

# CULTIVATING CRITICAL- THINKING SKILLS

## THROUGH AN INTERDISCIPLINARY STUDY OF THE EARTH'S ORIGIN

**T**eaching junior high school students is a daunting task, as these teens morph through their most extreme makeover since infancy—hovering precariously between childhood and young adulthood. Early adolescents experience enormous physical and social changes as they commence a gradual and uneven intellectual transition from concrete to abstract thought.<sup>1</sup> Spiritually, they are making lifelong decisions about their relationship with Christ and the church. Indeed, *Value-genes: Ten Years Later* reported that 58 percent of students in Adventist schools are baptized between the ages of 10-14, in grades 6-8. If students are not baptized during these years, 27 percent will not yet be baptized by the end of their senior year in high school.<sup>2</sup>

### **Critical-Thinking Skills**

Helping early adolescents make spiritual decisions and develop abstract thought challenges Adventist educators as they seek to produce “thinkers and not mere reflectors of other men’s thoughts.”<sup>3</sup> Thinking means more than the acquisition of facts to prepare for a test. It requires the ability to examine information, consider alternatives, distinguish between fact and opinion, and evaluate evidence using sound reasoning. As early adolescents begin thinking deeply about life, teachers can help facilitate purposeful, directed thinking, keeping in mind that students thrive when assisted in

**BY SANDRA J. BALLI, ALLEN M. COOPER, AND LUCAS D. HAMILTON**





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One area of study with considerable potential for cultivating critical-thinking skills is the study of Earth's origin. The North American Division (NAD) Office of Education recommends an 8th-grade science curriculum that includes a study of creation *and* evolution. In Bible class, the students study faith, sin, and the history of the weekly Sabbath.<sup>4</sup> An interdisciplinary study that simultaneously integrates Bible and science is a practical way for teachers to guide 8th graders through a critical examination of evolution and creation combined with a thoughtful study of Adventist fundamental beliefs.<sup>5</sup>

### Interdisciplinary Instruction

Interdisciplinary instruction is a well-recognized method that approaches a topic from the perspective of two or more disciplines. It thereby helps students make logical connections among disciplines and organize isolated bits of information.<sup>6</sup> It also helps prepare them for the workplace and real life, where subject areas are not artificially separated by clocks or bells. Interdisciplinary instruction is developmentally appropriate for early adolescents, giving them an opportunity to work in cooperative groups, ask questions, explore alternatives, and engage in project-based activities addressing real-world issues.<sup>7</sup>

What follows is an example of an interdisciplinary thematic unit (ITU) for 8th grade that combines science and Bible in a project-based study of Earth's origin. The unit, called *Origins*, was developed by two teacher-education students from Pacific Union College (a science major and a religion major) who have now completed their programs and hold both public and Adventist teaching credentials.

This particular ITU was designed to fill 12 90-minute blocks each for science and for Bible; however, it can be adapted for shorter class periods. It can be taught by one teacher in a self-contained classroom who is conversant in both disciplines, or by a science teacher and a Bible teacher working as a team.

In this unit, students investigate evidence for and against five origins theories: Young Earth Creation, Day-Age Theory, Gap Theory, Theistic Evolution, and the Big Bang, along with Naturalistic Evolution. The first four origins theories acknowledge God's involvement,<sup>8</sup> while the fifth theory is entirely naturalistic.<sup>9</sup> An element that ties the disciplines together is a project requiring each student to investigate an origins-related topic introduced in either science or Bible class. The students demonstrate what they have learned using visual aids in a culminating presentation that they can share with classmates and parents.

## Interdisciplinary Unit Example

The religion unit, entitled *Does the Bible Say When?*, explores the great controversy between Christ and Satan, the Genesis creation account, and the biblical flood, interpreting geologic evidence through a spiritual lens. The science unit, entitled *Does the Dirt Say When?*, examines geologic evidence and various scientific interpretations of origins.

**B**ecause early adolescents do not readily transfer or connect information across disciplines, the Bible and the science teacher should meet regularly to plan explicit references to each other's lessons if the unit is taught by two teachers. If the unit is taught by one teacher, explicit references to each discipline need to be part of daily lesson planning to ensure that students make connections between science and religion. Such deliberate planning will foster relevant, deep, and meaningful learning (note the explicit references to each discipline in the example that follows).

