Carol Campbell

An Unchanging Mission in a Changing World

An organization's mission, vision, and values identify its purpose (Why it exists) and goals (What it plans to accomplish) and remain relatively unchanged over time. Adventist education seeks to educate the whole person—spiritual, physical, intellectual, and social-emotional—with the aim of preparing learners to serve God and humanity.[1] However, an organization's strategic roadmap from mission to vision (How it accomplishes its goals) must be flexible, adapting to an ever-changing cultural context. Ellen White stated, "No exact pattern can be given for the establishment of schools in new fields. The climate, the surroundings, the condition of the country, and the means at hand with which to work must all bear a part in shaping the work."[2]

In the past several decades, significant cultural shifts have occurred with the development of new communication tools, affecting the way in which we think, work, and interact with others. These shifts served as the impetus for new working environments for 21st-century citizens—moving from unconnected goals to a shared vision; from a context of isolation to one of collaboration; and from a decision-making process based on one's perception of reality to a data-informed culture. The notion of work as predictable shifted to the concept of a dynamic, creative, and innovative learning organization; and from a focus on the parts of the workplace to a systems view of the relationship among the parts.

Pink[3] characterizes these changes as the transition from "algorithmic" to "heuristic" tasks in the workplace. An algorithmic task is one in which employees follow a set of well-defined instructions down a single pathway to one conclusion; a heuristic task is one in which employees experiment with possibilities and devise novel solutions. During the 20th century, most work was algorithmic in nature, but outsourcing and automation have changed this. It is estimated that in the United States, 70 percent of job growth now comes from heuristic work, while only 30 percent comes from algorithmic work. Similar shifts are likely, worldwide, as technology continues to impact the way we think, work, and communicate.

The changing cultural context, however, has not led to significant changes in educational methodology. Schools, in general, continue to focus on preparing students for a 20th-century workplace, with teaching and learning highly routinized and predictable. Change theory, though, emphasizes that schools must be involved in a strategic cycle of continuous improvement to meet the needs of 21st-century learners.[4] So what type of educational shift is necessary to prepare Adventist students to serve God and humanity in the 21st century?

From the beginning, God designed us to wonder, question, and learn about our environment. In the Garden of Eden, Adam and Eve were encouraged to explore and share what they had learned with God and the angels.[5] This type of learning was also encouraged in the schools of the prophets.[6] More than 100 years ago, Ellen White noted, "Every human being, created in the image of God, is endowed with a power akin to that of the Creator—individuality, power to think and to do. . . . It is the work of true education to develop this power, to *train young people to be thinkers, and not mere reflectors of other people's thought.* Let students be directed to the sources of truth, to the vast fields opened for research in nature and revelation. Let them contemplate the great facts of duty and destiny, and the mind will expand and strengthen."[7]

Neuroimaging has shown that as we age, cognitive processes tend to shift from the creative right brain to the logical left brain. Learners arrive at school full of wonderment and questions, but the more time they spend in school, the more their natural curiosity diminishes. With a heavy emphasis on algorithmic tasks, a "knowing-meaning gap" results, with students having little or no time to apply and think deeply about what they have learned. In addition, such practices often lead to a significant disconnect between life in school and the reality of life outside of the classroom.

Thus, educational theorists and researchers have begun to confirm what Ellen White stressed many years ago. Greater emphasis is being placed on the value of providing learners with opportunities for meaningful inquiry and critical thinking so they are better prepared for the changing world outside of school.[8] Specifically, Marzano notes that most educators rely heavily on teacher-centered instruction that emphasizes lecture, practice, and review.[9] Instead, he cautions, "Instructional shifts are required to help students process information, be more thoughtful and analytic about their conclusions, and apply their knowledge." The Partnership for 21st Century Learning[10] has identified the 4Cs (critical thinking, communication, collaboration, creativity) as vital 21st-century outcomes with the goal that students will acquire the knowledge, skills, and dispositions that will prepare them to be creative, connected, and collaborative lifelong problem solvers. Costa and Kallick,[11] likewise, emphasize a balanced approach where knowledge, skills, and dispositions are developed in the context of rich, challenging tasks that demand skillful, creative, and cooperative thinking. Several frameworks are available to aid in the development of critical thinking and inquiry practices. The C3 Framework,[12] in particular, outlines four dimensions: developing questions and planning inquiries, applying disciplinary tools and concepts, evaluating sources and using evidence, and communicating conclusions and taking informed action. These processes redefine the student-teacher relationship, placing students at the center of the learning, with teachers as facilitators to guide students to take ownership of their own learning. In student-centered

Continued on page 55

or personalized learning,[13] teachers deeply engage all learners in the acquisition of key knowledge and skills, while creating opportunities for thinking "so that they can pursue powerful questions, tackle complex problems, collaborate with diverse people, imagine new possibilities, and communicate their ideas."[14] How should Adventist educators respond, then, to the changing cultural context of the 21st century and the mounting evidence that supports a shift in educational practices, while maintaining the distinct Adventist education mission and vision? The authors in this issue share some ways in which Adventist education, from early childhood through higher education, can become relevant to 21st-century learners through a focus on Ellen White's recommendation to "*Train the young people to be thinkers . . . not mere reflectors of other people's thought.*"[15] How can thinking be made visible in your classroom and serve as the strategic link between mission and vision?

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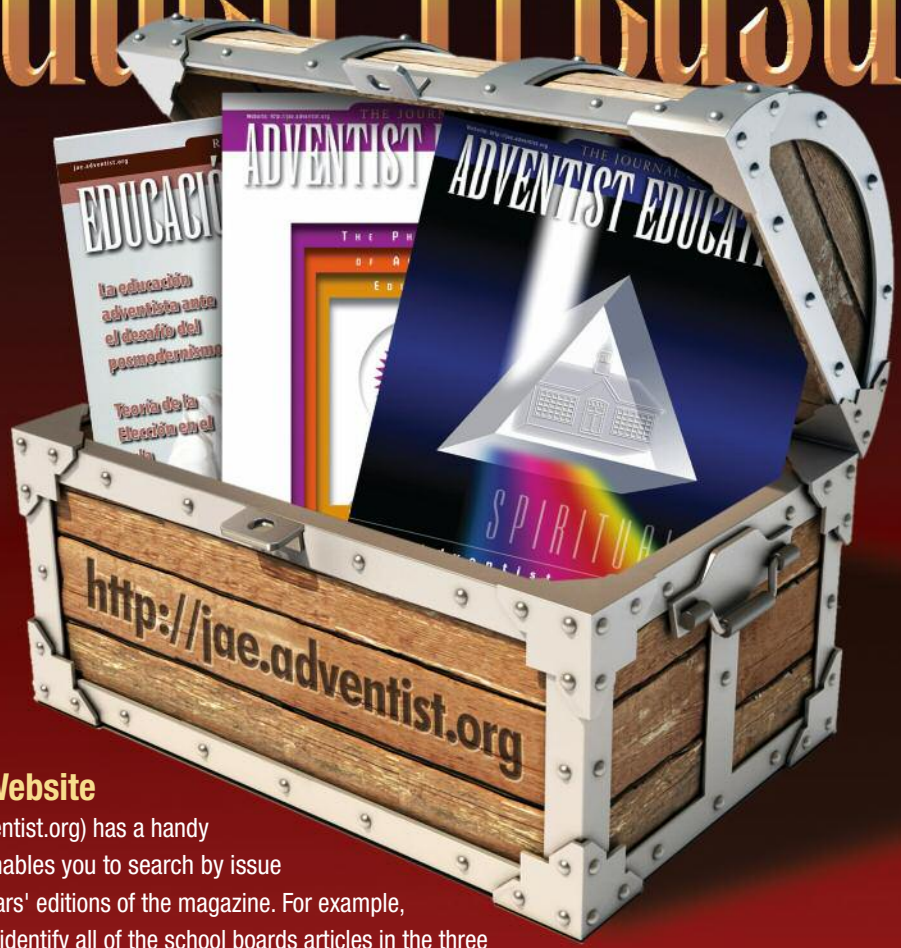
Hidden Treasure



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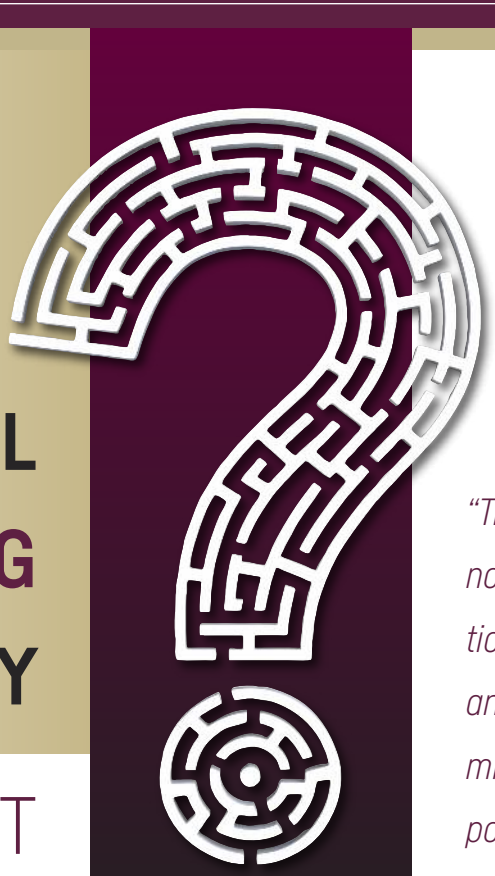
Critical Thinking and Inquiry in Adventist Education



"True education is not forcing instruction on an unready and unreceptive mind. The mental powers must be awakened, the interest aroused."[1]

Seventh-day Adventist educators recognize that "Every human being, created in the image of God, is endowed with a power akin to that of the Creator—individuality, power to think and to do. . . . [and that] It is the work of true education to develop this power, to train young people to be thinkers, and not mere reflectors of other people's thought."[2]

This is *our great calling and our challenge* as Adventist teachers. It is vital, therefore, that we intentionally employ strategies by which we can guide young people to become *reflective thinkers and independent learners*, who become *responsible for their own learning journeys*, who are capable of *doing their own thinking and planning*, who become *responsible, collaborative, lifelong learners,* and who will *demonstrate their individuality* in service to God and humanity.

Before further exploring the challenge placed before us, however, there are at least two other issues to consider: the place of a standards-based curriculum in teaching and learning, and 21st-century skills.

Standards-based Curriculum and 21st-century Learning and Teaching Skills

In many countries, 21st-century educators increasingly observe and experience the implementation of national[3] and system[4] standards-based teaching and learning curriculum frameworks for developing and assessing students' understanding, knowledge, and skills. One common purpose of these initiatives is to provide equity in preparing students for further education (university, college, and technical), careers, and the challenges of global citizenship in an increasingly technological advancing, mobile, and globalized world.[5]

Generally, educational standards describe what young people should learn as they progress through schooling.[6] In some countries, such as Australia, standards also describe the extent of learning, and the quality, depth, and sophistication of understanding and skill development at each stage of schooling.[7] Educators are expected to provide students with experiences and learning goals that are consistent across the nation, linked to authentic experiences, and which seek to prepare young people for the 21st century.[8]

In addition to a standards-based curriculum, educational leaders and teachers have likely been exposed to a number of models for teaching and assessing 21st-century skills,[9] which seek to support students in developing independence of thought and becoming responsible, collaborative, lifelong learners. These skills have been categorized as describing "*ways of thinking*, ways of

BY SANDRA ENGLAND

working, tools for working, and skills for living in the world."[10] Most lists include variations of the following attributes: creativity and innovation, *critical thinking* and problem solving, communication and collaboration, decision making and learning, using information and communications technology (ICT) and information literacy, as well as developing citizenship, life, and career skills, and personal and social responsibility.[11]

Adventist educators could use the skills listed above to extract and create system-developed Christian standards, values statements, and frameworks that embed the Adventist worldview throughout the K-12 curricula,[12] and assist students in preparing for a life of Christian service and character development for this life and the life to come.

The Challenge

How then do educators rise to the challenge outlined above, the challenge to train our young people to be independent thinkers? To assist their students in becoming independent and critical thinkers, teachers can refine their own understanding of cognition and metacognition by taking a deeper look at the powerful teaching and learning frameworks in the current educational climate that incorporate cognitive and metacognitive learning and teaching skills and strategies, and which encourage the use of rich assessment practices.

Such frameworks include: Inquiry-based Learning, with models such as Kath Murdoch's Framework[13]; Understanding by Design (Wiggins and McTighe)[14]; Project-based Learning[15]; Webb's Depth of Knowledge Framework[16]; the Structure of Observed Learning Outcomes Taxonomy (SOLO)[17]; and the Transformational Planning Framework[18] (upon which the Australian *Adventist Encounter* Curriculum is built). Teachers should also consider the valuable and seminal work of researchers Ron Ritchhart, Mark Church, and Karin Morrison from *Harvard Graduate School of Education: Project Zero Visible Thinking Routines*.[19] Such frameworks and strategies provide educators with the opportunity to use inquiry-based teaching and learning practices, rich assessment strategies, and engaging thinking routines to develop in their students the capacity to think critically.

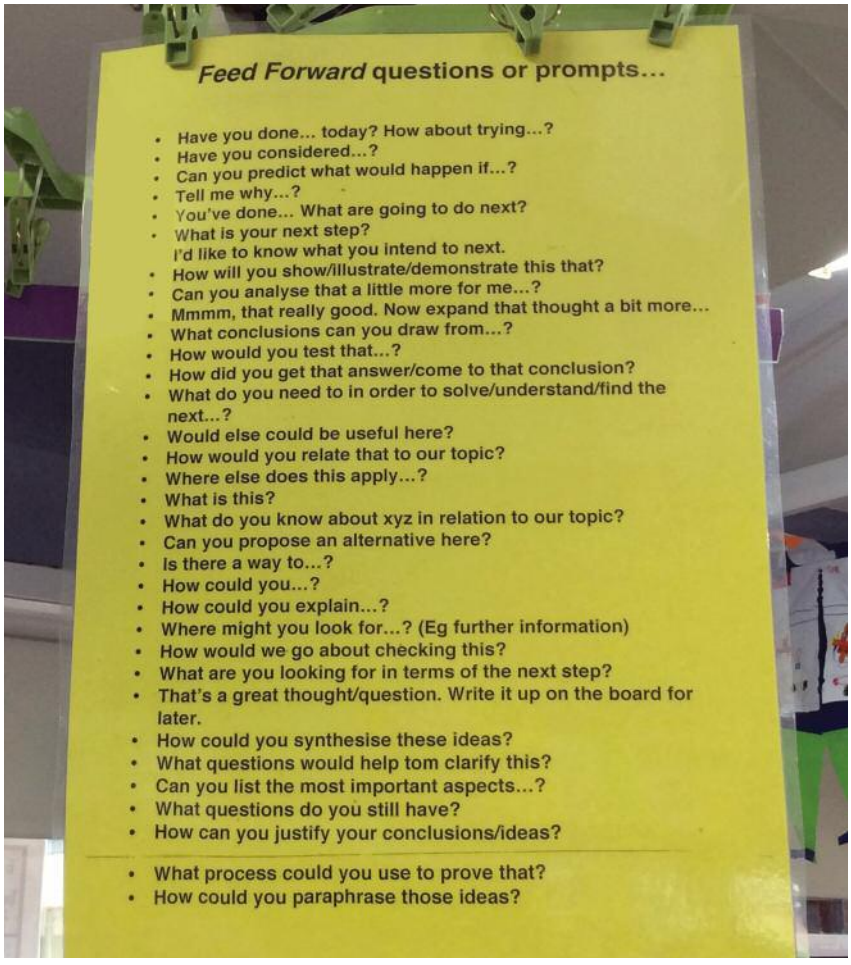
When educators are considering the *why, what,* and *how* of integrating critical thinking skills into their teaching and learning practice, they need to consider the difference between cognition and metacognition. *Cognition* is defined as the "mental ability or process of acquiring knowledge by the use of reasoning, intuition, or perception,"[20] while *metacognition* is defined as the "knowledge of your own thoughts and the factors that influence your thinking,"[21] or put simply, thinking about thinking. Teachers should ensure that *both* of these types of thinking become part of students' learning experiences.

In addition to teaching 21st-century skills, it is also vital that teachers become *intentional* in their use of assessment practices–

particularly the powerful formative assessment strategies—and teach students to understand the role of assessment in learning. "Assessment: The Bridge Between Teaching and Learning" is a paper on the role of assessment as a formative element in learning. The author, Dylan Wiliam, emeritus professor of educational assessment at University College London, suggests that assessment—in particular, formative assessment—is a "bridge between teaching and learning"[22] through which achievement of deep understanding, knowledge, and skills can be accomplished.

In considering the relationship between inquiry-based learning frameworks, thinking processes and strategies, and formative assessment practices, the questions to keep in mind include the following:

- *How can we assist our students to see themselves as thinkers and learners as well as develop in them a critical awareness of their own thinking and learning?*
- *How can we as educators ensure that we provide our students with well-planned, rigorous learning experiences that enable us to move beyond assuming what they have learned to knowing they have learned?*
- *How can we (both teachers and learners) use formative assessment practices more effectively to strengthen the bridge between teaching and learning?*
- *How can we use these separately or together to give our students voice and choice?*



Feed Forward questions displayed as prompts to move the lesson forward, provide feedback, and assess understanding.

Teaching and Learning Frameworks and Metacognition Strategies That Work Together

Metacognitive practices and skills can be fostered in learners by designing an effective, engaging, and challenging inquiry-based curriculum. Furthermore, to form that bridge[23] between teaching and learning, the scaffolds used in such rigorous curriculum design, when well applied, also guide the planning for and effective use of formative assessment and visible thinking practices. Together, these have the potential for significant impact on the learning and achievement of all learners.

