Applying Understanding by Design

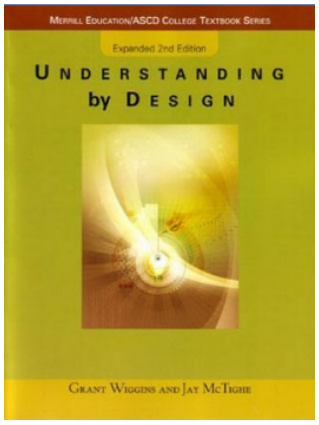
Introduction

This guide looks at the Understanding by Design framework and discusses how it is integrated into the design and application of the Miller & Levine Biology program. It also points out program features that support the implementation of Understanding by Design in your instruction.

What is Understanding by Design?

Understanding by Design (UbD) is a disciplined way of thinking about the design of curriculum, instruction, and assessment.

The UbD framework is described in detail in the book *Understanding by Design* by Grant Wiggins and Jay McTighe.



The book's coauthor, Grant Wiggins, has worked with Pearson to incorporate his unique instructional philosophy across all academic disciplines.

The goal of UbD is a deep understanding of important ideas needed to teach. UbD provides a way to move from simply covering the curriculum to ensuring understanding. This is done through a process of learning that provides students with opportunities to investigate, explore, test, and verify important concepts. It really boils down to helping students learn to transfer knowledge.

Big Ideas, Big Questions

With the UbD framework, the curriculum is not simply a series of discrete facts and skills. Big Ideas give context and meaning to the content. A Big Idea is a working concept, theme, or issue that a student uses to make sense of otherwise discrete content elements.

Big Questions are the Essential Questions that are designed to challenge theories and force students to stretch their thinking, using course content to support and inform answers. In doing so, students find meaning, value, and connections to what may have previously felt like rote memorization of boring content. UbD does not help students

just know something; it helps them understand why it matters and how they can apply what they have learned.

Backward Design

Let's talk for a moment about something called backward design.

UbD emphasizes the use of the backward design process to develop instruction. This process involves identifying the desired results first and working backward to figure out how to get there. Let's see how.

Backward design involves three stages:

- Stage 1: Identify the desired results of instruction.
- Stage 2: Determine the acceptable evidence of understanding.
- Stage 3: Plan the learning experiences and the instruction.

Transfer of Knowledge

The ultimate goal of education is to help students apply or transfer what they learned to new and unfamiliar situations. According to Grant Wiggins, the lack of transfer is the primary reason that students fail to perform on state testing: they've learned something in a particular context in the classroom, and then if that context is presented slightly differently on the state tests, they have a difficult time extrapolating to a different situation.

In the UbD framework, the ability to transfer means that students are able to take the Big Ideas, facts, and examples that they have learned and adapt them to fit many different settings and problems.

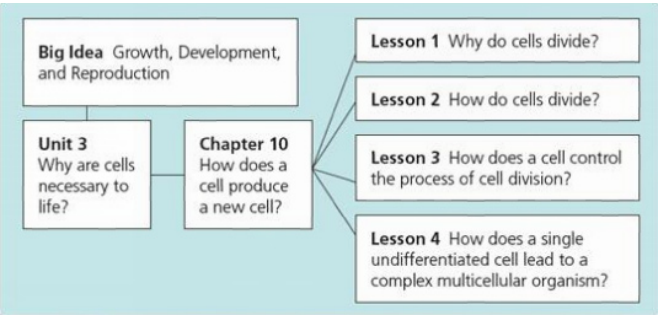
UbD and Miller & Levine Biology

Miller & Levine Biology leverages the UbD model to provide a way to move from simply covering the curriculum to ensuring understanding.

According to the UbD model, understanding is not achieved by simply covering content. It is achieved through carefully designed instruction derived from specific goals.

The process of learning provides students with the opportunity to investigate, test, and verify key concepts to make sense of key biology content.

Miller & Levine Biology emphasizes the use of a backward design process to develop instruction. Rather than beginning the planning process with activities, materials, or textbook content, the backward design in Miller & Levine Biology begins with identifying the desired long-term results.



These desired results serve as the focal point for the planning of all curriculum, instruction, and assessment and helps avoid superficial coverage of content.

UbD in Practice

Some of these UbD concepts are integrated into the way Miller & Levine Biology was built. Being familiar with these features makes it easier to use UbD strategies in the instruction of the program.

The UbD framework calls for Big Ideas and essential questions to open each unit, chapter, and or lesson. Miller & Levine Biology took that framework and created Big Ideas and Big Questions. Big Ideas form the backbone for each chapter. These Big Ideas are the essential understandings for the chapter. They are always accompanied by an essential question.

Within the UbD framework, real-world connections, activities, and inquiries should make material relevant and meaningful. This concept has been incorporated into the Miller & Levine Biology program through the use of the Chapter Mystery. Throughout the chapter, students gather important clues to solve the mystery by the end of the chapter. In the process, they build a meaningful understanding of the content and how it relates to the real world.