The *Origins* unit is undergirded by four essentials that students revisit throughout their study:

1. Evidence exists to support several theories of the origin and age of planet Earth and life upon it;
2. Both geologic and theological evidence give clues about when the Earth and its lifeforms originated;
3. The evidence can be interpreted in different ways based on a person's worldview; and
4. It is possible to weigh the geologic and theological evidence to develop a well-reasoned understanding of why Adventists hold a fundamental belief in biblical creation.

The following summary offers short excerpts from the 12 original lessons. The lessons may be adapted according to time and resources, or the complete unit may be obtained by contacting the authors.

### Lesson 1

*Religion.* Students investigate the origin of sin, which is central to a

Christian view of creation. They read Isaiah 14 and Ezekiel 28 to explore the reality of Satan and the influence of fallen angels on Earth. Afterward, they complete a group project examining potential problems such as creating beings who can sin.

*Science.* Students analyze the difference between creationist and naturalistic worldviews and examine evidence both for and against the Big Bang theory. The teacher alerts students that they will study the theological implications of the Big Bang theory in religion class (Lessons 2 and 7), including polonium radiohalos, which are problematic for this theory.

### Lesson 2

*Religion.* Students explore why God created the Earth when Satan was determined to oppose Him. They discuss the presence of the Trinity in Creation and the logical six-day weekly order, using skits and artistic depictions. Students review the Big Bang theory, and then discuss how many Christians, including Seventh-day Adventists, view the origin of the Earth based on the biblical creation account.

*Science.* The teacher introduces four origins theories that acknowledge God's involvement (i.e., Young Earth, Gap, Day-Age, and Theistic Evolution), and students separate into groups to research supporting and contradictory evidence for each theory. The teacher makes connections, referring to a timeline that students will create in religion class (Lesson 9) depicting creationist theories.

### Lesson 3

*Religion.* Students compare Genesis 1 and 2, and attempt to locate the site of the Garden of Eden. The teacher leads out in a discussion of the differ-

ence between God's creation of the universe, an act that is somewhat removed, and His creation of human beings, which is much more intimate. To illustrate the difference, each student creates a man or a woman out of *Fimo* dough and gives the person a name, skills, personality, and other characteristics.

*Science.* The teacher introduces the geologic processes of weathering, continental drift, and volcanism. He or she explains how rocks were formed and how the relative ages of rock layers are determined. The teacher compares the theories of uniformitarianism and cata-



Students discuss the conditions necessary to produce fossilization.

strophism. Afterward, students use peanut butter and jelly sandwich materials to simulate various geologic processes and determine how they influence original horizontality and superposition. Subsequently, the teacher introduces the unit's main research project, which centers on each student's understanding of origins.

### Lesson 4

*Religion.* Students analyze Satan's activities in the Garden of Eden and create skits dramatizing conversations between God, Adam, and Eve. The



students connect their learning to science class by discussing the curses of sin such as the need to till the ground, pain in childbirth, and dietary changes. They answer questions such

colored beads) based on the ratios of parent and daughter isotope “atoms” (different colored beads) within the “fossils.” Connecting to religion class, the teacher emphasizes what students

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**Using dough, students “create people” to illustrate God’s intimate involvement in giving His created beings unique characteristics.**

as these: Was this “evolution”? Were these curses ordained of God for all time, or should humans try to restore things, as closely as possible, to the conditions that existed at Creation?

*Science.* Students examine how scientists use radioactive isotopes to determine the ages of rocks and fossils, and analyze the assumptions and limitations of this dating method. Using diagrams, graphs, and computer animations, the teacher presents the basics of atomic structure and radioactive decay. Student groups apply what they have learned about half-life properties by calculating the ages of different “fossils” (simulated by small bags of

have learned about polonium 215, previewing future material in religion class (Lesson 7) regarding its role in the formation of radiohalos (evidence for Young Earth Creation).