Three well-recognized, widely accepted, powerful frameworks that readers may find particularly useful are the following: (1) Understanding by Design—a framework developed by Grant Wiggins and Jay McTighe[24]; (2) the Depth of Knowledge Framework developed by Norman L Webb[25]; and (3) The Structure of the Observed Learning Outcomes Taxonomy (or SOLO Taxonomy) developed by John Biggs and Kevin Collis[26] and expanded upon by the work of Biggs and Catherine Tang[27] and Pam Hook.[28]

Understanding by Design (UbD) Inquiry Learning Model

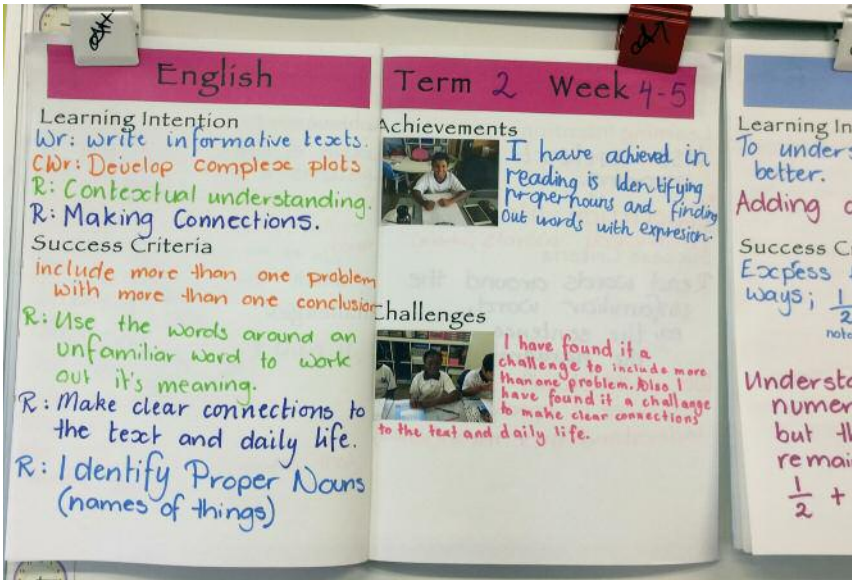
UbD, sometimes called "'Backward Design' leaves [the planning of] teaching activities until the end"[29] and is intended to engage teachers in purposeful curricular planning that begins with setting a unit's learning goals and designing authentic performance and assessment tasks. "Wiggins and McTighe argue that you can't start planning *how* you're going to teach until you know exactly *what* you want your students to learn."[30]

By applying within the framework the recommended series of planning tools, teachers have the opportunity to develop engaging, authentic teaching and learning experiences for students that will engage them in rigorous inquiry for understanding and transfer of learning. The model also promotes the development of complex thinking skills. Learners' metacognitive skills will be fostered through the meticulous exploration of the big ideas and essential questions set by educator and learner.

UbD has three phases:

- Phase One: Identifying the desired results of teaching and learning;
- Phase Two: Determining acceptable evidence of learning, describing understandings, developing big ideas and essential questions, and outlining the necessary skills to be learned and applied;
- Phase Three: Framing learning activities and experiences.

Because Understanding by Design also



An example of Learning Intentions and Success Criteria used in a Year 4 classroom. Students reflected on their own learning, recorded their reflections, and added them to the class record in a permanent journal.

uses a continuous-improvement approach, it lends itself well to the application of the formative assessment strategies outlined above. For example, goals, understandings, and skills lists can be restated as learning intentions (LI) from which success criteria (SC) can be developed. LI and SC might also be used to develop assessment rubrics, which students can use to self- and peer-assess their progress toward attaining the established goals. And the LI and SC can be used to frame quality interactions (teacher to student, and student to student), to which teachers can refer when providing learners with verbal and written feedback.

At the end of each unit, teachers' formative assessments can be combined with the evaluation of the completed performance tasks or assignments to clearly demonstrate for all involved what students know, understand, and are able to do.

Webb's Depth of Knowledge Framework

Standards-based curricula describe the content, concepts, quality, depth, and breadth of attainment, as well as the thought processes expected of learners at each level of their schooling. It is the teacher's task to be sure the instruction, tasks, and assessments unpack the complexity of these expectations.

Questions that must therefore be answered include the following: *How do we have learners interact with content? What strategies could be used to engage students and extend their thinking within the content and contexts of their learning? How do we foster complex thinking and measure its development in our learners?*

Most teachers will be familiar with, and will have used, Bloom's Taxonomy (which is often characterized as a progression from lower-order to higher-order thinking) to define levels of thinking demanded by various learning tasks. Karin Hess[31] suggests that Webb's Depth of Knowledge (DOK) Framework is a more effective taxonomy for use in **fostering complex thinking and metacognition** because it asks, *"How deeply does the student have to know the content to be successful?"*

Thus, "DOK is not about difficulty; it is about *complexity*."[32] It "provides a vocabulary and a frame of reference when thinking about our students and how they engage with the content. DOK offers a common language to understand 'rigor' or cognitive demand, in assessments, as well as curricular units, lessons, and tasks. Webb developed four DOK levels that grow in cognitive complexity and provide educators a lens on creating more cognitively engaging and challenging tasks."[33]

While Webb's Depth of Knowledge Framework provides an overview of each of the DOK levels,[34] Karin Hess,[35] who has worked extensively to help make DOK accessible to educators, describes each of the levels and their purposes this way:

The four DOK levels:

1. *Recall and Reproduction:* Demonstrate recall of a fact, term, principle, or concept; or perform a routine procedure;

2. *Basic Application of Skills and Concepts:* Use information and conceptual knowledge, select appropriate procedures for a task with two or more steps with decision points along the way, solve routine problems, organize/display data, interpret/use simple graphs;

3. *Strategic Thinking:* Apply reasoning, develop a plan or sequence of steps to approach a problem that requires some decision making and justification. Often involves abstract, complex, or non-routine reasoning. Investigations may produce more than one possible answer as long as the supporting opinion, judgment, or critique is justified;

4. *Extended Thinking:* Engage in investigations with real-world applications that require time to research, solve problems, and process multiple conditions of the problem or task. May involve non-routine manipulations across disciplines/content areas and multiple sources. More time is needed for inquiries/projects/assignments at this level because it requires more complex thinking.

As when creating activities based on Bloom's Taxonomy, verbs may be used as stems to create tasks or project descriptions, for example, ***"Describe*** the habitat of a bush wallaby." With DOK, however, the depth of rigor does not depend on the verbs but on what comes after them. For example, while *Describe* is the verb used in the following samples, it is what follows that deepens the level of rigor in the task.

- DOK Level 1: *Describe* the process of _____. (Requires basic recall of facts. There is a right answer.);
- DOK Level 2: *Describe* how _____ and _____ are alike and different. (Requires application of ideas, in this case to compare and contrast);
- DOK Level 3: *Describe* why these steps were taken to solve _____. (Requires demonstration of decision making and justification of decisions made);
- DOK Level 4: *Describe* the most significant effect of _____ . (Requires extended investigation using multiple sources of information and may produce several possible answers).

To help students use more complex reasoning, DOK provides a thorough guide for planning inquiry-based units of work which incorporate engaging lessons and activities that scaffold thinking. Indeed, more complex thinking will usually be fostered when *every* learning experience incorporates all four DOK levels. This is because cognitive capacity and metacognitive skills are being developed continuously, as well as assimilated over time. In addition, when combining the four levels, teachers and students can more easily engage in formative assessment practices because they can frequently refer to the framework's continuum of complexity and cognitive demand.

SOLO Taxonomy

SOLO, which stands for the **S**tructure of the **O**bserved **L**earning **O**utcomes, was first described by John Biggs and Kevin Collis in 1982 in *Evaluating the Quality of Learning: The SOLO Taxonomy*.[36] Biggs described SOLO as "a means of classifying **learning outcomes** in terms of their complexity, enabling us to assess students' work in terms of its quality not of how many bits of this and of that they got right."[37] Pam Hook defines SOLO as "a model of learning that makes learning intentions and success criteria visible to students and teachers."[38]

SOLO provides both a structure and a process for learning. It makes both the task and the learning outcome visible, and assists students in understanding how to assess their own learning. Similar to DOK, SOLO can be used to describe the cognitive complexity of the learning assignment. In addition, teachers and learners can use the framework to assess the level of achievement of learning outcomes, as well as the level of metacognition undertaken. Furthermore, learners assessed as functioning at a specific level can demonstrate performance and thinking practices from all of the previous levels.

The SOLO Taxonomy consists of three **levels of understanding:**

1. *Surface understanding*
2. *Deep understanding*
3. *Conceptual understanding*

It also includes five clear **levels of learning outcomes,** represented by a series of symbols (See diagram at right):

1. *Prestructural:* Symbolized by a dot.
2. *Unistructural:* Symbolized by a single bar.
3. *Multistructural:* Symbolized by three unconnected bars.
4. *Relational:* Symbolized by three connected bars.
5. *Extended abstract*: Symbolized by three connected bars with extending lines.

At the *prestructural* level, learners need help to get started because they do not understand the topic of study. They are unable to organize and connect information.

Surface understanding (superficial, isolated ideas) includes the *unistructural* level of outcomes, where the learner has one idea relevant to the topic, as well as the *multistructural* level of outcomes, where he or she has several relevant ideas. At the *unistructural* level, learners are able to define, identify, and perform a simple procedure. At the *multistructural* level, they can define, describe, list, and combine. The move from *unistructural* outcomes to *multistructural* outcomes represents a quantitative increase in understanding.

Deep understanding (connected ideas) incorporates the *relational* level of outcomes, where the learner can take several ideas related to the topic and link them together. At the relational level, learners are able to formulate questions, compare and contrast, explain causes, sequence, classify, analyze from part to whole, relate ideas, and apply what they have learned.

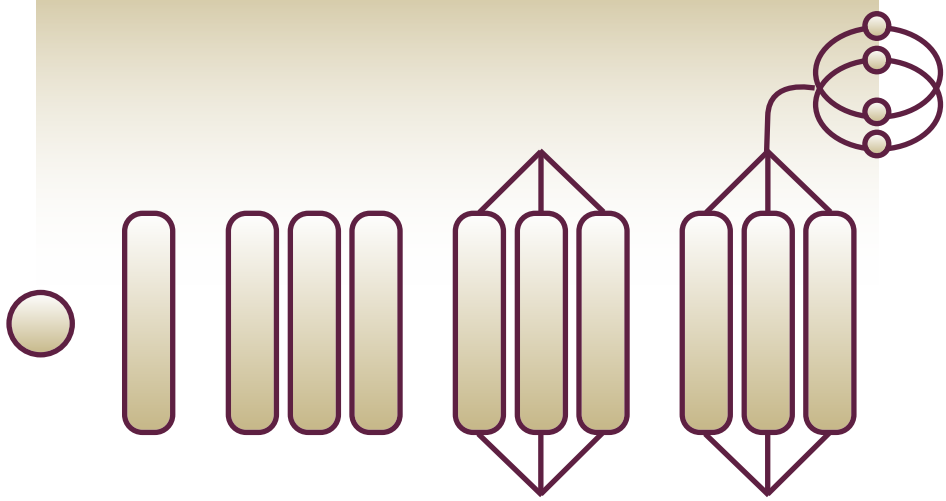
Conceptual understanding comprises the *extended abstract* level of outcomes, where the learner has taken the linked ideas and extended them. At the *extended abstract* level, learners can evaluate, theorize, generalize, predict, create, imagine, hypothesize, and reflect. The move between *multistructural* outcomes and *relational* and *extended abstract* outcomes represents a qualitative or deepening increase in understanding.

SOLO makes learning visible and can be used in a number of ways for different purposes, including the following:

- Determining learners' prior knowledge, understanding, and skills;
- Planning cognitively challenging learning tasks that provide for increasing cognitive and conceptual complexity;
- Aligning teaching to learning intentions (outcomes) and success criteria;
- Choosing and applying formative assessment and metacognitive strategies such as giving feedback and feed forward (suggestions for changes that will impact the future), and self-assessment that ensures learners make further progress in their learning.

It is also important for teachers to understand that only after the structures of SOLO are shared with students will they begin to move toward becoming reflective, responsible, and independent learners. Sharing can be done in a number of ways, the simplest of which are (1) to teach learners the symbols of the taxonomy and use them, for example to code learning intentions and activities; (2) to share and use the descriptions that have been developed to illustrate each level of understanding and level of learning outcome;

The SOLO Taxonomy



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and for younger learners, (3) to teach the series of hand signs developed by Hook[39] to illustrate each learning outcome level.

More About Metacognition

From birth, learners use their cognitive processes, and educators, during students' years of primary and secondary schooling and higher education, work with their students to nurture these skills. *But what do teachers do about metacognition?*

Simply put, metacognition is thinking about thinking. In her *Metacognition CFT Teaching Guide,*[40] Nancy Crick, assistant director of the Center for Teaching at Vanderbilt University, cites the meta research of John Bransford et al., published in *How People Learn,* where he recommends that metacognition be used as an effective approach to instruction. By tackling "thinking about thinking" in this way, teachers will foster in learners the ability to transfer and adapt new learning to new contexts and tasks.

Why is it important that educators should put importance on teaching their students to think about their thinking? What does this achieve for the learner? And how is it practiced?

A metacognitive approach to instruction is important because it "helps students become aware of their strengths and weaknesses as learners"[41] across a variety of personal, interpersonal, and social learning contexts inside and outside the classroom. To achieve at a higher level, students must be explicitly taught and "learn specific and correct [metacognitive] skills"[42] and strategies with which to monitor and improve their learning because in doing so, they become consciously competent learners and thinkers.

Metacognitive skills and behaviors can be taught specifically by applying most formative assessment strategies and by using tools and structures such as the Project Zero Visible Thinking "Introducing and Exploring," "Synthesizing and Organizing," and "Digging Deeper" routines [as described in *Making Thinking Visible*[43]]. For example, by having students access their prior knowledge through preassessments, and deciding for themselves how they might go about pursuing new learning; by showing them how to use various formative assessment and thinking routines, tools, and structures to guide and reflect on their learning; and finally, by providing them opportunities at the conclusion of each unit to look back and outline the changes to their thinking over time. Explicit teaching and modeling of these skills and strategies helps make thinking more visible to learners and provides them with ways "to talk about learning and thinking, compare strategies with their classmates and make more informed choices."[44]

A metacognitive approach to instruction is important because "it helps students become aware of their strengths and weaknesses as learners" across a variety of personal, interpersonal, and social learning contexts inside and outside the classroom.

Conclusion

Christian educators will always have a responsibility to ensure that their students develop independence of thought and action and are well prepared to live responsibly in this world while learning to serve God and others. Educators today find themselves in a climate of standards-based teaching and learning combined with the imperative to prepare students for their futures by ensuring they learn the 21st-century skills. This article has provided a brief overview of some useful frameworks: UbD, DOK, and SOLO, as well as some formative assessment and metacognitive practices.

Each of the frameworks and practices is designed to support teachers in providing rich inquiry-based learning experiences for learners. Well used, each has the potential to help teachers introduce and reinforce complex cognitive and metacognitive skills. Each (1) offers students voice and choice about their learning; (2) provides both teachers and learners with the opportunity to strengthen their use of formative assessment practices; (3) ensures that learning and thinking are made visible and accessible to all learners; and (4) has the potential to make a significant impact on student achievement.

When we open our teaching and learning "toolboxes" to powerful inquiry-based planning models and frameworks; consistently and intentionally use formative assessment practices; deliberately make teaching and learning visible for our students as well as ourselves through the use of multiple strategies for developing complex cognitive and metacognitive habits—when, indeed, all of these are made central to effective, engaging instruction and the processes of learning in our classrooms, then we will be taking giant steps toward achieving our goal of ensuring our students become reflective, independent, lifelong learners, ready for their place in this world and the world to come.

This article has been peer reviewed.

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Continued on next page

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Using Questions to Drive Inquiry

How do you encourage students to ask higher order "fat" questions (as opposed to lower-order "skinny" questions) that will help them with their investigations?

It seems so easy: Just ask a question, and students will get to work figuring out the answer. Voila, inquiry is occurring! Unfortunately, it's much more complex than that to facilitate critical thinking in the classroom. A significant part of inquiry-based learning rests on the questions teachers and students ask themselves and others. Asking a great question is fodder for the type of thinking every teacher hopes students learn to do.

Questioning Gone Wrong

Before we focus on the type of questions that get students thinking, it's important to note those that don't. A common, but ineffective, questioning approach is known as I-R-E.[1] The teacher *Initiates* a question, a student (or students) *Respond*, and the teacher *Evaluates* those responses. Students call this "guess what's in the teacher's brain," and only a few of them in any given classroom are willing to play the game. For example:

Teacher: Why did Marty (a character in the book *Shiloh*[2]) steal the dog from Judd Travers? Joseph?

Joseph:[3] Because Judd Travers was not a good owner.

Teacher: Good. But what was he doing that made him a bad owner? Brandi?

Brandi: He beat the dog and had him on a chain all the time.

Teacher: Right. Why did Judd do that to his dog?

And the game continues, with students answering questions for which the teacher already knows the answers.

Before we go too much further, it's important to note that literal questions do have a place in the classroom. But limiting a lesson to these types of questions will not ensure that students think deeply. In this article, we offer advice about two types of questions that can facilitate students' deep thinking while also recognizing other types of questions can do the same thing.

Essential Questions

An essential question is just that: a question. But it's a question for which there is no clear-cut right answer. As Jay McTighe and Grant Wiggins[4] noted, an essential question:

1. Is *open-ended;* that is, it typically will not have a single, final, and correct answer.
2. Is *thought-provoking* and *intellectually engaging*, often sparking discussion and debate.
3. Calls for *higher-order thinking*, such as analysis, inference, evaluation, prediction. It cannot be effectively answered by recall alone.
4. Points toward *important, transferable ideas* within (and sometimes across) disciplines.
5. Raises *additional questions* and sparks further inquiry.
6. Requires *support* and *justification*, not just an answer.
7. *Recurs* over time; that is, the question can and should be revisited again and again.

Essential questions encourage inquiry and discussion, disagreement

BY DOUGLAS FISHER and NANCY FREY

and disequilibrium, and above all a humbling acceptance that some matters are never truly settled. In schools whose teachers and administrators truly believe in critical inquiry, the curriculum is organized around essential questions that the students propose and vote on. The adults in the school get no vote on these essential questions; only students do (in many schools, it is the adults who select the questions). In most schools that use essential questions, the entire school focuses on the same question at the same time, differentiating readings and lessons based on the ages of the students. At our school, Health Science High and Middle College in San Diego, California, grade 9 to 12 students selected the following essential questions for the 2015-2016 school year (one per quarter):

1. Who do you want to be? What do you want to be?
2. What's your story?
3. Which is stronger, mind or heart?
4. What defines beauty?

Students are expected to read widely to determine their personal response to the question, incorporating ideas from all of their classes. Wide reading builds background knowledge and vocabulary. Simply said, readers who read a lot know more about the world. In addition, readers who read a lot end up asking more questions and for broader purposes, rather than simply reading to locate answers to specific questions. For example, Raquel, a 6th grader, read *Wonder*[5] as part of her reading selections in response to the essential question, "What defines you?" Interestingly, Raquel also developed her own question, namely the way in which disability defines a person, and she read a lot of books on the topic during the nine-week investigation.

