the words as the students scanned the text to locate the words. She asked the students to record the page number next to the words so they could easily return to the word in the text as they work to complete the vocabulary study.

During Reading/Learning

Ms. Pritchett knew the vocabulary might serve as a stumbling block for many students, so she decided to read the text aloud, pausing to let them reread the sentence or sentences using one of the vocabulary words. She also provided time for them to think about the word and make any notes or ask questions. She encouraged the students to begin thinking about each of the new words as they saw them in context.

When she finished reading the text aloud, Ms. Pritchett wanted to be sure each student understood how to use the **Triple-Entry Vocabulary Journal** before they began to work with a partner on the rest of the *mitosis* vocabulary. The class worked with the first two words as a large group. She asked each student to individually record the context meaning of *interphase* and write the meaning in their own words. She asked one or two students to share their personal definitions. The students started to kid one another about the drawings they were completing, but Ms. Pritchett jokingly said, “I’m not looking for a Rembrandt. I only want the diagram to have meaning for you so you can remember the word.” She guided the students as a class to complete the same process with *prophase*.

Ms. Pritchett continued the lesson by asking the students to work with a partner to read over the text together once more. “Let me summarize for you what you should be doing.” She explained

they should look for context clues in the surrounding sentences, captions, charts, and diagrams. “But what if there isn’t a clue?” whined Marsha. “If you do not feel as though you have enough information, turn to the glossary to read a complete definition. Once you feel confident you understand the meaning of the word, close the book and discuss your definition with your partner before writing your own definition in column two. Then, in column three, you can draw a diagram of the phase of *mitosis* or write a short description of a personal connection with the phase to demonstrate your understanding. The goal is to create an aid to help jog your memory so you will clearly understand the meaning of the word. Having a firm understanding of the vocabulary terms will help you as we continue to read and discuss *mitosis* throughout the unit.”

Ms. Pritchett circulated the room to provide assistance as needed. She reminded several students to be precise when paraphrasing the text definitions. She noticed that two students seemed to be struggling with how to complete the assignment, while one student had put his head on the desk instead of moving to work with a partner. She pulled the three students together and provided more explicit instruction on how to find the words and write their own definitions. She wrote down the student contributions as they developed a common definition on which they could all agree. The students completed the final definition independently before sharing with Ms. Pritchett and their group. She was pleased to see the three were on the right track to understand how to use the strategy.

To help students understand the phases of *mitosis* even better, before class began Ms. Pritchett had set up different stations within the lab, using the microscopes, and prepared slides to demonstrate the different phases of *mitosis*. The stations were purposely randomly arranged and not labeled as to the phases of *mitosis*. She asked the students to move as groups of four to view the slides and to identify the correct labels and order for the six phases. She asked them to add information they observed in the third column of their **Triple-Entry Vocabulary Journal** if it added to their understanding of the meaning.

After Reading/Learning

To determine whether the students were beginning to understand that *mitosis* is actually a series of phases, Ms. Pritchett asked the students to complete a **Quick Write** to explain the sequence of divisions, or phases, the cell moves through to form two daughter cells from one parent cell. She gave the students a moment to reflect and think about the vocabulary, animation, and slides they had experienced during class and encouraged them to use the information from their **Triple-Entry Vocabulary Journals**. She stressed that the **Quick Write** is not to test them, but to give them another way to practice using the vocabulary and think about the concept of *mitosis*.

“I will collect them because I want to see how you understand the process through your explanations of what actually occurs during *mitosis*.” It was encouraging to see that almost all of the students were actually writing, since this had not always been the case. She knew students would continue to need support using the **Triple-Entry Vocabulary Journal**, but she felt the engagement of the students during today’s lesson indicated a positive connection with the strategy and learning new vocabulary. She will confirm that perception when she reads the students’ **Quick-Writes** and learns what further support students need in defining words on their own. She hopes that, with practice, students will become increasingly independent in using the **Triple-Entry Vocabulary Journal** to support conceptual learning.