### **Lesson 5**

*Religion.* Any discussion of sin is incomplete without an understanding of how the atonement can restore people or groups who are at odds to a positive relationship. Students create and present a skit showing how trust is destroyed between two parties, what the separation means in the eyes of local law or culture, and how the two parties can be brought back into a rela-

tionship through some kind of sacrifice by one of them.

*Science.* Students study the huge amounts of time represented by the naturalistic interpretation of the geologic column that permeates textbooks and the popular press. They study diagrams that show how naturalists divide geologic time into eras, periods, and epochs. The teacher uses a timeline to contrast how adherents of Young Earth Creation view the scope of geologic time. Pairs of students use adding-machine tape and colored pencils to create a naturalistic geologic timeline. Making connections, the teacher instructs students to keep their naturalistic timelines to compare with the creationist timelines they will make in religion class (Lesson 9).

### **Lesson 6**

*Religion.* Students analyze several views of the atonement (e.g., personal, judicial, totalitarian). They design a collage showing the natural consequences of sin such as leaving the Garden of Eden, the death of plants and animals, and the human awareness of needing to wear clothing.

*Science.* Students study organisms that supposedly originated (via evolution) in each of the periods of the geologic column. After outlining a naturalistic explanation of the geologic column, the teacher discusses some of the life forms found in each geologic period. Students work in pairs to create a poster that illustrates their research on life forms, environmental conditions, and special events (e.g., ice ages, large-scale extinctions).

### **Lesson 7**

*Religion.* Students explore the worldwide flood progression that brought the Earth to its present state, according to the Creation Evidence Museum (CEM) model.<sup>10</sup> The teacher discusses polonium 215 and radiohalo formation. Students pretend to be polonium radiation trying to escape granite. During the first exercise, the “polonium” students try to escape the slowly solidifying granite, and succeed. The next time, the “polonium” stu-

dents are not able to escape the crystallizing granite because it cools too quickly. The evidence for quick cooling lends support to Young Earth Creation and the Flood. A video, *Fingerprints of Creation*, presents additional information about radioholols, referring back to science class (Lesson 4).<sup>11</sup>

*Science.* Students examine how fossils are formed, along with different interpretations of the fossil record by naturalists and creationists. A lecture covers the various types and groups of fossils, as well as the conditions necessary to produce fossilization. The teacher summarizes the naturalistic interpretation of the fossil record, and makes connections to religion class by discussing a creationist interpretation that incorporates the potential effects of a worldwide flood. After using acid etching to locate fossils on slabs of Rochester Shale, pairs of students create reports detailing the numbers, sizes, and identities of the fossilized organisms they found.

### Lesson 8

*Religion.* Students discuss the patriarchal genealogies in Genesis 6-11. They assess the claim by many creationists that the long ages proposed by evolutionists would result in a human population that greatly exceeds the number of people currently on Earth. The class also discusses counterarguments that the increase from the eight survivors of the Flood would not equal the current population of the world in the time frame given.<sup>12</sup>

*Science.* Students learn about the naturalistic perspective on the origin of humans, using the fossil record. In the process, they become familiar with several of the most famous human fossil discoveries. Student pairs investigate these issues through a teacher-designed WISE (*Web-based Inquiry Science Environment*) project complete with video clips, pictures, charts, and animations.<sup>13</sup> The teacher summarizes evolutionary changes (e.g., skeletal, lifestyle, intelligence) according to a

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Students dramatize Adam and Eve's sorrow after the Fall as they come to recognize the curse of sin and their separation from God.

naturalistic interpretation, and provides a creationist interpretation for several early human fossils.

### Lesson 9

*Religion.* Students create a rough timeline of three creationist theories (i.e., Young Earth, Gap, and Day-Age), comparing them with the naturalistic timelines from science class (Lesson 5). The class takes a poll (with students standing in classroom corners) to express their current understandings about one or more origins theories.

*Science.* Students begin work on their unit projects. They choose an origins-related research topic, a presentation format (e.g., PowerPoint, tri-fold display board, informational brochure), and a visual aid (e.g., table, graph, picture).

### Lesson 10

*Religion.* Students continue to work on their projects, identifying major

concepts within their chosen focus, and outlining potential details. Students also begin work on a second visual aid for their final presentations (e.g., poster, model, drawing).