My Shadow*
By Robert Louis Stevenson

I have a little shadow that goes in and out with me,
And what can be the use of him is more than I can see.
He is very, very like me from the heels up to the head;
And I see him jump before me, when I jump into my bed.

The funniest thing about him is the way he likes to grow—
Not at all like proper children, which is always very slow;
For he sometimes shoots up taller like an India-rubber ball,
And he sometimes gets so little that there's none of him at all.

He hasn't got a notion of how children ought to play,
And can only make a fool of me in every sort of way.
He stays so close beside me, he's a coward you can see;
I'd think shame to stick to nursie as that shadow sticks to me!

One morning, very early, before the sun was up,
I rose and found the shining dew on every buttercup;
But my lazy little shadow, like an arrant sleepy-head,
Had stayed at home behind me and was fast asleep in bed.

*http://www.poets.org/poetsorg/poem/my=shadow.

Text-dependent Questions

At a more lesson-specific level, text-dependent questions have the potential to facilitate inquiry and critical thinking. Text-dependent questions require a careful reading of the text so that students can produce evidence in their verbal or written responses. There are several ways to structure questions so that students return to the text to find evidence for their responses. Our experience suggests that these questions should not be focused solely on recall. Rather, emphasis should be placed on using explicit and implicit information from the text to support one's reasoning.

At least six categories of questions can be used to structure a progression of text-dependent questions that move from explicit to implicit meaning, and from sentence level to whole text and across multiple texts. Some of these question types may not be suitable for a particular reading; all of them do not need to be used with every piece of text.

These questions can be organized into three phases:[6]

- What does the text say?
- How does the text work?
- What does the text mean?

It's important to note at this point that text-dependent questions are meant to be used in fostering collaborative conversations. Unlike the I-R-E process described earlier, text-dependent questions should engage students in thinking and talking, not just responding to the teacher. We believe that while beginning at the literal level is important, this should not be the end-point. Rather, as soon as students understand the text at the literal level, the teacher should move the questions to the structural level. In one class, this may require 10 minutes of discussion and investigation; in another classroom, three minutes; and still another, 22 minutes. Students' discussions about text-dependent questions should signal the teacher regarding the appropriate time to push the thinking deeper. Of course, students can also ask text-dependent questions of themselves and each other as they learn to read and think this way. We have found that they do so after they have experienced this type of learning over time.

In the next section, we will describe each of the types of questions and provide example questions from the poem, "My Shadow"[7] by Robert Louis Stevenson, focusing on students in grades 4 and 5.

General understandings. These questions get at the gist of the text. What does the author want us to know or understand from the content of the poem or prose? Often, these questions focus on the (1) main claim, as well as the evidence used to support it, (2) the arc of the story, or (3) the sequence of information. For Stevenson's poem, the teacher might ask: *What is the subject of this poem? Is the narrator a boy or a girl? How do you know?*

Key details. These questions focus on important details the author uses to inform the reader. Thus, these questions often include *who, what, where, when, why*, or *how* in the stem. They can also include more nuanced details that add clarity to the reading. Key detail questions tend to focus on information presented directly in the text, which is important enough to warrant a question. These are recall questions, and by themselves would not make for a strong lesson. For the poem, a teacher might ask: *When does the shadow appear? What is the "funniest" thing about the shadow? What happens to the shadow in the last stanza?*

Vocabulary and text structure. Some of the questions that students must consider revolve around the vocabulary used by the author,

as well as the structure of the text itself. Text structure questions require that students consider the organization of the reading, such as the use of problem and solution or character dialogue to propel action. In asking questions related to vocabulary, teachers must be sure to include both denotation (definitions) and connotation (the idea or feeling that a word invokes). In addition, as appropriate, the questions may focus on shades of meaning, word choice, figurative language, idioms, and confusing words or phrases. Finally, questions can provide students with an opportunity to use context or structural clues to determine the meaning of unknown words. For the poem, a teacher might ask: *Describe what the shadow looks like. Is it always the same? What is a* notion? *The narrator says the shadow is not like "proper children." What does* proper *mean?*

Author's craft and purpose. This area of questioning relates to the choices that authors make as they write. Topics include the genre of the text, the role of the narrator, as well as literary devices. In addition, understanding the overall purpose of the text guides students in following the flow of the reading. Readers should understand whether the text is meant to inform, entertain, persuade, or explain something to them. In some situations, the text has a specific bias or provides only part of the story. When this occurs, students could be asked about the perspectives not explored in the text. For the poem, a teacher might ask: *Does this poem rhyme? How does this affect the tone of the text? What does the narrator call his shadow? When the shadow is described and shooting "up taller like an India-rubber ball" and getting "so little that there's none of him," what's actually happening?*

Inferences. Some of the questions students need to consider will require them to understand how the parts of a text build to a whole. This probes each argument in persuasive text, each idea in informational text, or each key detail in literary text. Importantly, inference questions require that students have read the entire selection so that they know where the text is going and how to reconsider key points in the text as contributing elements of the whole. For the poem, a teacher might ask: *How does the narrator feel about his shadow? How do you know? Does the narrator think of this shadow as being a part of himself? Why or why not?*

Opinions, arguments, and intertextual connections. The final category of text-dependent questions should be used sparingly, and typically comes after students have read and reread a text several times to fully develop their understanding. Readers should develop opinions about what they read, and they should be able to argue their perspective using evidence from the text and other sources, experiences, and beliefs that they hold. For this poem, a teacher might ask: *The narrator says of his shadow: "what can be the use of him is more than I can see." Do you think he actually thinks shadows are useless? Think about your own shadow. Does it do some of the same things the shadow in the poem does? Which ones?*

Conclusion

Teachers can use essential questions and ask text-dependent questions to encourage critical thinking and facilitate inquiry. Having said that, we recognize that there is more to this type of learning than one question or even 10. Habits must be built, and expectations must be set. Procedures must be taught. And teachers have to trust the process. We felt that it would be helpful to other teachers to show how we focus on questions because we have seen the power in using the just-right question to engage learners.

This article was commissioned for this issue.

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Promoting Critical Thinking in Early Childhood:

Inquiring Minds Want to Know

"As children, our imaginations are vibrant, and our hearts are open. . . . Everything amazes us, and we think anything is possible. We continuously experience life with a sense of newness and unbridled curiosity."—Yehuda Berg.[1]

From birth, young children are naturally curious. Their world is an exciting place, filled with new things to explore, and they are filled with wonder, discovery, and an innate yearning to understand the "whys" and "hows" of the way in which the world works. This process of discovery and making sense of the world is known as *inquiry*. "Inquiry is a dynamic process of being open to wonder and puzzlements and coming to know and understand the world."[2] It is a hands-on process in which children are involved in their learning, formulate questions, investigate, and then build new understandings, meanings, and knowledge. Inquiry is a way of teaching that encourages children to learn by asking questions, exploring ideas, solving problems, and discovering how things work.[3]

Understanding the development of inquiry in young children provides the teacher with useful information needed to design the classroom environment, plan for instruction, and assess the impact of inquiry-based practices on the achievement of young children.

Gonya[4] describes the Stages of Inquiry Development as shown in Table 1.

Research suggests that inquiry-based teaching and learning promote increased creativity and enhanced ability to solve problems. As a result, young children are more actively engaged in their learning, improve their language skills, and develop more positive social interactions. In addition, inquiry helps children to create "habits of mind."[5] Often, inquiry-based learning skills are "retaught" to children as scientific methodology when they are older. However, if teachers understood how children naturally and intrinsically learn, they will be less prone to suppress the curiosity and sense of wonder in children, and will be in a better position to build upon and expand these naturally embedded skills into those of inquiry-based learning. If we, as educators, can harness the natural curiosity of children, we will help them develop critical thinking skills and facilitate inquiry while fueling their natural passion for learning.[6]

Classrooms where teachers emphasize inquiry-based learning have the following characteristics:[7]

- Inquiry occurs in the form of authentic,

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Table 1. Stages of Inquiry Development and Age-based Examples*

Stages of Inquiry Development	Example
Infants investigate by observing.	Zoe sees the sunlight as it shines through the windows.
Toddlers investigate by observing and doing.	Elijah opens the shade, and sunlight shines through the windows. When he closes the shade, the room is dark.
Preschoolers investigate by observing, doing, and questioning.	Mariah stands in front of the window. "What shadows can I make?" she wonders. "Do all things make a shadow? Why isn't the shadow the same all the time?"
Elementary-age Students investigate by observing, doing, questioning, and discovering or seeking answers.	Grant wants to find out why and how the sun rises and and sets in a pattern. He wants to know, "How does this affect shadows?" Grant looks for books in the library about the Sun.

*Jennifer Gonya, "Turning Curiosity Into Inquiry: An Early Childhood Best Practice" (Resources for Early Childhood: An Online Resource for Ohio Educators, 2007), p. 5: http://rec.ohiorc.org/record/10316.aspx. Accessed November 18, 2015.

real-life experiences within the child's natural environment.

- The learning environment is filled with materials that support inquiry.
- Inquiry capitalizes on student curiosity.
- Data and information are actively used, interpreted, refined, digested, and discussed.
- The inquiry connects to family and community.
- Inquiry is integrated across the curriculum.
- Teachers consistently model the behaviors and language of inquiry. Children are major participants in their learning.
- Teachers and children interact frequently and actively.
- Children are encouraged to communicate their curiosities.
- Teachers approach inquiry with enthusiasm and excitement.

Developing Inquiry Skills in Young Children

Although curiosity and exploratory play come naturally to children, inquiry does not. For one to grow into the other, teachers must intentionally support and guide children as they explore their environment. Teachers can encourage the inquiry process in varying ways such as building a foundation of inquiry and modeling the skills and language of inquiry.[8] While there are several approaches to fostering inquiry-based teaching and learning, I will focus on two essential practices: Play-based Learning and Creating the Environment.

Play-based Learning

The benefits of play have been recognized by the scientific community. Evidence indicates that "neural pathways in children's brains are influenced and advanced in their development through exploration, thinking skills, problem solving, and language expression that occur during play."[9] Research also demonstrates that play-based learning leads to greater social, emotional, and academic success. Thus, experts recommend that play not be separated from learning. When children are engaged in purposeful play, they are discovering, creating, and expanding their learning.[10] The teacher should take advantage of students' high interest and engagement in play by centering the curriculum, the lessons, and the activities on topics of interest, while also incorporating standards-based goals and objectives for children's learning into well-planned play experiences. The teacher should also be an active participant in the child's play. While children are engaged, the teacher should observe, support, and extend their play, make connections to the concepts being explored, and promote inquiry. In order to do this, the teacher could do the following:

- Create time in the daily schedule for discussion and reflection on shared and individual child experiences;
- Engage in "teacher talk," intentionally seeking opportunities to verbally state ideas, questions, and findings. (See Table 2.) Everything teachers say can influence what children learn. Intentional, purposeful conversations support children's overall development. Teachers should intentionally orient their classroom talk to encourage their students' engagement in a particular activity, to extend their vocabulary, and to promote their social and emotional development.[11]

Table 2. Teacher Talk Example[12]

- Explain your own thoughts as you approach an investigation. For example, in art class, say, "I wonder what would happen if I mixed the red paint with the yellow paint."
- Choose richer vocabulary. Instead of saying, "Let's make a picture of the ocean," you could say, "Let's make a mural about ocean creatures."
- Give clues about what words mean. "That block tower is gigantic! You can't even see over the top!"
- Encourage children to think of multiple solutions. "How else could we . . . ?"
- Make predictions. "What do you think will happen if . . . ?"
- Verbalize children's feelings. For example, you might say, "You look sad. Are you sad because we have to go inside?" Ask them to confirm or to identify terms that more accurately describe how they feel.
- Use completion prompts during reading. For example, you can start a familiar phrase, "I'll huff and I'll puff and . . . ," then allow the children to complete the prompt.
- Use recall prompts, encouraging the children to recall previous events such as "Do you remember where we went yesterday?"
- Ask "Wh" questions–Who, What, When, Where, Why.

▪ Document students' experiences, observations, and conclusions in order to determine each child's progress in mastering vital skills, and to identify areas in which further skill development is required, as well as to determine ways to modify, enhance, or extend learning experiences.

Creating the Environment

Creating an inviting learning environment supports children's social, emotional, physical, intellectual, and spiritual growth and development. Welcoming surroundings enhance children's disposition toward learning and give them a sense of belonging.[13] Purposefully planned learning spaces also encourage children's curiosity as well as their sense of discovery, and prompt communication. Creating an environment that facilitates play, promotes engagement, encourages social interactions, and stimulates learning is critical to the development of inquiry.[14] Creating engaging environments that promote learning is more than simple room arrangement. Learning environments include indoor and outdoor spaces, as well as materials and resources. Engaging environments encompass the values of play, large and small muscle activity, creativity and performing, messy and sometimes loud play, opportunities to resolve conflict and activities that are hands-on.[15] Indoor and outdoor spaces that promote and facilitate inquiry should include:

▪ welcoming spaces for children, families, and educators;

▪ transition spaces for moving indoors and outdoors;

▪ inclusion of children's perspectives in the design;

▪ areas to display children's projects and creations;

▪ adaptive design features to accommo-

date persons with disabilities;

- spaces for small, active groups;
- places that encourage interaction and relationship building;
- private, quiet spaces for talking, thinking, and planning;
- natural materials such as tree stumps, branches, plants, and water to enhance and define spaces;
- habitats for insects, birds, or other animals.[16]

Creating an engaging environment combined with a variety of learning experiences provides opportunities for children to practice formulating their own questions and seeking answers. For example, a simple walk outside can often spur a variety of questions, such as "How do ants build their home?" or "Why are flowers different colors?" Other experiences, like having a classroom pet, growing a class garden, or placing bird feeders outside the window, also offer opportunities for children to practice the process of inquiry. And practice is vital if children are to establish this inquiry "habit of mind." Once they do, they will use it in a multitude of settings and throughout life.[17]

Conclusion

Implementing a process approach to inquiry often involves a transformation in the way in which we think about how children learn, how we deliver instruction, and in the way our schools are organized for teaching and learning.[18] Challenges to inquiry-based practices include time for planning and collaboration, managing the classroom during less-structured activities, and understanding how to balance child-directed experiences with teacher-directed experiences.[19] However, a commitment to the approach, a quest for more knowledge, and a better understanding of the process, as well as support from leadership, staff, and the families served, will aid in transforming the school culture and the classroom environment.[20]

Curiosity is a natural part of young children's lives, and when nurtured and encouraged, it can grow into something even more meaningful. Early-childhood programs are where the journey from curiosity to inquiry begins. Ellen G. White stated that "Small children should be left as free as lambs to run out-of-doors, to be free and happy, and should be allowed the most favorable opportunities to lay the foundation for sound constitutions."[21] She further advised, "let the little ones play in the open air; let them listen to the songs of the birds, and learn the love of God as expressed in His beautiful works."[22] The world is a natural learning environment, providing children with many opportunities for discovery about the world around them, the God who loves them, as well as mental, physical, social, and emotional growth. Fueling the curiosity of young children and then joining them in the inquiry process is the beginning step in developing a joy for learning, a desire to know more, and the ability to grow in knowledge, understanding, and wisdom.

This article has been peer reviewed.

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21. Ellen G. White, *Fundamentals of Christian Education* (Nashville, Tenn.: Southern Publ. Assn., 1923), p. 21.

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Promoting Inquiry in the Elementary Classroom

The brain likes novelty. What does this look like in your classroom as glue to retention?

"Tell me and I forget, teach me and I may remember, involve me and I learn."

~Ancient Proverb[1]

Several classes from Rogers Adventist School in College Place, Washington, had just returned from a field trip to McNary Dam in Umatilla, Oregon. Students gathered in the classroom to discuss what they had learned. A question was posed to the students: "How was learning today different from a day in the classroom?"

"We learn when we make little clay models or do experiments, but we learn more when we go there," responded Ray,[2] a 4th-grade student. Ryan, also a 4th grader, thought for a moment then spoke; "We learn more from being there. It is like *Līve Learning*." Students agreed as they repeated the new words, "*Līve Learning*," which would become a key to how we study in our classroom. Two years later, the term has been handed down, and students refer to *Līve Learning* as if it were a learning strategy they had always known.[3]

Just as primary sources are often the best, learning is optimal when students can visit the learning site. But teachers may face time and money constraints. It is simply not possible to tour any and every part of the world that fits the current curricular topic in order to learn the history and geography of the area. *Līve Learning* (learning from actually being there) is inquiry-based learning at its best; however, since this is not always possible, then the next best thing is for students to dig into the subject, exploring areas of interest and sharing their findings with their classmates. Inquiry-based learning provides such a learning experience.

With the wealth of information available on the Internet, and knowing that the knowledge base of many subjects is constantly changing and expanding, students in classrooms today need to know how to find knowledge and apply it. Inquiry-based learning helps to develop the skills needed to become a lifelong learner. When the learner is actively involved in the process, the activity has more meaning than when information is fed through textbooks and what the teacher has gleaned.

BY AUDREY MAYDEN CAMPBELL and JOY BRUNT VEVERKA

How Do I Begin?

Step 1: Choose a Question

Inquiry-based learning begins with a question. Students choose a question they want to answer or a topic about which they wish to learn more. This step can take some time but helps to ensure student motivation regarding the project. Students start by perusing the topic to be studied, asking what they would like to know. At first, it may be necessary for the teacher to offer some suggestions. But as students become more comfortable with this type of study, they will begin to ask their own questions. As information is gathered, they either narrow or broaden their topic to a manageable scope and size. This can be done by using books, interviews, magazines, encyclopedias, videos, Websites, or even their textbooks. What kinds of questions lead to a good project? Questions cannot deal with a simple fact or something that is already known. Neither can they be something that can be answered by a quick Internet search. The questions must have an objective base for an answer. Finally, the questions can't be too personal. They should lead to deeper understanding and to conclusions worth sharing with others. Whenever students can share their research outside of the classroom, the authenticity makes the inquiry valuable and credible.

Step 2: Do the Research

Once a topic is chosen, students search for resources to help them learn more about their topic. Books, magazines, encyclopedias, textbooks, and the Internet can be used for research. Students may also have access to an online research database such as EBSCOhost or CultureGrams (see sidebar on page 23). Other research sources might include personal interviews. As students compile and cite their research, they may slightly alter or even change their questions. It is during this step that the students need to delve into a variety of sources.