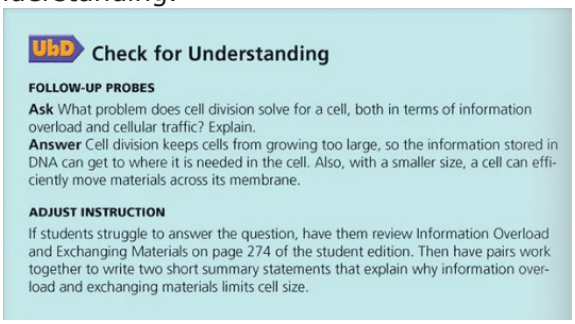
UbD requires that pedagogy and content help students connect key concepts, identify patterns, and predict outcomes to support enduring understanding. One way that the Miller & Levine program does this is that it uses visual analogies to make complex content comprehendible to students.

The UbD framework suggests that planning should include customizable teaching, planning, and assessment tools. There are many ways in which the Miller & Levine program accomplishes this. It is one program that offers four unique solutions. It offers an On-Level program for traditional classrooms, the Foundations Series for lower level readers, a Core Edition for an integrated technology approach, and a complete digital version for technically advanced classrooms. In the Teacher's Edition, there are many customizable teaching, planning, and assessment tools to design the most effective instruction. The Address Misconceptions section serves as a point of use intervention. This section provides a heads-up about problem areas of the curriculum. It suggests ways to intervene and clear up these misconceptions.

Address Misconceptions

Cell Growth Students may think that cells get smaller and smaller with every successive cell division. Tell students that cells go through a period of growth after they divide. Remind students that cell division helps a cell avoid the problems of growing too large.

There is also a UbD section that suggests discussion topics and activities. In this section, there are tips to help adjust instruction based on students' understanding.



UbD Check for Understanding

FOLLOW-UP PROBES

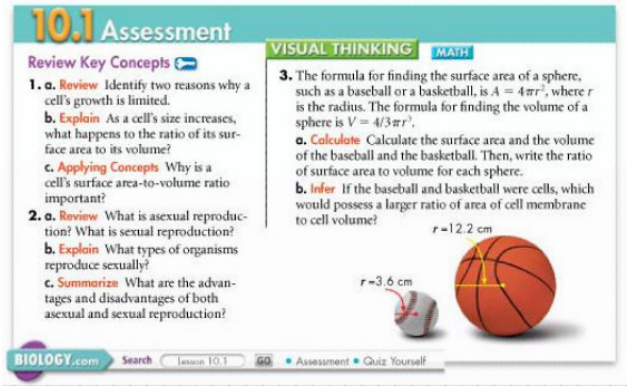
Ask What problem does cell division solve for a cell, both in terms of information overload and cellular traffic? Explain.
Answer Cell division keeps cells from growing too large, so the information stored in DNA can get to where it is needed in the cell. Also, with a smaller size, a cell can efficiently move materials across its membrane.

ADJUST INSTRUCTION

If students struggle to answer the question, have them review Information Overload and Exchanging Materials on page 274 of the student edition. Then have pairs work together to write two short summary statements that explain why information overload and exchanging materials limits cell size.

Miller & Levine also offers flexibility through differentiated instruction. Lesson options are noted in the chapter planner and throughout the Teacher's Edition.

UbD also calls for a variety of assessment options throughout the chapter, unit, or lesson. These options help measure each student's degree of understanding. These assessments include authentic assessments that gauge understanding through real-world applications. The Miller & Levine Biology program offers a variety of assessment options, including end-of-section assessments, opportunities to analyze data, end-of-chapter assessments, and opportunities to prove that students have connected to the Big Idea of the chapter.



10.1 Assessment

Review Key Concepts

1. a. Review Identify two reasons why a cell's growth is limited.
b. Explain As a cell's size increases, what happens to the ratio of its surface area to its volume?
c. Applying Concepts Why is a cell's surface area-to-volume ratio important?

2. a. Review What is asexual reproduction? What is sexual reproduction?
b. Explain What types of organisms reproduce sexually?
c. Summarize What are the advantages and disadvantages of both asexual and sexual reproduction?

VISUAL THINKING **MATH**

3. The formula for finding the surface area of a sphere, such as a baseball or a basketball, is $A = 4\pi r^2$, where r is the radius. The formula for finding the volume of a sphere is $V = 4/3\pi r^3$.
a. Calculate Calculate the surface area and the volume of the baseball and the basketball. Then, write the ratio of surface area to volume for each sphere.
b. Infer If the baseball and basketball were cells, which would possess a larger ratio of area of cell membrane to cell volume?

$r = 12.2$ cm
$r = 3.6$ cm

BIOLOGY.com Search Lesson 10.1 GO • Assessment • Quiz Yourself

Finally, UbD supports the meaningful use of technology. The Miller & Levine program makes meaningful connections to the Big Ideas of biology through the use of technology. These instructional pieces are all accessible through Biology.com.

Review

This guide explained that UbD is a framework that is used to design curriculum. The framework focuses on Big Ideas and Big Questions. The goal is not coverage of the material but a deep connection to the concepts. Through the use of backward design, the desired outcomes are identified first, acceptable measures of this evidence are determined, and then the learning experiences are planned.

It also discussed how the Miller & Levine Biology program was designed using UbD concepts. These features encourage students to learn the Big Ideas of biology.

To learn more about Understanding by Design, Pearson offers workshops and professional development opportunities that can help integrate the principles into teaching. Just look for more information on this Web site or contact a Pearson sales rep.

To find out more about Grant Wiggins and UbD, visit his Web site at grantwiggins.org.