*Science.* Students examine the process of erosion and consider its implications for the age of the Earth. They analyze the potential impact of huge amounts of moving water (such as a large-scale flood) in shaping the face of the Earth. Following a discussion of hydraulic erosion accompanied by a video about Glacial Lake Missoula and the geologic consequences of its sudden drainage, students create small-scale landscapes of different materials at varying gradients.<sup>14</sup> They then run water across the landscapes to explore the relationship between the extent of erosion and volume of flow, rate of flow, landscape composition, and landscape gradient. Connecting to religion class (Lesson 7), the teacher reminds students that they have stud-

ied the Creation Evidence Museum model of causes and effects of a worldwide flood.

### Lesson 11

*Religion.* Students create a timeline for secular theories, including Theistic Evolution and the Big Bang. The class reviews supporting and contradictory evidence for all five theories (creationist and naturalistic) and discusses the spiritual implications of the theories that require death to occur before Adam and Eve's sin.

*Science.* Students continue working on their projects, creating a properly formatted bibliography and further developing their presentation.

### Lesson 12

*Religion.* Students continue to work on their projects, completing a third visual aid and submitting their work to a classmate for peer review.

*Science.* Students take a field trip to a petrified forest (or explore a petrified forest on the Internet). They gain experience with one group of fossils studied in class and describe naturalistic and creationist theories about the geologic processes that led to petrification. In the process, they discover that dramatic geologic processes have taken place throughout the world.

As the unit moves toward completion, students present their visual projects during subsequent class periods or at a school open house.

### Closing Thoughts

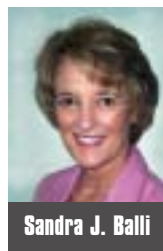
Public schools have long struggled with the role of science and religion in the classroom as ideologically divided school boards and courts debate what should and should not be included in science textbooks, limiting the likelihood that public school students will investigate alternate theories of origins. By contrast, Adventist teachers and students, unfettered by such restrictions, can examine evidence on both sides of the debate and cultivate critical-thinking skills as they come to understand why Adventists believe the biblical creation account.

The example interdisciplinary unit,

*Origins*, addresses the spiritual, intellectual, and social needs of early adolescents, providing multiple ways for them to critically investigate questions, work in cooperative groups, exercise faith, and demonstrate their knowledge through discussions and projects. Careful planning is needed to design the structure and substance of the interdisciplinary unit to include explicit references to what is being taught in the corresponding discipline(s). These purposeful connections are the key to the broad and deep understanding associated with higher-level learning.

The goal of the unit is to ensure that students understand these concepts: (1) Evidence exists to support several theories of the origin and age of planet Earth and life on it; (2) Both geologic and theological evidence offer clues about when the Earth and life on it originated; (3) The same evidence can be interpreted in different ways based on one's worldview; and (4) Each student can weigh the geologic and theological evidence to develop a well-reasoned understanding of why Adventists believe theories about creation based on the Bible record.

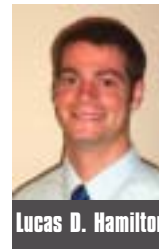
Teachers who help their early adolescent students explore an in-depth investigation of the Earth's origin within a supportive Adventist environment can stimulate critical thinking skills at a decisive spiritual juncture in their students' lives. Such adolescents can apply these thinking skills to further lifelong learning in all their academic pursuits. ✍



**Sandra J. Balli** is an Associate Professor of Education at La Sierra University in Riverside, California. She has also taught at Pacific Union College and at the University of Minnesota. Dr. Balli earned a Ph.D. in Instructional Theory and Practice from the University of Missouri. **Allen M. Cooper** is enrolled in a Master's program in biology through Loma Linda University's School of Earth and Biological Science. He can be reached by e-mail at [allenmcooper@yahoo.com](mailto:allenmcooper@yahoo.com). **Lucas D. Hamilton** is teaching Bible, English, and



*World Geography* at Cascade Christian Academy in Wenatchee, Washington, to 6th, 7th, and 8th graders. He can be reached by e-mail at [lhamilton@ccawenatchee.org](mailto:lhamilton@ccawenatchee.org).



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