Step 3: Interpret Information

Students take notes and write down information that helps answer their questions or further their inquiry. This is when students learn to cite their sources and interpret information. As they locate information, they copy down the bibliographic information for each source they have used and take notes on the content. If students are using the Internet to find sources, they can open a Word document and copy and paste their sources as they find them. In this step, students learn to look critically at the facts they find. Is the information from a reliable source? Is it from a primary or secondary source? Is the information broad enough and deep enough to lead to sound conclusions? Students can check source against source, comparing facts for validity.

Step 4: Report Findings

When research is completed, students choose methods to share their findings. Reports—either written or verbal, PowerPoint presentations, Prezi (a Web-based presentation software), posters, displays, and brochures—

Students put the finishing touches on a PowerPoint presentation to share with classmates.

are some of the Web-based ways to share. Other students may choose to write skits or plays, create models, publish a book, or plan an event at an outside-of-school venue.

Putting the Plan Into Action

I (Audrey) collaborated with a colleague (Joy) and her students on an inquiry-based project. The students were learning about the Southeastern states of the U.S. in their social studies class. We discussed how to begin this project and decided that we would conduct a brief overview of the states. When this was accomplished, students brainstormed other aspects or information that they wanted to know about this geographical area. During a brainstorming session, all ideas were placed on the board without discussion or judgment. Those ideas were projected onto the board so all students could read them. Soon it became apparent that the questions fell into six or eight categories, so after creating headings, we divided the statements into the categories selected. These categories included architecture, food, places of interest, weather/climate, industry, wildlife, and geographical features. Next, the students chose the category about which they wanted to learn more and were separated into groups of three or four.

The students were excited! We brought books on the different topics into the classroom for the students to use, and they also referred to the CultureGrams database (see sidebar on page 23) for research during

Students in Joy Veverka's classroom utilize a variety of materials to create answers to their inquiries.

their computer time. Some students also used their textbooks to find background information.

As they wrote down their information, we seized the teachable moments to talk about using one's own words and not copying someone else's words. Students learned that credit needs to be given to authors, that just changing a few words does not make writing their own.

A few of the students needed some guidance, but most involved themselves in the subject and appeared excited to be working on the project. Soon we began asking them how they would like to share their project information with the class. A group that was learning about wildlife in the ocean came up with the idea of developing sketches of the leatherback turtle and manatee drawn to scale in order to show the size of each. Other students found video clips to share or worked on presentations. In the process of creating reports, students learned to copy and paste information on the computers.

Over a one-week period, students shared their work in a variety of ways: Some used PowerPoint, some made posters or models, some gave oral reports, and some illustrated their presentations with photos or videos, while others prepared food items to taste.

Following the presentations, the students participated in a discussion about the projects they had just completed. Students talked about how much they had learned and their enjoyment in working on the projects.

Joy Veverka's 3rd- and 4th-grade students engage in inquiry-based experiences that help them develop skills such as learning how to create research questions, gather evidence, interpret information, cite sources for both, and work collaboratively to present information.

Audrey Campbell and the 3rd- and 4th-grade students listen to a poster presentation. Students also used PowerPoint presentations, models, oral reports, video- and photo-illustrated works, and prepared food items to share their findings.

They felt that they had learned more than if the topic had been textbook-driven. All agreed that the learning experience had been fun, and they wanted to have more opportunities using an inquiry approach.

Challenges to Implementing the Inquiry-based Approach

Topic Selection

Inquiry-based learning may seem a bit difficult at first for the teacher. Students may not choose the same areas of study that the teacher has in the past. Their questions and inquiries may take them to unusual topics. For example, students did not always select areas that I (Joy) felt were important. They skipped over one of my favorite places in the southeastern United States, Savannah, Georgia. However, they discovered other fascinating facts. One group, researching food, discovered the Barter Theatre in Abingdon, Virginia. Still in existence today, it began during the Depression when northeasterners, who were out of jobs and money, came to perform in exchange for food, something of which the cash-poor farmers in the area had plenty. Cooper Schroeder, a 3rd grader, even made a model of the Barter Theatre. As the project progressed, it became evident that they were studying in depth, covering required curriculum, but in their way rather than mine, a way that made it come alive for them.

Scheduling

Teachers may wonder when they will have time for inquiry-based learning and how they will fit it into their program. Granted, it takes increased teacher engagement during the time students are working with their project. Students will be working on a topic for a few weeks, and during that time, there will be no daily assignments to grade for that subject. Stages of a project are checked off along the way, and partial grades can be given. Rubrics are great tools that should be used throughout the process and can be used to help calculate the final grade for the finished project.

Inquiry-based learning is front-loaded in that the teacher is involved in gathering materials, establishing rubrics, and planning how to use the allocated time. Since students are researching, preparing, evaluating, and presenting, many aspects of the curriculum are covered at one time. Content areas such as science and social studies are investigated and researched using the tools taught in skills subjects such as technology and language arts. When subjects are combined, or integrated, time becomes less of an issue than it is when each subject has a specific time frame.

Some teachers may feel that this approach will take time away from addressing content standards, and may worry about how well students

will perform on standardized tests since specific subject matter might not have been covered in the inquiry-based learning projects. It is important to note here that standards serve as a guide and represent a recommended level of understanding. Inquiry-based learning requires that teachers plan ahead to ensure that students' reading, writing, and thinking skills will be strengthened in the process. As a result, students participating in inquiry-based learning will engage with content beyond what is required, and in many cases do much better on standardized tests.[4]

Student Engagement

While most students are excited to be involved, at times there may be students (one or two) who are not engaged or do not pull their weight. A one-on-one conversation with such students may help them find something about which they are passionate, or simply a method of research with which they can feel confident. Inquiry-based learning provides the diligent student the opportunity to dig deep into subject matter, while at the same time providing the more reluctant student with multiple opportunities for success.

Conclusion

While *"Līve Learning"* provides the optimal opportunity for students to learn new content, it is not always possible for teachers and students to leave the classroom and physically travel to new places. Inquiry-based learning allows teachers to plan for student engagement with new content by utilizing the vast body of information currently available online through sources such as EBSCOhost, CultureGrams, and a variety of other resources. (See box at right.) This approach allows students to develop their inquiry skills as they pursue topics of interest, ask questions, and search and find answers. Ultimately, there is increased teacher and student engagement which enriches the learning experience and helps create lifelong learners.

This article has been peer reviewed.

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Joy Brunt Veverka, M.Ed., *is the 3rd- and 4th-Grade teacher at Rogers Adventist School, where she has taught since 2002. Mrs. Veverka has taught in a variety of school settings, including secondary, small schools, single elementary, departmentalized, and multigrade classrooms. For 13 years, she taught classes for Walla Walla University.*

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1. The source of this quote has been debated. For this reason, we are citing it as an ancient proverb.

2. The students' real names are used with permission.

3. Since the inquiry described in this article, Joy Veverka's classroom has utilized inquiry-based learning exclusively. She uses Project-Based Learning (PBL) and STEAM (science, technology, engineering, arts, and math) as learning strategies and methodologies. Resources such as Website Validity (http://acoachma.tripod.com/) and Youth Learn: Technology, Media, and Project-based Learning to Inspiring Young Minds (http://www.youthlearn.org/learning/general-info/our-approach/intro-inquiry-learning/intro-inquiry-learning) continue to be staples in her classroom.

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Research Tools

EBSCOhost

EBSCO, an online database designed for research, offers a broad range of periodical articles, eBooks, biographies, and professional journals: https://www.ebscohost.com/schools.

CultureGrams

CultureGrams from ProQuest K-12 provides up-to-date information on every state, province, and country in the world: http://www.culturegrams.com/

Identifying Appropriate Websites to Use in Research

- Is the site professional? Are there any errors?
- Who is the author? Is he or she qualified in the subject? Are his or her credentials listed?
- Is the site current? How recently has it been updated?
- Is the site copyrighted?
- Can you find the same information on other similar sites? Do the links support the information?

Source: http://acoachma.tripod.com/.

For Additional Information*

Inquiry-Based Learning: http://www.inquiry-based.com/teacher-resources.html.

Neil Stephenson, "Introduction to Inquiry Based Learning": http://www.edutopia.org/resource/casey-techinquiry-inquiry-based-learning.

Pins on Inquiry-based Learning: https://www.pinterest.com/. (Because pins change often, it is not possible to list a specific pin. However, there are some very useful PowerPoints on this topic.)

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*Websites accessed November 9, 2015.

Critical Inquiry in *ByDesign Science:*

10 Reasons to Like the *ByDesign Science* Texbooks

Teacher! Teacher! What made that happen?"

When students begin to question the phenomena that they have observed, much of the task of teaching is complete, and learning begins. Inquiry teaching methodology seeks to lead students on that quest.

ByDesign Science is a new customized faith-based inquiry science program for grades 1 to 8. This hybrid (print and digital e-book) science program has been developed for traditional and nontraditional classrooms. The program was developed by the Seventh-day Adventist Church's North American Division (NAD) Office of Education in collaboration with KendallHunt Religious Publishing.[1] The *ByDesign* elementary science textbook series stages the questioning, exploring, and explaining inquiry process to maximize the "teachable moments" in each student's science education. This process is implemented within the context of the Adventist worldview.[2]

Aligned with the new NAD science standards, *ByDesign* has been developed for traditional and nontraditional classrooms. The program is built on a foundation of inquiry that encourages wonderment, questioning, collaboration, and exploration of multiple resources to conduct research and investigations. This engaging, rigorous, and developmentally appropriate curriculum nurtures children's natural curiosity as they explore the wonders of God's creation through the lens of the Bible.

After serving as a member of the *ByDesign* series review team and listening to teachers talk about their experiences, I compiled a list of the top reasons to like the new science series:

Top 10 Reasons to Like *ByDesign* Science Textbooks

1. ***Scripture and the Adventist worldview are integrated parts of the curriculum.***

In the early stages of developing this new series, it became apparent that since every science concept impacted our worldview, it would be impossible to have a science text with only a Bible scripture or religious nugget in each chapter. The committee's discussion determined that the presuppositions were not an add-on but a part of the rich biblical heritage needed to explain basic science concepts.

2. *Questions are the heart of the* ByDesign *curriculum* (see Chart 1).

The level and tracking of questions were intentional in the development of this series. Each question was tabulated, and the pacing of questions that students would encounter was put where it would have the maximum benefit.

3. *Inquiry-based instruction saturates the curriculum* (see Chart 2).

All four levels of inquiry are used throughout the curriculum. The use of directed and structured inquiry predominates as students learn the language and processes of science. As students become more proficient, they can begin to ask their own questions and inquire through guided and open inquiry.

4. *Multigrade organization is available.*

Continued on page 26

BY JERRELL GILKESON

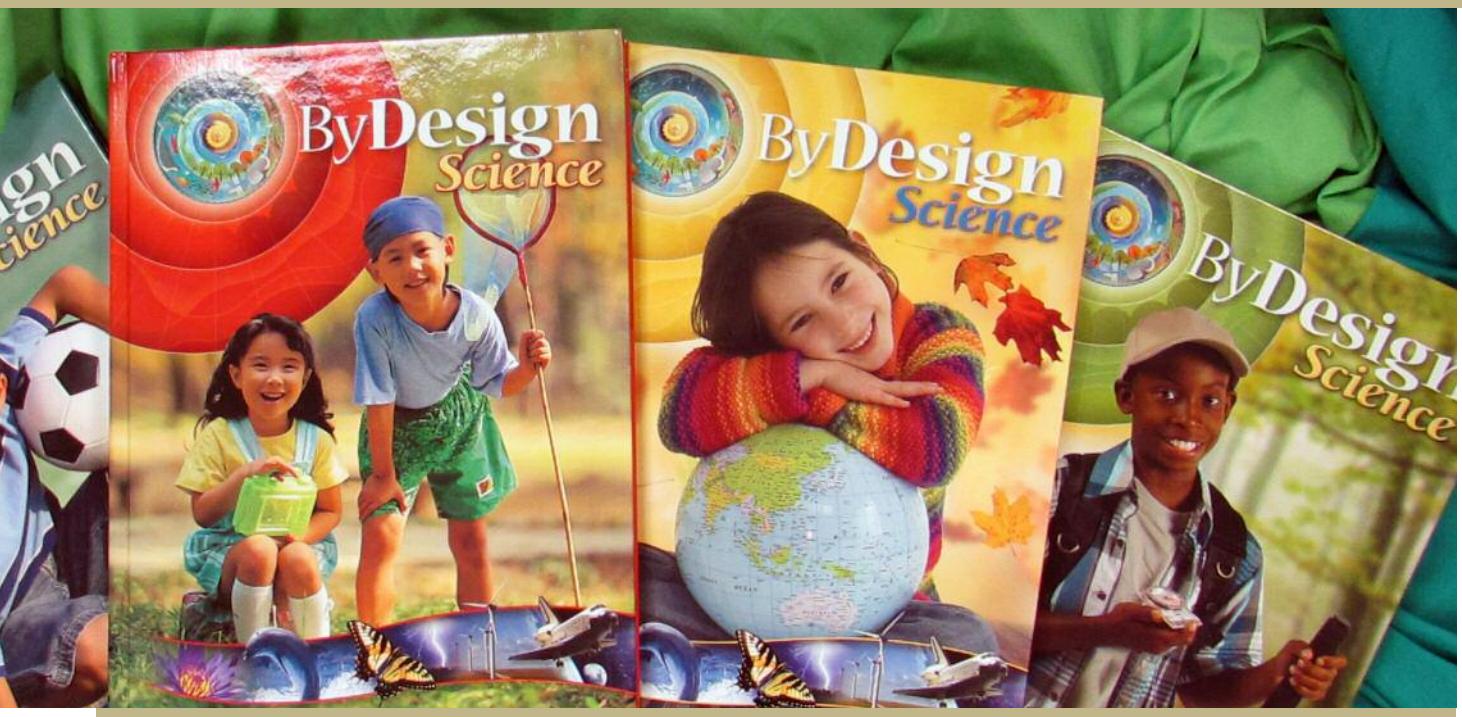

Chart 1. LEVELS OF QUESTIONS

LEVELS OF QUESTIONS	COMMON FRAMEWORK QUESTIONS	CORRESPONDING SCIENTIFIC AND ENGINEERING PRACTICES	BLOOM'S TAXONOMIC LEVEL
Factual Questions Asks students what is known and understood.	Factual/Convergent	Asking questions and defining problems Using mathematics and computational thinking	Knowledge Comprehension
Questions About Hypotheses Asks students what can be predicted and tested.	Convergent	Asking questions and defining problems Planning and carrying out investigations Analyzing and interpreting data	Comprehension Analysis
Inference Questions Asks students to go beyond the immediately available information.	Divergent	Developing and using models Constructing explanations and desiging solutions	Application
Interpretive Questions Asks students "What are the consequences?"	Evaluative	Engaging in argument from evidence Using mathematics and computational thinking	Analysis
Reflective Questions Asks students "How do I know I know?", "What do I still not know?", "What do I assume?"	Evaluative/Divergent	Obtaining, evaluating, and commucating information	Evaluation
Transfer Questions Asks students to take their knowledge to new places and to act on their knowledge in real-life situations.	Divergent	Constructing explanations and designing solutions Developing and using models	Synthesis

Created by Dan Wyrick, Director of Nature by Design Learning, and adapted from materials developed by Dennis Palmer Wolf.

The curriculum features a four-year cycle for the Grades 1 to 4 and Grades 5 to 8 student, and teacher multigrade resources.

5. *Science methodology is taught at every level.*

Science laboratory procedures, equipment, recording of data, and examples of great scientists' processes of discovery are all included in this series.

6. *Lab journaling is central to the learning process.*

Good science practice requires meticulously recording observations of all activities. This skill is emphasized throughout the Next Generation Science Standards for K-12 science.[3]

7. *Delivery is available in print and in e-book formats.*

Print and e-book resources are available for teachers and education associates. These are accessible once the series is purchased. E-book formats include flash applications for PC and Mac, and an HTML application for iPad. Resources are supported by Mac, PC, iPad, Tablet, Kindle, and Samsung Android.

8. *Teacher Editions (TEs) offer inquiry, instruction, and assessment in one location.*

The TE for each grade brings together the tools needed for lesson planning. The Big Ideas, Lesson Goals, and a plethora of tools—including features that address multiple intelligences, English language learners, language-arts writing support, differentiated instruction, vocabulary, scaffolding, and assessment—are all included.

9. *Health Challenges bring the physiological science concepts under study into students' daily lives.*

The science concepts become reality to students as they look at their own physical health.

10. *These beautiful books appeal to students and feature clear, up-to-date pictures, tables, and illustrations throughout.*

Many teachers have said this is one of their favorite aspects of the curriculum and a main reason why this series needs to be in their classrooms. When students see the books, they want to explore, discover, and read them.

Concerns

Yet, while there is excitement about the new series, there are two concerns:

Chart 2. LEVELS OF SCIENCE INQUIRY

LEVEL	DESCRIPTION	QUESTION?	METHODS?	SOLUTION?
1	**Directed Inquiry** You will confirm a science principle with an inquiry. You will likely know the expected results before you begin.	X	X	X
2	**Structured Inquiry** You will be given a question to answer. You will also be given a procedure for finding the answer.	X	X	
3	**Guided Inquiry** You will be given a question to answer. You will plan and do your own procedure to find the answer.	X		
4	**Open Inquiry** You will be given a topic, but you will decide the question you want to answer and how to answer it.			

ByDesign: A Journey to Excellence Through Science, Teacher's Edition (Dubuque, Iowa: KendallHunt Religious Publishing, 2012): Science Journal Overview, p. xxxi. Used with permission.

1. *Schools and teachers will not order the new series because of the costs.*

Although the initial cost of the textbook series is comparable to those of similar programs, the expense of preparing hands-on lab materials can be extensive. The school/teacher has a choice of self-assembling the materials or purchasing them as a lab kit to be used for a classroom full of students over multiple years. Many schools want to preserve teacher preparation time and not compromise on using the inquiry activities. Other schools wish to have a more hands-on approach to securing the materials from local sources. The concern is that the worst-case decision might be made: to not do the activities.

2. *Teachers will evade the rigor of preparing to use the multiple resources designed to support inquiry methodology and revert to lecture mode.*

It often seems easier to simply "tell" children what is going on in science and then test them on the concepts. Although this is efficient for the teacher, it is very inefficient for most students. We now know from brain research that a majority of students learn what they are interested in, and can see and experience.[4]

Unions and conferences are developing in-services, video labs, and other resources to assist in mastering inquiry methodology. And, with these resources, teachers who are using the series can better support the learners in their classrooms.

To discover more about the *ByDesign* science program, visit http://adventisteducationbydesign.com.

Jerrell Gilkeson, Ed.D., *is Associate Director of Education for the Atlantic Union Conference, South Lancaster, Massachusetts.*

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1. KendallHunt Religious Publishing; http://viewer.zmags.com/publication/7a19b16c#/7a19b16c/16. All Websites in the endnotes were accessed February 8, 2016.

2. *ByDesign*: *A Journey to Excellence Through Science:* http://adventisteducationbydesign.com.

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By Design Science

By Design Science:
A Journey to Excellence through Science for grades 1–8.

***By Design:* A Journey to Excellence through Science** is your new faith-based inquiry science program for grades 1–8. This engaging, rigorous, and developmentally appropriate curriculum nurtures a child's natural curiosity as they explore the wonderment of God's Creation through the lens of the Bible.

By Design is innovative and multi-dimensional in content and organization by offering a balanced and integrated development of science and health within the framework of the Adventist worldview.

Call 1-800-542-6657 to order this new faith-based program today! Visit **kendallhunt.com/bydesign** for more information.

"All things were made by Him, and without Him was not any thing made that was made". John 1:3

Kendall Hunt Religious Publishing
A Division of Kendall Hunt Publishing

Developed in Collaboration with the Seventh-day Adventist NAD Office of Education and Kendall Hunt Religious Publishing, A Division of Kendall Hunt Publishing.

Critical Thinking:

Practical Strategies for Teaching and Learning

"It is the work of true education . . . to train young people to be thinkers, and not mere reflectors of other people's thought."[1]

Most educators would agree that the development of critical thinking should be a key focus of teaching and learning. In some countries, critical thinking is a major component in national curriculum standards. For example, the Australian Curriculum[2] identifies critical and creative thinking as one of seven general abilities at the heart of effective learning. And the New Zealand Curriculum[3] identifies "thinking" as the first of five key competencies that are essential for living and lifelong learning. The rapid rate of change in so many aspects of 21st-century life requires the ability to process, interpret, analyze, and respond to problems and challenges in a broad range of socio-cultural contexts. For this reason, critical thinking, including the ability to think independently, is central to successful teaching and learning.

An awareness that critical thinking is important, however, is not enough. Teachers need to actively engage students of all ages in critical thinking. This suggests two questions: *What does critical thinking look like in the classroom*? and *What strategies can be used to facilitate critical thinking?*

The Critical Thinking Classroom

A "thinking" classroom is a flexible classroom that includes collaborative learning, where different points of view and solutions to problems are shared. It is a place where students engage in substantive communication with one another and with their teacher(s) regarding problems, issues, and questions that extend to life beyond the classroom. Substantive communication involves engagement in "sustained conversations about the concepts and ideas they [students] are encountering. These conversations can be manifest in oral, written or artistic forms"[4] and can occur between teacher and student(s), or among students themselves. This classroom dynamic includes regular peer and teacher feedback that demonstrates strong personal and corporate reflection and well-informed evaluation that is evidence based, rather than unsubstantiated opinion.

A safe learning environment is a basic requirement for critical thinking and learning to occur. This is an environment where learners are free to express their ideas, to explore different perspectives and solutions to problems, and to make mistakes in their quest to discover solutions and answers through a process that includes hypothesizing, testing, and validating the ideas. In a Christian context, this environment is enriched by values based on biblical principles that guide the choice of content and the nature of the learning experiences.

A body of evidence supports the idea that critical thinking and learning needs to be visible so that all learners can access it.[5] A "thinking" classroom allows student movement and exposes young people to the full range of learning modes. This includes making thinking visible through using different writing surfaces where students can express, clarify, and hone their ideas by generating visual texts such as mind maps

BY G. ADELLE FAULL

and graphic representations, as well as engaging in discussion. In a "thinking" classroom, students are readily able to access different sources of information, such as technology, books, the teacher or an expert in the field, in order to test and confirm their ideas and different points of view.

Willingham questions whether critical thinking can actually be taught and argues, "Decades of cognitive research point to a disappointing answer: not really."[6] If this is so, then teachers are likely to have a very frustrating time attempting to facilitate students in the development of critical thinking. This article argues that, while critical thinking may not be a "skill" per se, the process of engaging in critical thinking does involve a set of skills that can be taught and mastered. Figure 1 provides a conceptual model of the dynamic process of engaging in critical thinking so it becomes a cognitive habit. It is this ***process*** and ***practical strategies*** for its implementation that will now be examined.

The Process Explained

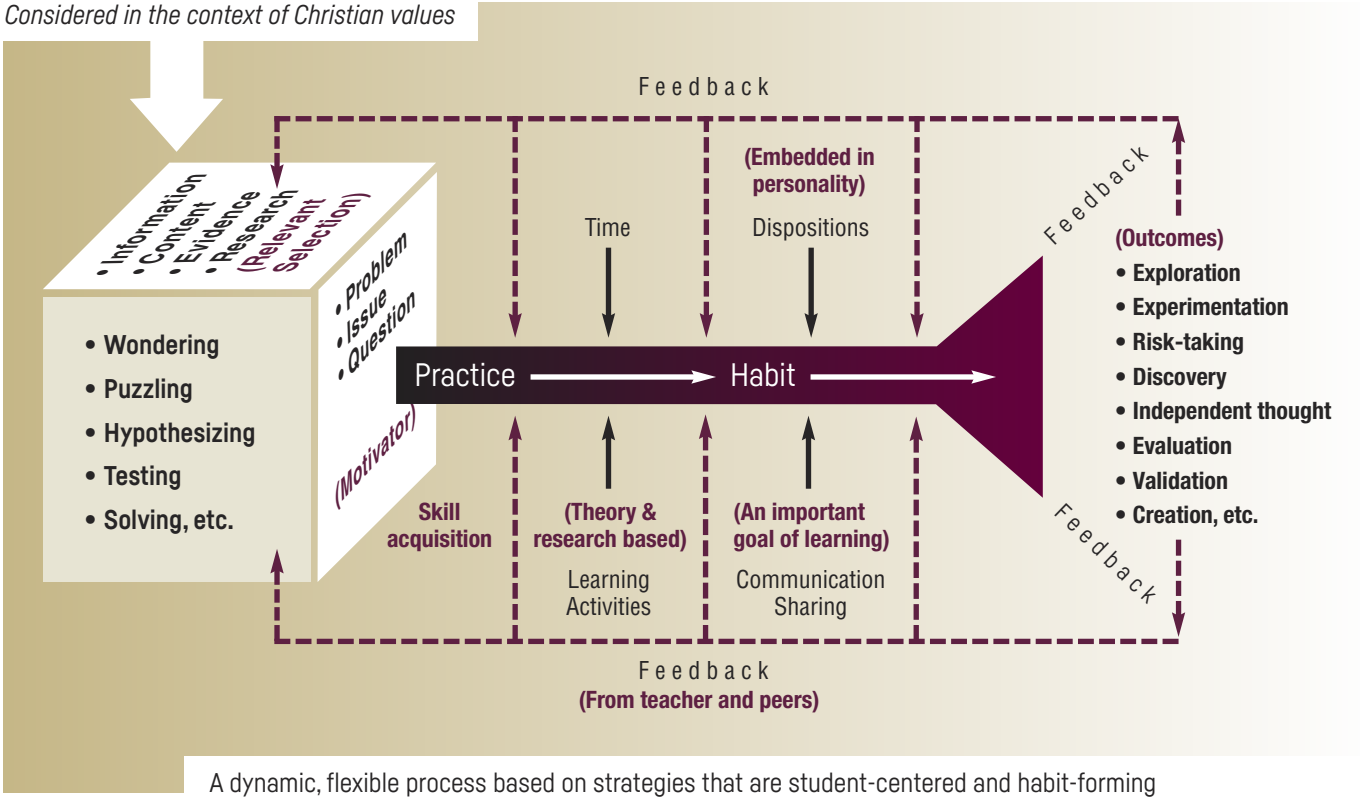
As indicated in Figure 1, the development of critical thinking is conceptualized as a dynamic process based on the interaction of carefully considered learning activities and communication, including feedback. The learning activities should be based on problem solving that includes cognitive processes such as wondering, puzzling, reflecting, and hypothesizing. This requires the development of a safe learning environment that is conducive to experimentation and testing. In the context of this model, critical thinking is closely allied to creative thinking.

Learning, as conceptualized in this model, is not content-driven. Rather, the design of learning activities involves the teacher and the students in a process of selectively using information, content, evidence, and research that will be useful for engaging with the question or issue and solving the problem. Critical thinking is required not only for the selection of relevant content and information, but also for how to judiciously approach problem solving.

Factors influencing the effectiveness of critical thinking include time spent on the learning activity and the dispositions the students and the teacher bring to the learning experience. Quality feedback underpins the process of critical thinking, and this includes substantive communication between the student and the teacher, and among the students themselves.

Key elements of critical thinking include exploration, experimentation, risk-taking, discovery, independent thinking, evaluation, validation, and creation. These elements presuppose the development of trust between students and the teacher, and a learning environment embedded in Christian values such as acceptance, perseverance, and loving-kindness. This environment allows students to make mistakes and learn from them as part of the process of developing their critical-thinking abilities. In keeping with the research of Collins[7] and van Gelder,[8] the underlying premise of this model is that critical thinking involves skills that can be taught.

Figure 1. A Conceptual Model of the Process of Mastering Skills Embedded in Critical Thinking



A dynamic, flexible process based on strategies that are student-centered and habit-forming

Practical Strategies for Mastering Skills Embedded in Critical Thinking

The following ideas are based on authentic classroom practice that promotes critical thinking. The New South Wales Quality Teaching Model (QTM)[9] has been used as the pedagogic framework for these strategies. It can be seen that other theoretical frameworks such as Anderson and Krathwohl's[10] update of Bloom's Taxonomy.[11] Pearson's Red Critical Thinking Model,[12] and Ennis's[13] Taxonomy are also useful tools for planning learning experiences that develop students' critical thinking.

Strategy No. 1: Design Engaging, Authentic, and Challenging Questions or Problems

If the intention of education is to teach students to think critically and independently, participants need the opportunity to practice and master the prerequisite skills. Learning activities should be designed to engage students in significant, authentic learning experiences based on challenging questions, issues, and problems. The Technologies Department at Avondale School, New South Wales, Australia, under the leadership of Nigel Lynn, launched an initiative that serves as an example of how the design of learning activities and units of work can help build critical-thinking skills. The Year 8 Design Challenge (Term 4, 2013) was used as a pilot program for combining creative and critical thinking in the context of planning collaborative, authentic learning experiences linked directly to the local community. The central activity challenged students to design an item to meet the needs of residents of a nearby retirement village.

The rationale for targeting the population was based on four criteria: (1) accessibility, including proximity to the school; (2) the needs-based design of the activity; (3) the scheduled time for teaching the unit in which the project was embedded; and (4) the availability of clientele in conjunction with the timing of the unit.

The project had to be designed around an authentic, community-based need identified by the students after soliciting input from their "clients." This involved interview-type conversations between the students and clients. Explicit criteria for the design of the item were:

- The design had to be for a specific product, rather than a system or an environment;
- The finished product had to be functional;
- The product had to be finished to a high standard over a 13-week period; and
- Students were allowed to use technologies of their choice to realize the product.

Besides identifying and exploring the need for specific products, the design cycle required critical research of existing products and the formulation of a design that was "new" as well as useful. This involved problem-solving skills that included the elements of experimentation and testing of the design solutions to justify a final prototype. The cycle involved ongoing feedback from peers, as well as the teacher, and this informed the design and creation of the final product.

Students participated in design teams that included peers with

A satisfied client proudly displays the portable walking stick holder designed by a Year 8 Design Team. Clients were transported from a nearby retirement village to Avondale School (Australia), where regular consultations took place in the Collaborative Learning Center.

Regular consultations led to strong friendships between clients and design team members. This team created a storage chest for family memorabilia for a client, who became a friend. Other design teams can be seen in conversation with their clients. The senior Hospitality class at Avondale School provided afternoon tea.

whom they would not usually work. Normal classes were replaced by team workshops where the management and interpretation of the design process involved group interaction and discussion. Students were able to consult with any of the four technology teachers in order to create the final solution to their design challenge. A significant aspect of the teaching and learning process was that teachers took on the role of consultants. Each team was self-regulating and responsible for directing its own design and learning process.

Explicit criteria were discussed through substantive team communication, and high expectations were clearly enunciated at the beginning of the project. These expectations were realized not only in the final design product, but also through ongoing documentation of the design process and the cumulative learning that occurred.

During participation in the project, students were encouraged to reflect on the design process, at both a personal and team level. Team captains represented their teams at periodic meetings, with the teachers present. This allowed for important cross-team dialogue regarding issues they encountered and a range of possible solutions.

The sharing of ideas enriched the range of solutions and approaches to problems that arose. In addition, team captains discussed the process and progress of each team's design activity. The discussion included peer reflection, evaluation, and feedback—all key elements of critical thinking. They then shared feedback with their teams, where further reflection and refinement of the designs occurred. This process continued until the design challenge had been completed.

Examples of realized products included: an iPad stable table with an adjustable gradient platform; a mobile knitting station that stores wool and allows the operator to knit using wool fed from the station, thus avoiding knots and tangles; and a portable walking stick holder that can be clamped to any item of furniture in order to keep the walking stick accessible for the user. These products required the implementation of critical-thinking skills that were problem-based and had authentic value for senior members of the local community. The pilot program was refined, and the project was undertaken, again, the following year (2014) with similar learning gains for the Year 8 students and benefits for the community members.

Observations and Reflections

A number of observations can be made regarding this project. First, the process of design was collaborative. The teachers collaborated in the creation of the project. Student teams engaged in substantive communication that allowed for dialogue regarding different points of view and different approaches to dealing with the design challenge. As a result, each team member was exposed to a variety of design approaches and the rationale for each. Second, students were engaged in highly effective pedagogy. The programming for this project was based on the QTM (2003)[14] and activated each of the three dimensions: Intellectual Quality, Quality Learning Environment, and Significance. Third, the project engaged students in a high level of authentic learning because the focus problem was related directly to the real-life needs of their clientele. Finally, the project engaged students in a high level of critical and creative thinking, in terms of Pearson's Red Critical Thinking Model.[15] Important aspects of the process of design and collaboration included active engagement in examining and evaluating assumptions about the design project and the most effective way(s) to meet the needs of the given clientele. This was achieved mainly through substantive communication, questioning, peer evaluation and feedback, and reflecting on different points of view and contributions to the dialogue and planning process. Team members were required to back up their ideas with evidence, rather than opinion. They were involved in analyzing the ideas they generated and the data given as part of the process of selecting the most effective way to meet the design challenge. They were then required to draw their conclusions and come to an agreement regarding the best approach to the design, working as a team to achieve their project goal.

Strategy No. 2: Establish Routines That Make Critical Thinking Visible

Harvard University's Project Zero[16] has yielded well-researched evidence indicating the effectiveness of making thinking visible in the classroom. The resources that have been developed as part of the project provide worth-

while strategies for assisting students to practice and master thinking routines, including those related directly to critical thinking. The ideas are expressed in terms of routines that are regularly activated in the classroom. The work of Ritchart and Perkins[17] and Ritchart, Church, and Morrison,[18] for example, provides a rich resource in this area. These routines are equally applicable in primary and secondary school classes. One of the core routines is *Connect-Extend-Challenge*.

This routine provides students with a logical framework for *connecting* new information with what they already know and understand. Once this important link has been established, students are encouraged to *extend* their thinking by considering new questions that move their thinking in new directions. In the context of critical thinking, the third step in this routine is probably the most important. Students engage in reflecting on those aspects of the learning experience and content that *challenge* or *puzzle* them. They think critically by asking questions, reflecting, and setting themselves problems to solve, with a view to coming to a deeper understanding of the information, concepts, content, and underlying principles they are studying. A practical example demonstrates how thinking routine strategies can be used to foster critical thinking that is enriched by focusing on values.

In the context of a study of transformation of text, a group of Year 11 English students explored how elements of Shakespeare's comedy, *The Taming of the Shrew,* were transformed in the film, *Ten Things I Hate About You,* directed by Gil Junger. This included an examination of the underlying values and socio-cultural contexts of each text. In order to promote critical thinking, students were required to reflect on their learning and understanding of the texts through the use of the thinking routine, *Connect-Extend-Challenge*. They were asked to select three specific values explored in Shakespeare's play, and then analyze and evaluate how these values were either reinforced or challenged in the film. They were required to do this with reference to specific scenes from each text. The process involved group discussion, brainstorming, substantiating through use of textual support, peer evaluation of the quality and defensibility of the ideas, and generating a visible representation of this process of thinking in a form of their choice, such as a mind map, flow chart, or diagram.

In order to be deliberate in their thinking and economical in their use of time, students were asked the following guiding questions:

▪ *How did the treatment of values in the film compare to the treatment of the same values in the play?* This question invited students to make ***connections*** between the two texts.

▪ *What new insights about values did you gain from your viewing of the film? To what extent has your understanding of these values and the way each composer has treated them been enriched?* This question required students to ***reflect*** on and ***evaluate*** their learning in terms of the extent to which their understanding had been extended.

▪ *What is still challenging you, in terms of the treatment of values you have explored across the two texts? To what extent do these values and the way they have been explored coincide with or challenge your own values?* These questions provided students with the opportunity to ***reflect*** on and ***think critically*** about the gaps in their understanding. In addition, the "Challenge" component of this routine provided an avenue for students to critically reflect on their own values. The responses were then shared in class, where different points of view were considered, textual evidence was gathered, and the propositions were then peer evaluated. It should be pointed out that, prior to reaching this level of thinking and sharing, a high degree of relational trust had been developed.

Throughout this thinking routine, students were recording and mapping their ideas on large pieces of paper, which enabled them to visually represent their responses to each stage of the thinking routine. During this process, they were also involved in discussing and sharing ideas. Their "visible thinking" was then placed on the noticeboard at the back of the classroom so all students could access a variety of perspectives and ideas, including textual evidence that supported their thinking.

Strategy No. 3: Create Thinking Zones

The organization of classroom spaces and classroom time are important considerations for the development of critical thinking. One idea is to create a "thinking zone" in the classroom. This can be as simple as organizing a circle of desks, cordoned off with a bead curtain, where students may choose to sit and critically think about their learning and understanding of content and concepts. The thinking zone can be equipped with technology that enables online communication, such as discussion threads, blogs, Twitter, or Skype.

Teachers can integrate thinking zones into their planning as they design regular critical and creative-thinking focus periods for each lesson. The critical-thinking activities can be as short as 10-minute segments of a lesson or can continue over a number of lessons. The point is to make critical thinking a classroom habit that is regularly practiced by the students and their teacher(s).

Recommended Reading and Resources for Critical Thinking

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The George Lucas Educational Foundation: Edutopia. *Resources and Downloads for Teaching Critical Thinking* (n.d.): http://www.edutopia.org/stw-kipp-critical-thinking-resources-downloads#graph2.

Conclusion

The intent of this paper was to present a model of the process of mastering skills known to be embedded in critical thinking and, with the model, provide a selection of strategies for facilitating learning a range of approaches for mastery of these skills. A discussion of the principles underlying the strategies was informed by examples of learning experiences being tried in our school. Results of these trials seem to indicate that critical thinking can be learned using appropriate strategies.

While these results rest heavily on qualitative evidence, there is clear indication that critical thinking can be taught and that the deliberate teaching of and programming for critical thinking does improve the quality of student learning and motivation. The Year 8 design project demonstrates how critical thinking can be developed in a learning context where emphasis is placed on problem solving that is authentic and directly related to community needs. The design cycle provides a useful framework for developing critical thinking that involves research, experimentation, and testing of the design, as well as ongoing evaluation of the design product. The observations based on this project strongly support the notion that the skills implicit in critical thinking can be taught.

In the case of the Year 11 English class engaged in the visible thinking routine, student feedback was positive.[19] Prior to the implementation of the *Connect-Extend-Challenge* thinking routine, these students depended on teacher input. After implementation, they focused on *their* thinking. As a follow-up, students engaged in designing research projects based on their particular needs and interests, thus leading to differentiated learning experiences and a notable difference in the level of student engagement and motivation. This suggests three important principles for the development of critical-thinking skills. First, students need to be engaged in a structured approach to thinking. Second, students need to be engaged in self-direction where they critically think about their own understandings and interpretations of subject content. Third, students need to be provided with opportunities to practice and develop critical-thinking skills.

"Thinking zones" call for flexible approaches to organizing the classroom and designing programs where stronger emphasis is placed on the developing of thinking skills. This approach also relies on a differentiated approach to teaching and learning and provides students with the opportunity for independent, critical thinking. It has been found that some students engage more readily in the thinking-zone approach to teaching and learning than do others, responding to a more carefully scaffolded approach to the development of critical thinking. Overall, most students require training in order to understand *how* to self-direct, and to master the skills implicit in being able to think critically and independently.

Teachers themselves need to model critical thinking in their day-to-day classroom activities. There is a strong case for encouraging teachers to be involved in professional development and learning conversations that not only equip them to facilitate students' critical thinking, but also build their ability to think critically. As teachers build their competency, they will recognize that strategies exist that can be applied to the design of learning experiences that foster mastery of critical thinking, and they will grow confident in using these approaches in their classrooms. A list of recommended reading is included for further information and ideas.

This article has been peer reviewed.

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15. Watson, "Critical Thinking—The Key to Working Smarter," op. cit.

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19. Student comments such as, "I haven't really thought about how I think," and "I found the last part of the thinking routine quite hard. It made me think in a different way," confirmed a change in their approach to studying Shakespeare and in their evaluation of their own thinking.

Experiential Education and Inquiry Learning

Direct and authentic experiences provide some of the best opportunities for adolescents to learn and practice the critical and reflective-thinking skills that accompany inquiry learning. It has been my experience while working with 13- to 15-year-olds that when they are taken out of the confines of chairs, desks, and whiteboards to places where they feel free to explore and express their abilities and overcome their limitations, deep learning and understanding are likely to occur.[1] While these experiences may also be of relevance for other age groups, this group is my area of expertise and research.

In this article, experience is conceptualized as a continuum with vicarious experiences at one end and real-to-life (direct and authentic) experiences at the other. The metacognitive moments afforded by direct and authentic experiences provide the richest opportunities for reflection and critique.

The Wilderness Experience and Real Life

The Bible contains numerous examples of great leaders and prophets of God going through wilderness experiences in preparation for their life's work. For example, Moses and his years caring for sheep, David and his experiences as a shepherd, and John the Baptist and his experiences in the desert immediately come to mind. Jesus' experiences also provide examples, such as when He "was led by the Spirit into the desert" and He "went out to a mountaintop to pray and spent the night praying to God."[2] The writings of Ellen White also mention our inherent need for time in the natural world.[3] And Adventism has a rich tradition of using experiences in nature for personal development, spiritual connection, and discovery as typified by the worldwide Pathfinder program.

The Need for Direct and Authentic Experiences

Experiential Education (EE) is an overarching term that encompasses Outdoor Education (OE), Experiential Learning, Environmental Education, Adventure Therapy,[4] Service Learning, and numerous other programs. These forms of education are generally based on philosophical foundations in which individuals construct new ideas and generate meaning from the interaction between current and past experiences.[5] These approaches offer helpful insights into how we might best learn and then transfer these new understandings into new and different contexts.

The term "Experiential Education," as used in this article, is defined as direct and authentic experiences in learning environments outside the classroom. OE, as a subcategory of EE, can thus be applied to direct and authentic experiences in natural environments outside the classroom.

The literature contains numerous examples supporting the value of direct and authentic experiences in changing people's attitudes about the natural world. For example, Rodger Jones, in *The Journal of Adventist Education's* special issue on Environmental Awareness,

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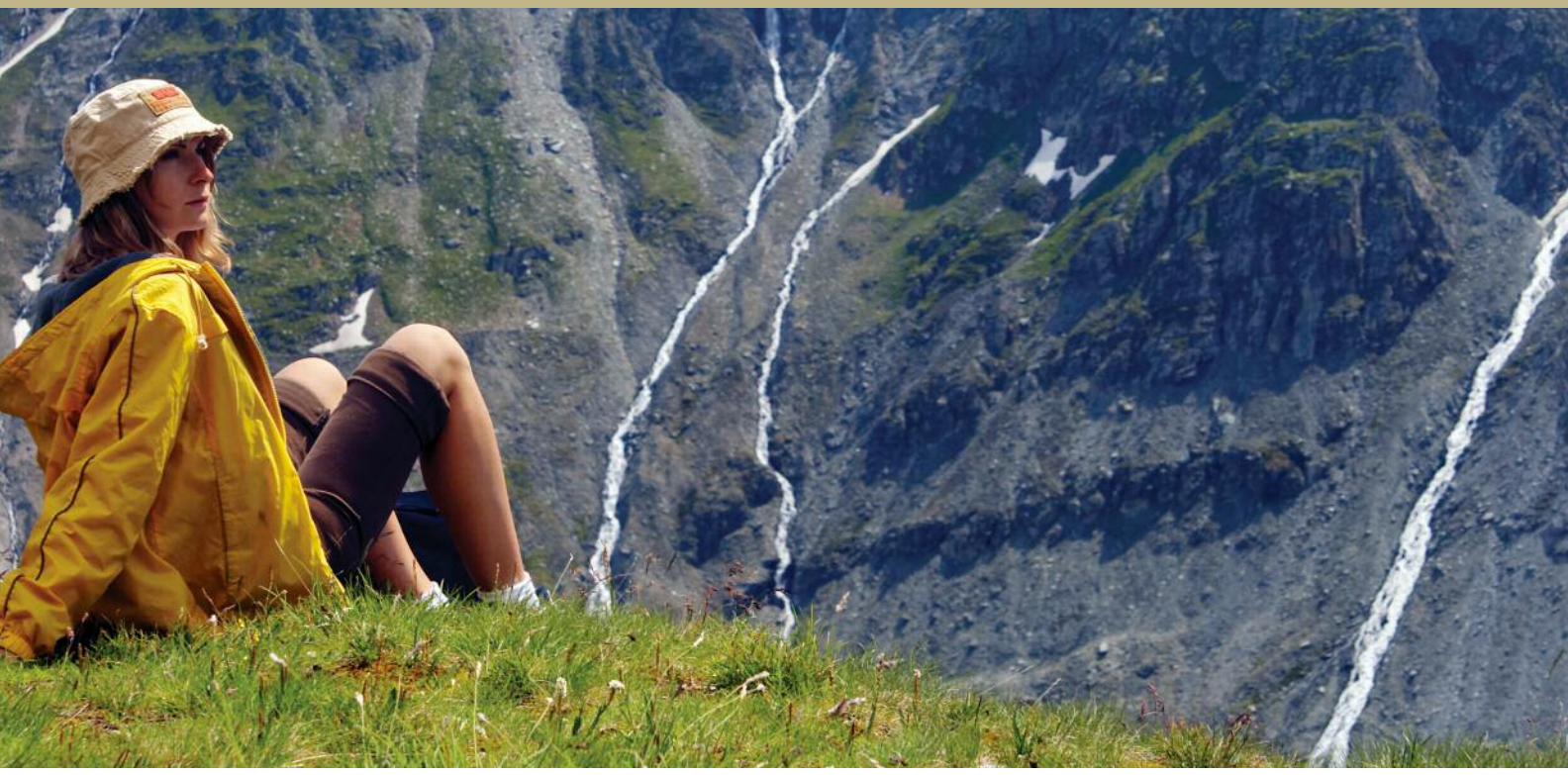


pointed out the value of environmental education for "changing people's perceptions and perspective by encouraging them to feel a sense of dependence upon, and responsibility for, nature."[6] Jones believes that only as people experience natural environments will they change their view of how to interact and care for nature. It seems the farther we are removed from the natural world, the less likely we will be to take responsibility for it.

In another example, Richard Louv describes the need for young people to get into the outdoors more often to alleviate "nature deficit disorder."[7] He sees a significant correlation between humanity's growing detachment from the natural world and the increasing incidence of mental health and spiritual decline. Comments such as "Time in nature is not leisure time; it's an essential investment in our children's health (and also, by the way, in our own)"[8] highlight the value he places on direct and authentic experiences in the natural world.

In Scandinavian countries, there is a name for this outdoor connection: *friluftsliv*.[9] Historically, this has referred to the deep-seated relationship between humans and the natural world. Without this bond, people feel unfulfilled and broken. The only way to achieve a sensation of wholeness is to spend time in direct and authentic experiences in the natural environment.

An Experiential Education (EE) Program in Practice

The Gilson College[10] Learning 4 Life (L4L) EE[11] program has been designed to minimize the enervating effects of early adolescence on academic learning. Numerous teachers who work with young adolescents will attest that classroom-based learning is not high on the agenda for many in this age group. In fact, one author was moved to write:

"Many teachers believe they should receive hazardous duty pay for teaching adolescents. Adolescence is for many—adolescents, parents and teachers alike—a time of turmoil, rapid growth, and learning, as well as shifting emotions and searching for personal and social identities."[12]

Authors such as Cole, Mahar, and Vindurampulle[13] have detailed the significant mental, emotional, and social changes 13- to 15-year-olds undergo in the normal course of adolescence. In their second paper on this theme, they suggested possible ways to minimize the effects of this turbulent time; for example: finding a location where students feel able to develop a sense of ownership, offering opportunities to build strong relationships with their teachers, creating a curriculum that fosters deep engagement with their learning, and providing experiences that enable students to take on adult-like roles.[14]

The L4L program is organized with this framework in mind and includes three components: expeditionary learning, urban learning, and service learning. A group of Year 9 teachers cares for most of the curriculum and also coordinates, implements, and participates in each aspect of the program. The planners structure the following components:

- An expeditionary component encourages self-confidence, environmental awareness, and spirituality. It comprises a day walk, a five-day base camp experience with an overnight backpacking walk, a four-day navigation camp, and a seven-day expedition.
- An urban component fosters group awareness and dynamics within an inquiry-learning context. It requires students to go on five-day trips to the Melbourne Central Business District (CBD), where groups gather data relating to a self-determined inquiry-learning theme.
- A service component enables participants to see themselves as part of a community that contributes to the greater good through giving back to their neighbors. Students spend three service days in the local

area and attend an 11-day service camp in Warrnambool near Victoria, Australia, when they work with local councils and community groups in various voluntary capacities.

Wherever possible, within the general learning areas, units of work are integrated with the three program themes. Before the commencement of each year, the whole program is mapped out with multiple curriculum areas aligned to the applicable program component.[15] For example, while expeditionary learning is taking place, the students work on units relating to mountain landforms, mapping, and navigation in their geography course. Another example involves students, as a part of their history studies, in writing a creative essay imagining themselves living in one of the areas they visit when it was at the height of the bustling gold-mining boom of the 1860s. They research the cultural and geographical nature of the area around that time as they identify primary and secondary data sources to include in their story.

During the urban-learning component, students focus on a group-determined inquiry, within an assigned broad area, such as transport or iconic buildings. Working in self-selected groups of four or five and before the first visit to the urban center, the group members determine what data to collect, how to collect and obtain the information, how the data assist in answering their inquiry, and how their findings will be presented. When a learning engagement framework is used, students gain the benefits of experiential learning and also learn to apply principles of Self-determination Theory[16]: competence, relationships, and autonomy.[17]

A detailed description of the L4L program is provided in *Experiential Education and Learning Engagement for Year 9 Students: A Case Study*,[18] available free online.

Research

Kolb[19] and colleagues' work on Experiential Learning, while contested by some authors,[20] provides a useful model for practitioners to help change student attitude and behavior. As an activity or experience draws to a close, or if there has been a significant incident, participants are given an opportunity to reflect on and write about what they have learned from the experience(s). They are then asked to look for ways to transfer and implement their changed understanding in other contexts. This method has been widely praised in many EE and OE contexts over the past two or three decades.

Researchers have found evidence of heightened metacognitive skills in students who have participated in EE or OE programs. A case study of the L4L program provides proof that participation in authentic outdoor activities in natural environments achieves this goal.

The growing body of literature in this area provides evidence that direct and authentic experiences enable positive personal and spiritual development, and enhance environmental awareness.[21] Researchers have found evidence of heightened metacognitive skills in students who have participated in EE or OE programs. A case study of the L4L program[22] provides proof that participation in authentic outdoor activities in natural environments achieves this goal. As one respondent commented:

"It helped me realise that my learning is up to ME, and no one else.… Say I was climbing a mountain, for example, in the Walls of Jerusalem, Tasmania. Let's say I'm over it all.… I feel exhausted.… I want to give up.… At this point, there is NOTHING the teacher/guide could say to make me move … unless I hold the desire in myself to keep going. It's the same with my learning. It taught me a lot of intrinsic motivation and reaching my own goals. I realised that I can do anything if I put my mind to it … (be it mountain climbing, or Chemistry, study–lol) … It's all a state of mind."[23]

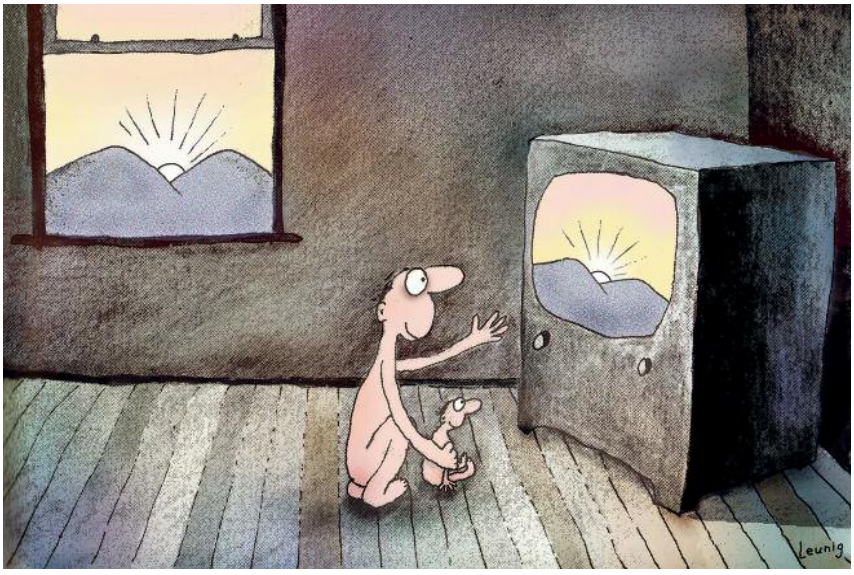
It is evident that this participant has applied to life and classroom learning lessons learned in outdoor experiences. The thinking about thinking reflected in this comment shows that, for this participant at least, time spent in authentic outdoor experiences in natural environments can be life-changing and lasting. The depth of insight displayed by this young person's reflection on the OE experiences demonstrates the value of such opportunities for critical thinking.

Additional respondent comments from this study appear to support this conclusion:

"Going through this program, just in general, has changed me on the inside to a certain degree. It has taught me to be more grateful for the small things in life, to be more humble, to receive things with gratitude, the importance of friends and family in your life, but most of all, how much we need and how important God is in our lives."[24]

L4L, like similar experiential programs, provides opportunities for participants to develop their thinking processes and encourages metacognition.[25] More recently, participants in the L4L program have been asked to complete questionnaires that encourage them to reflect and comment on their experiences. One question asks students to rate how much participation in the program has helped their thinking skills and processes. Of the responses collected, 164 respondents overwhelmingly reported that participation had improved their thinking processes. Nine respondents reported excellent improvement in their thinking processes, 66 reported very good change, 82 reported some improvement, six reported little change, and one reported no improvement.[26]

There is little doubt that student participation in programs that offer direct and authentic experiences with an inquiry learning focus has the capacity to improve their critical-thinking skills.



Used with permission.

Figure 1. "TV Sunrise" by Michael Leunig.

Cultivating a Healthy Relationship With Nature

While there is substantial evidence to support the effectiveness of OE and EE programs in transforming the ways students engage with the outdoors, there is a related concern that deserves consideration: that people may regard the natural world as somewhere to escape to and/or return from. In this thinking, our direct and authentic experiences in the natural world are detached from the reality of our lives. The natural environment is but another location we visit to "mine" its resources for our personal benefit.

In this view, the natural environment is a place where one escapes from the competing demands of "real life." Then, after a period of time, participants return to the place where they ordinarily live their lives—wherever they call home. In "real life," people are surrounded by things that have been designed and created to separate and protect them from the reality of the natural world: houses to keep them dry and warm; motor vehicles to transport them to destinations in detachment and comfort; televisions and computers to enable them to connect and communicate without leaving the security of their home or office.

The illusion of what it might mean to live one's life in this way is well captured in the whimsical, yet profound, image by Australian cartoonist Michael Leunig,[27] in which he depicts a father and son sitting in front of a television watching a sunrise (see Figure 1). To the side, there is a window through which one can see the very same event occurring! This simple image makes an insightful statement about the way we have come to view the world in which we live. We have allowed our technology to so detach us from the reality of the natural world that we have come to believe the illusion. Our experience of the sights, smells, sounds, and sensations "out there" are mediated and interpreted through our technology, and the view that we can experience the world in a vicarious manner, and be convinced we have a healthy relationship with it, is deeply disturbing. This convinces us that we are in control of our lives and our destiny, and may make us suspicious or afraid of the natural world.

This view runs very deep in the human psyche. For thousands of years, we have been taught to equate this artificial way of life to progress and improvement. Jack Hobbs,[28] in a discourse on the history of Western art, refers to this change in how humans related to the world around them: "hand in hand with science and the art of appearances came an attitude of detachment from nature, signifying that the Greeks and Romans were no longer participants in but witnesses to the drama."[29]

Consequently, we have come to view the world "out there" as a scary place against which we need protection. We reject the natural connection that we all require in order to feel whole because we cannot control it and feel insecure while immersed in an outdoor setting. There is little wonder then, that many educators are reluctant to embrace the notion of direct and authentic experiences with the natural world. The reasons are complex and profound, and only briefly alluded to here, but a growing body of literature in the public domain explores the value of direct and authentic experiences to ensure that learning is both emancipatory and lasting. The research shows the value of encouraging educators to engage their students in as many direct and authentic experiences as possible. Planned learning experiences in natural environments provide opportunities for students to strengthen the natural connection to the outdoors, feel confident in natural surroundings, and develop a healthy relationship with nature.

Conclusion

This article has presented the case for the importance of providing direct and authentic experiences outside of the classroom for adolescent students in Adventist schools. Research and experience with this age group show that such opportunities afford students rich learning experiences with lifelong impact, as well as improved engagement and metacognitive learning outcomes, when offered with an inquiry learning context. While there are obvious economic and time-related costs involved in the development and implementation of such programs, the personal development, learning improvement, and teacher-student relationship benefits will far outweigh other considerations.

This article has been peer reviewed.

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3. Ellen G. White wrote in *Testimonies for the Church*, volume 7: "Nature is God's physician. The pure air, the glad sunshine, the beautiful flowers and trees, the orchards and vineyards, and outdoor exercise amid these surroundings, are health-giving—the elixir of life. Outdoor life is the only medicine that many invalids need. Its influence is powerful to heal sickness caused by fashionable life, a life that weakens and destroys the physical, mental, and spiritual powers" (Mountain View, Calif.: Pacific Press Publ. Assn., 1948), pages 76 and 78.

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Promoting Critical Inquiry in Teacher-education Candidates

On a scale of one to ten, how would you rank your classroom as an environment of rich critical thinking?

Project-based learning is an educational method based on the premise that students learn best "by experiencing and solving real-world problems" through discovery and inquiry, with teachers serving as coaches or facilitators.[1] This method aims to help students think creatively for themselves, and makes learning come alive through inquiry and self-directed learning. Project-based learning includes the following four basic principles: (1) students apply things they have learned to solve problems; (2) learning is self-directed and controlled; (3) teachers adopt the role of coach or facilitator; and (4) students typically work in pairs or teams (as they would in real-world working environments).[2] Each of these components is necessary for the successful implementation of project-based learning. This article will provide a brief history of project-based learning, a review of the basic principles of this approach, and a description of how project-based learning was implemented in a teacher-education methods course.

A Brief History of Project-based Learning

Principles of this inquiry-based approach to learning were modeled by Socrates as he taught his students through questioning, inquiry, and critical thinking about daily life. Confucius and Aristotle modeled the same philosophy and were early proponents of learning by doing.[3] Education literature credits John Dewey with developing the initial concepts of project-based learning and advocating for the "learning by doing" approach. Dewey promoted his beliefs in his work *My Pedagogical Creed*, where he wrote, "The teacher is not in the school to impose certain ideas or to form certain habits in the child, but is there as a member of the community to select the influences which shall affect the child. . . ."[4]

Suzy Boss explains that Dewey's ideas evolved into project-based learning. She writes: "Dewey challenged the traditional view of the student as a passive recipient of knowledge (and the teacher as the transmitter of a static body of facts). He argued instead for active experiences that prepare students for ongoing learning about a dynamic world. He pointed out, 'Education is a social process; education is growth; education is not a preparation for life but is life itself.'"[5]

Dewey's work influenced developmental psychologist Jean Piaget, who believed that learning took place as the individual constructed meaning from each experience. According to Boss, Piaget's ideas "laid the foundation for the constructivist approach to education in which students build on what they know by asking questions, investigating, interacting with others, and reflecting on these experiences."[6]

It is also interesting to note that Ellen G. White in the book *Education* discussed the effectiveness of learning by doing around the same time

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as John Dewey. She promoted the application of thought through real-life experiences, where the learner learns by doing. She wrote:

"Every youth should be taught the necessity and the power of application. Upon this, far more than upon genius or talent, does success depend. Without application the most brilliant talents avail little, while with rightly directed effort persons of very ordinary natural abilities have accomplished wonders. And genius, at whose achievement we marvel, is almost invariably united with untiring, concentrated effort."[7]

Project-based learning, then, is not new; it has a long history of implementation. Today, this methodology is experiencing a renaissance with various levels of success among teachers and students.[8] And while the philosophy of project-based learning has gained a stronghold within educational circles, Adventist and Christian educators must think about how this philosophy supports their ability to integrate faith with learning. If Seventh-day Adventist educators believe that God's ideal for His children is accomplished through "a path of continual progress,"[9] then they must also ensure that every youth is taught "the necessity and the power of application" as he or she walks that path.[10] Project-based learning can help educators achieve this goal and help students experience success.

What Is Project-based Learning?

Project-based learning belongs to a family of teaching approaches that includes discovery learning, problem-based learning, experiential learning, inquiry-based learning, expeditionary learning, and constructivist learning. Using these approaches, the teacher is the "guide on the side and not the sage on the stage,"[11] providing a basic structure for what students learn through research and experimentation.

Project-based learning belongs to a family of teaching approaches that includes discovery learning, problem-based learning, experiential learning, inquiry-based learning, expeditionary learning, and constructivist learning.

Teachers using project-based learning facilitate, coach, and guide students toward actively investigating and working on their own projects. According to John W. Thomas, teachers can lead their students into a deeper understanding of content by challenging them to solve problems or do simulations that mimic real life.[12] This model of teaching, he argues, facilitates quality learning. Teachers need to understand that coaching, facilitating, and guiding students are planned, intentional teaching tasks and not minimally directive ones. Minimal guidance during instruction is less effective, especially for learners who have limited prior knowledge within a content area. Effective coaching reduces the perpetuation of misconceptions and errors by providing feedback and prompts that guide students to higher levels of thinking and problem solving.[13]

Thomas[14] states that the project should consist of complex tasks involving students who problem-solve, make decisions, or investigate. Larmer et al.[15] include additional elements such as sustained inquiry, authenticity, student voice and choice, and reflection. Of reflection, these authors state: "Throughout a project, students—and the teacher—should reflect on what they're learning, how they're learning, and why they're learning."[16] Different authors suggest that a class discussion of real-life issues can lead to deep thinking and involvement in project-based learning, encouraging greater student engagement and interest in the assigned tasks.

Similar to Darling-Hammond, Jane L. David[17] lists four major approaches when considering a project for students to develop:

1. Solve a problem ("How can we reduce environmental waste?").
2. Investigate a phenomenon ("Why does a tennis ball bounce higher than a basketball?").
3. Design a model ("Create a model of a cell and its parts.").
4. Research a topic to present information that will help others make a decision ("Should the school board vote to require uniforms?").

Larmer and Mergendoller[18] suggest an additional seven essentials:

1. A need to know about the topic.
2. A driving question.
3. Student voice and choice.
4. Twenty-first-century skills.
5. Inquiry and innovation.
6. Feedback and revision.
7. Publicly presented product.

Varied approaches can be used to implement project-based learning in the classroom. The teacher needs to use his or her discretion in choosing the methods best suited to meet the needs of the curriculum and the students involved. The teacher must lead the students to think, research, and learn through their own research while serving as coach, facilitator, or guide.[19]

Introducing and Using Project-based Learning in the Classroom

Implementing project-based learning in higher-education classrooms became a mandate from the Education Department of the Government of Alberta, Canada, in 2013.[20] Educators were also required to fully implement project-based learning in all schools from K-12. Alberta universities with teacher-education programs were coached regarding how to introduce and implement project-based learning in their classrooms. University-based students were thus exposed to real-life project-based learning activities in their practicum classrooms. This practice is still ongoing in K-12 classrooms in both Adventist and public schools in Alberta, and in teacher-education programs throughout the province.

Initial Implementation

During the 2006-2007 academic year, the opportunity arose for me to apply my theoretical knowledge of project-based learning in my EDCI470 Reading and Writing Skills in the Content Areas class. My desire was to see how my university-age teacher-education students would use the knowledge they gained in my class to construct a project-based learning assignment for children who would be in their practicum classes.

The experience is summarized below, where I share how I navigated the process, results, and reactions from my students.

Students in EDCI470 usually develop several microteaching lessons based on relevant strategies taught in class. Because the course did not require a unit plan, I opted to introduce project-based learning instead. I referred my students to various journal articles on project-based learning, based on the concept of teaching students to think "outside the box" and to think for themselves while making learning "happen" or "come alive" with and through discovery and inquiry.

By the 2010-2011 school year, while expanding my study of inquiry-based teaching-learning approaches, I came across many more strategies that included the use of technology. This discovery led to having students use "new literacies" (e.g., hypertext, hypermedia, Weblogs, Wiki, Ning, WebQuest) in constructing their project. According to the primary textbook used for the course, students should be able to "Surf the Internet and bookmark, learn how to blog and build a wiki, be able to read and write and learn with texts that have multimodal elements such as print, graphic design, audio, video, and nonstop interaction."[21] A shift in how information is shared has occurred, and teachers must ensure that students can navigate both print and screen literacies.

After reading selected articles and textbooks, and searching for resources on the Internet, the EDCI470 students began to create project-based lessons that included the new literacies described above. They used the ideas presented in the text and searched the Internet for additional ideas on project-based learning. Working individually or in teams, they selected topics typically taught in junior high or high schools, or that they planned to teach in their major or minor content area(s) in the future.

Students received a copy of the activity and grading rubric shown below before they started on their project, which gave them prior knowledge about what was expected of them in terms of project-based learning, and how they would be graded at the end of the project.[22] These rubrics have been used in this particular class for the past four years (2011-2015).

Current Implementation

From the 2013-2014 academic year to the current 2015-2016 school year, students in the EDCI 470 Reading and Writing Skills in the Content Areas class have been given a project-based learning assignment. This project requires them to develop an assignment built on principles of the project-based learning model. They work on a topic typically taught in their major or minor content areas, and focus on involving their students in active learning.

Grading rubrics were again shared with the pre-service teachers before they started on their project. They were given the option to work with others who were specializing in the same content area or work alone on a chosen topic. They were expected to complete their projects within a seven-week time frame.

Examples of Student Projects 2013-2014

Since this class was smaller than usual, the students chose to work on individual projects. During the 2013-2014 school year, two students gave

Rubrics for Project-based Learning Activity

This activity is based on information learned in class regarding "new literacies" that permeate our classrooms. You will construct a project-based learning activity where students will have to learn in a community rather than by themselves. Remember to give guidelines for students to use as they work in a group. Include your expectations and rubrics on how you plan to grade your students.

EDCI470 Reading and Writing Skills in the Content Areas Project Rubric[23]

Comments	Total Points 100
Entry Event	10
Steps to Use in Project	10
Directions for Students	10
Looping Students	10
Concluding Project	10
Deadlines	10
Grading Scheme	10
Project – Final Evaluation	10
How well does this activity cover "new literacies"?	20

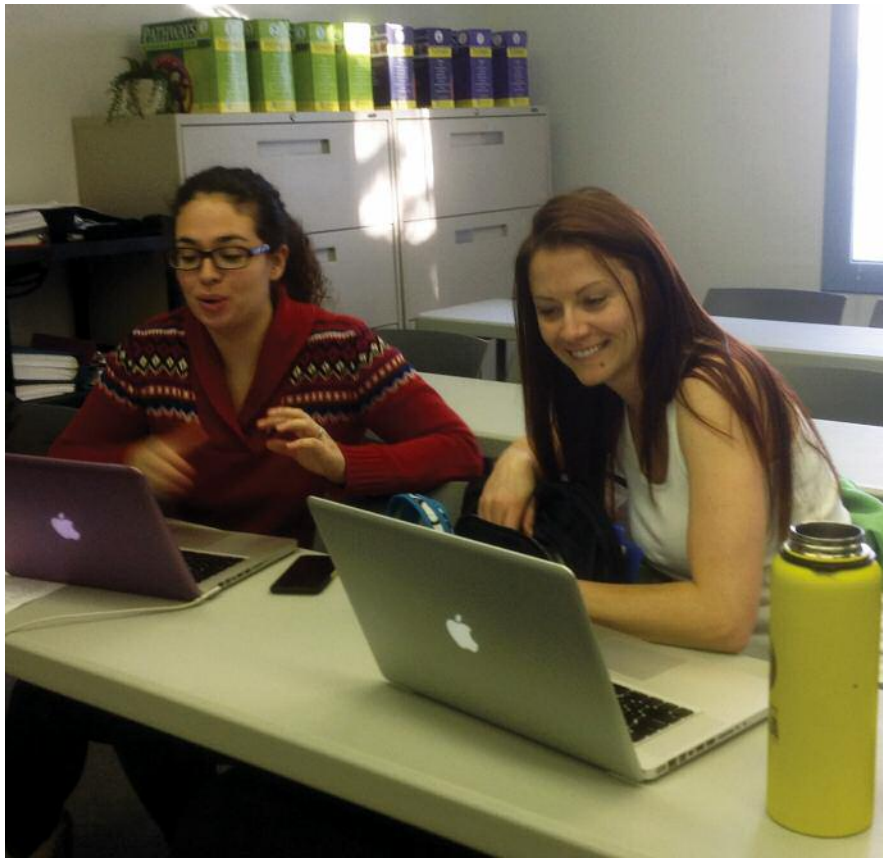
You may use this rubric as a template or create your own. Your final product will be evaluated based on the rubric you choose.

Created by June Fiorito, 2013.

me permission to cite their projects and use them as demos in my classes. Annina[24] worked on an art project that she planned to use in a workshop for her students. Naomi[25] chose the topic of "Globalization" to present to a high school social studies class.

Using "Art 30 Lab Class" from Google.docs, Annina instructed her high school students to focus on Art 30 (Alberta, Canada: Grade 12 equivalent). Students were expected to assimilate all knowledge and skills they would or should have acquired throughout high school and implement them in a final exhibition. They worked in small groups to set up, advertise, and then present a full-fledged exhibition of their work and to record it in an electronic or hard-copy portfolio.

Naomi, on the other hand, chose to use Wikispaces for her project-based learning assignment. Her project had two guiding questions: "To what extent should we embrace globalization, and what can we do to make a positive change in the world around us?" Naomi led her students through the following steps: Planning, Retrieving, Processing, Creating, and Sharing. She ended her project by calling on her students to participate in a "Final Reflection" during which they were to discuss and debrief their experiences during the project.



Students were given the option to work alone or with classmates who were specializing in the same content area, or in areas that worked well together.

Examples of Student Projects 2014-2015

During the 2014-2015 school year, more students opted to work on project-based learning assignments in groups. Students who had similar specializations or minors grouped together to work on their projects. The process worked much better with group participation because input from their classmates helped to strengthen each student's project. As they collaborated, and sometimes disagreed about what to include or not to include, they were able to fine-tune their strategies.

Cody and Hazel[26] chose to work together on a project that involved poetry, part of their English specialization. They led their students into a hands-on study of poetry. "New Literacies" played a major part in their presentation.

Kayla, Joseph, and Sarah (pseudonym),[27] who were specializing in science, worked on "Grade 11 Biology: Human Systems Unit D—Project Outline: Systems and Diseases." Their high school science lessons incorporated principles of project-based learning.

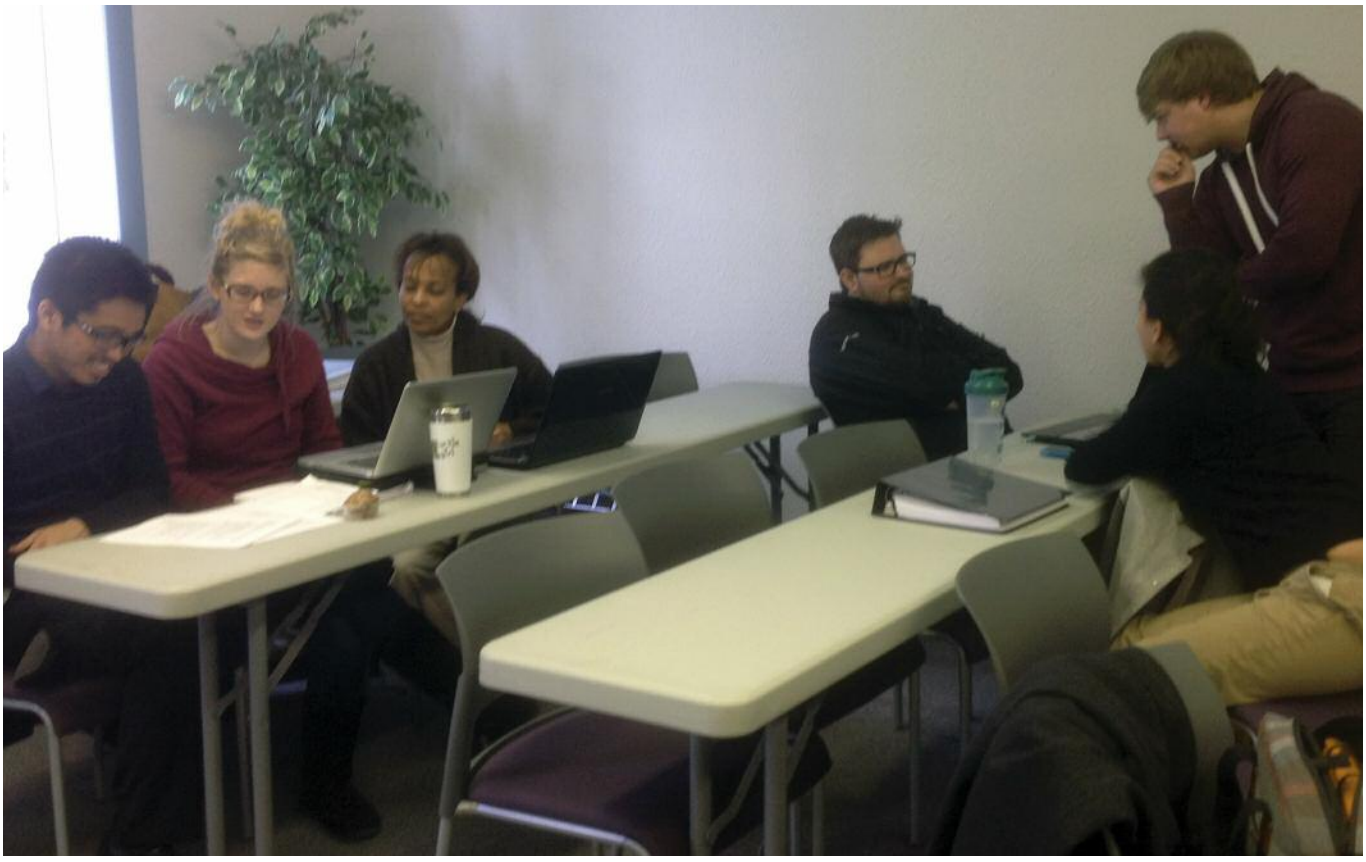
Zachary and Tristan[28] chose to work on a project that would enhance the teaching of Bible-related topics. Their title, "Coexist," was based on the *Journey to Excellence* Grade 9 Secondary Religion Standards in North American Division Seventh-day Adventist schools. The project used WebQuest to help students complete assignments based on the content.

Conclusion

Over the past nine years, as I introduced project-based learning in my higher-education classes, I have experienced both positive responses and indifference from my students. Reflecting on each experience helps me build on the successes and look for ways to address student indifference. My goals are to get students interested in their own learning and help them prepare to teach their future students.

The question should not be: "Is there a perfect version of project-based learning?" I believe there are no neat or tidy solutions for real-world problems. Individual educators can add or subtract features to create what they regarded as an ideal project-based learning assignment. This will help them (and teacher-education candidates) learn to navigate challenges, seek opportunities to integrate their faith, and become comfortable with searching for practical solutions to real-world problems. Currently, project-based learning is one of the hands-on approaches that has caught the vision of K-12 students and teachers in higher-education classrooms. Teachers who encounter challenges may access many online resources and books on how to plan and implement project-based learning in the classroom. I recommend collaborating with colleagues, as well.

Project-based learning allows students to be self-directed in pursuing topics pertaining to curricular needs and interests. Teachers in turn serve as coaches, facilitators, or guides, supporting students as they engage in inquiry and discovery. The approach provides Adventist educators with multiple opportunities to create learning experiences that mirror real-world experiences as students solve problems, investigate difficult topics, and create solutions to problems.



During the collaborative process, students relied on input and feedback from their peers. Team discussions helped them navigate disagreements, and ultimately, fine-tune the strategies used in their final projects.

This article has been peer reviewed.

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Inquiry Teaching in Higher Education: A Critical-thinking Context

When, where, and how do conversations about enhancing thinking practices take place in your classroom?

Human beings alone are uniquely created to think and question, and have an amazing propensity to learn through sharing ideas, teaching one another, and looking for answers.[1] Contrast this view of learning with the historic (traditional) instructional approach, founded in Western Europe more than 900 years ago: The teacher who arrives in the classroom with a bag of books and a brain full of rehearsed, hackneyed facts, and proceeds to dispense these facts to a passive, acquiescent audience of learners.

In Genesis, we read that God created Adam and Eve in His image and likeness.[2] That likeness was not only physical but also spiritual and mental.[3] They were endowed with an intellect similar to their Creator's. God intended that the first couple and their offspring should grow in relationship with Him and develop intellectually to attain the highest possible levels that humans can reach.[4] God, the Creator, was Adam and Eve's teacher in the Eden school, where He established the pattern for true Christian education.[5] By giving Adam the opportunity to name each of the animals,[6] He created a stimulating and challenging learning environment in which He encouraged His pupils to observe, pose questions, identify problems, conduct inquiry, and discover solutions. God freed Adam and Eve to be creative and to experience a sense of well-being and meaningfulness in the learning process.

Solomon's encounter with God[7] while still a young king exemplifies God's desire to actively involve learners. This experience prepared Solomon as a lifelong learner, problem solver, and wise king. By reflecting God's example of true education, the inquiry approach invariably results in deep engagement, which develops creative learners who are endowed with the essential skills to think scientifically and critically.

As Christian educators, God expects us to follow the example of the Master Teacher in providing learning opportunities that include inquiry-based critical thinking for the students He entrusts to our care. Questions bring clarity to problems, define issues, and engage young people in substantive learning. This approach parallels a method that Jesus used. In fact, we find that Jesus used 213 separate questions in the Gospels.[8] He used compelling questions to clarify spiritual truths, draw out responses, and combat His detractors.[9] George Knight quotes John A. Marquis, who opined, "Teaching is not telling

BY DERIL WOOD and JEANNETTE R. DULAN

because a great deal of our telling elicits no mental response."[10] In Christ's inductive, analytical approach, He incorporated questions that made His listeners think. His intent was to develop, not control minds.[11]

Generating powerful, essential questions is an integral part of critical thinking. Identifying the components of thinking can provide a framework for formulating essential questions. Using inquiry in the context of applying the elements of critical thinking is an appropriate tool in that mind development process.

The purpose of this article is to explore benefits and challenges of an inquiry-based approach within the paradigm of critical thinking in higher education. We have examined the biblical roots of an inquiry approach and will define inquiry and discuss its importance in a critical-thinking context. Further, we will cite examples of the application of the critical-thinking/inquiry approach in higher-education institutions, identify classroom delivery challenges, and finally present a framework for practical applications.

Inquiry Approach Defined

Providing a precise definition for inquiry is a challenge since teaching practices use several variations of inquiry-based learning. The most common variations include: problem-based learning, project-based learning, and case-based learning.[12] Examining the similarities and differences of each of these approaches extends beyond the confines of this article. However, each approach shares the common characteristic of a student-centered approach in contrast to a teacher-centered (traditional) approach. Inquiry-based learning, across all levels of education, is based on the philosophy of John Dewey[13] and by definition emphasizes a student-centered, active learning approach that focuses on questioning, critical thinking, and other metacognitive functions. Inquiry-based instruction provides balance to traditional instruction because it focuses more on involving students in the learning process. It gives students the opportunity to analyze their thinking and learning processes. It goes beyond *what* they know to *how they have come to know*, and helps them understand how they learned the things they know. It makes them more efficient and effective learners.

Instructors utilizing the inquiry approach generally engage in more formative assessment of student learning; that is, assessing learning during instruction in order to strengthen student understanding. Thus, formative assessments occur continuously during instruction. Summative assessment, on the other hand, is usually applied at the end of an instructional cycle. One of its purposes is helping to determine grades. Inquiry-driven instructors often use rubrics (grading guides) for both formative and summative assessments because they help to clarify expectations and take the mystery out of the assessment process.

In traditional classroom settings, students are less prone to ask questions, but rather listen and repeat expected answers. While traditional, direct instruction and related teacher-centered approaches can be effective and do have a place in the learning process, they should not dominate or exclude inquiry approaches.

Instructors utilizing the inquiry approach are more likely to view students as:

- actively involved in learning and construction of knowledge rather than passive recipients;
- able to systematically analyze and evaluate their thinking and consider others' viewpoints rather than randomly reflecting or dismissing others' thoughts[14];
- able to develop the skills of critical thinking and questioning in the mastery of content, rather than being limited to mastery of content through memorization[15];

Thus, within the framework of critical thinking, inquiry is viewed as raising essential questions that lead to lifelong learning. In fact, according to Elder and Paul, "It is not possible to be a good thinker and a poor questioner."[16]

The Importance of Inquiry

In traditional classroom settings, students are less prone to ask questions, but rather listen and repeat expected answers. While traditional, direct instruction and related teacher-centered approaches can be effective and do have a place in the learning process, they should not dominate or exclude inquiry approaches. This is especially important in the 21st century, when access to huge volumes of information is practically at our fingertips. Processing volumes of information for useful and meaningful application requires a systematic approach such as inquiry-based learning within the framework of critical thinking. For example, students can easily retrieve vast quantities of data from the World Wide Web. However, they need the critical-thinking filters to sort through the information, extract the essence, and evaluate the quality. In addition to drawing from printed text, students must be equipped to read between the lines and off the page. They need to develop the ability to raise questions, identify concepts, evaluate information, make inferences and draw conclusions, and utilize inquiry skills.

Inquiry is not so much identifying the right answer but engaging in the process of seeking to understand principles that lead to appropriate resolutions to questions and issues. According to Elder and Paul, "Questions define tasks, express problems, and delineate issues. They drive thinking forward. Only when an answer generates further questions does thought continue as inquiry. A mind with no questions is a mind that is not intellectu-

ally alive."[17] This concept is especially meaningful in higher education and can be used in all disciplines. "Every field stays alive only to the extent that fresh questions are generated and taken seriously as the driving force in thinking. When a field of study is no longer pursuing significant answers to essential questions, it dies as a field. To think through or rethink anything, one must ask the questions necessary to thinking through the logic of that thing, clearly and precisely."[18]

Inquiry Approaches in Higher Education

A review of the literature reveals emergent research in inquiry-based instruction at the higher-education level. Researchers have focused primarily on K-12 classrooms, emphasizing Science, Technology, Engineering, and Mathematics (STEM). However, 21st-century educators must prepare thinkers and innovators in a variety of fields. Tertiary-level educators must assume their share of the responsibility for equipping students to: apply essential questions as tools in the learning and critical-thinking process, and to apply principles for formulating, analyzing, assessing, and settling primary questions. These inquiry skills are the essence of student-centered learning, across the subjects (e.g., science, technology, engineering, economics, psychology, history, religion, the arts, and other subjects).

A growing body of literature in higher education reports that exposure to inquiry-based teaching approaches is related to significant gains in performance on tests of critical thinking and facilitates higher levels of cognition for students, who develop a process to better understand principles and concepts.[19] Greenwald and Quitamado[20] state that inquiry-based teaching is a method that ideally reflects the application of critical-thinking skills.

The adoption of critical-thinking/inquiry approaches at several colleges and universities suggests its increasing value to the learning community. Many of the clearly delineated approaches to critical thinking/inquiry approaches are associated with a mandate of the Southern Association of Colleges and Schools Regional Accrediting Association (SACSCOC) in the United States, in its initiation of The Quality Enhancement Plan (QEP). This requires all member institutions to implement a five-year plan that addresses a well-defined topic pertaining to the enhancement of student learning outcomes.[21]

While our research suggests this particular regional accreditation initiative is currently the only one of its type and structure in the United States, we believe the value of such an initiative is not dependent on external requirements, and merits implementation as an integral part of the academic process of any higher-education institution. Within this context, Oakwood University in Huntsville, Alabama, developed a Quality Enhancement Plan approved by the Southern Association of Colleges and Schools: Commission on Colleges that addresses critical-thinking

development through writing and prepares instructors to embed critical-thinking concepts in selected general-education courses with plans for continued implementation throughout the university curriculum. The preparation was based on a metacognitive approach that utilized the Paul and Elder[22] critical-thinking framework. The framework involved an online course in critical-thinking concepts and instructional applications, and cross-disciplinary interaction in workshops and seminars. This article will briefly describe the framework, focusing on inquiry-based strategies.

Examples of the implementation of critical-thinking/inquiry approaches in higher education suggest purposeful integration of this approach at the university level. The University of Louisville in Louisville, Kentucky, has an active critical-thinking program that reflects the inquiry approach within its framework. It provides resource materials, workshops. and small-group sessions fostering cross-disciplinary conversations about critical thinking.[23] Surry Community College in Dobson, North Carolina, focuses on improving student learning outcomes by using critical-thinking/inquiry processes that go beyond traditional lecture and rote memorization.[24] Florida Memorial University in Miami Gardens, Florida, has embedded critical-thinking skills in five general-education courses by using a framework that includes inquiry techniques.[25]

While not exhaustive, this sampling of higher-education programs that have adopted a critical-inquiry approach to student learning does illustrate the multiple contexts in which a critical-thinking/inquiry approach is being implemented.[26]

Challenges to Implementing Inquiry in Higher Education

We have addressed inquiry as a meaningful approach to teaching and learning that seeks to promote deep understanding and active involvement in the learning process. We have identified its biblical roots and pointed out its powerful effect as a method used by Christ, the Master Teacher. However, implementing the inquiry approach as a natural part of an academic environment may present a number of challenges such as the following:

- Lack of understanding of the deeper nature of inquiry-based learning;
- Moving inquiry from the theoretical to a perspective that is basic to how instructors view their students, their discipline, and their teaching practices;
- Lack of a practical framework that identifies the components of critical-thinking/inquiry;
- Lack of a common language in analyzing and evaluating inquiry applications; and
- Insufficient preparation and learning resources.

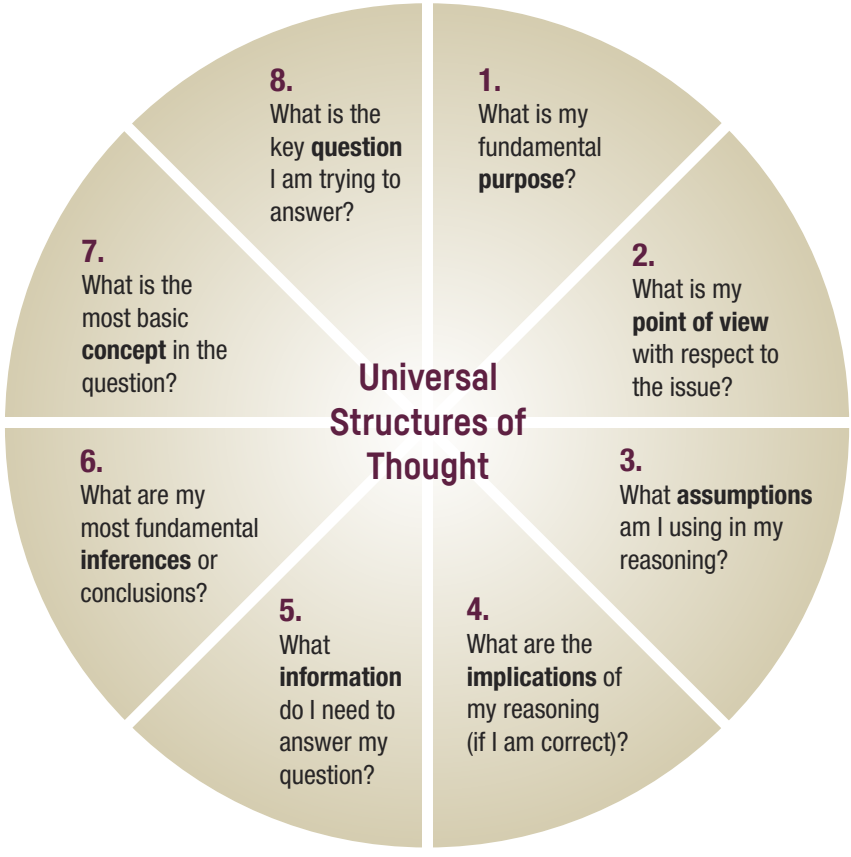
These challenges may be overcome through deliberate planning, in a collegial manner, effortful awareness of the usefulness of the framework, buy-in by faculty, training, practice, and monitoring.

An Approach to Implementation

To help teachers master the challenges of implementing an inquiry approach, we present essential questions within the framework of elements of critical thinking, also referred to as *elements of thought*. Many possibilities exist for organizing a systematic approach to questioning. We have selected one based on the elements of thought, which are question-generating concepts. These elements are tools that represent principles for formulating, analyzing, and evaluating primary questions. Appropriately used, they promote a view of students as active learners, are applicable across subject areas and disciplines, and provide a common language for teaching and learning.

For example, in a literature, Bible, history, psychology, math, or any other class, the instructor may ask students to read a chapter of the textbook and use the eight elements to

Figure 1.
Analytic Questions Implied by the Elements of Thought



do a critical analysis of the text they read. Students would then identify the author's purpose, the viewpoints considered, assumptions, implications for the reader, the information the author is using, the inferences and conclusions proposed, concepts involved in the discourse, and the questions at issue. These elements apply equally to the writing process. Furthermore, the instructor may ask students to consider some or all eight elements of thought as identified in the work of Elder and Paul[27]: purpose, point of view, assumptions, implications, information, inferences, concept, and question (see Figure 1 on page 48).

"Analyzing essential questions is vital to excellence in thought. When we analyze we break the whole into parts. Success in thinking depends, first of all, on our ability to identify the components of thinking. We can discipline our questioning by asking essential questions focused on those components."[28] This approach to inquiry teaching can be integrated into a course using steps similar to those used in instructional design for any subject. The general categories of instructional design include the following: identifying goals/objectives, developing an instructional plan, and designing assignments and assessments. Table 1 illustrates a process for inquiry in instructional design within the framework of the elements of thought.

Table 1. Elements of Thought and Inquiry in Instructional Design Across Disciplines

Instructional Design Components	Elements of Thought and Inquiry in Analyzing the Logic of Any Subject	Science (Example)	History (Example)
Goals and Objectives	What is the main **Purpose** or goal of studying this subject? What are people in this field trying to accomplish?	To figure out how the physical world operates through systematic observation and experimentation.	To create a "story" about the past that captures its dynamics and helps us make decisions about the present and plans for the future.
Instructional Plan	What kinds of **Questions** do they ask? What kinds of problems do they try to solve?	What can be figured out about how the physical world operates by observation and experimentation?	What happened during this particular time period and in this particular place in the past that can help us understand current events and make future decisions?
	What sorts of **Information** or data do they gather?	Facts that can be systematically gathered about the physical world.	Important information from the past gathered in the attempt to devise an account of the dynamics of the past.
Questions to Consider During Activities and Assignments	What are the most basic ideas, **Concepts,** or theories in this field?	The workings of the physical world as predicative and understandable through carefully designed hypotheses, predictions, and experimentation reflective of biblical accounts of Creation.	The past as understandable through careful study and interpretation.
	What do professionals in this field take for granted or **Assume**?	That there are laws at work in the physical world, some of which can be figured out through systematic observation and experimentation reflected in the biblical view of creation.	That there are important patterns and information in the past that can be figured out through systematic observation, study, and interpretation and that can help us live better in the future.

Adapted from Linda Elder and Richard Paul, *The Thinker's Guide to Analytic Thinking: How to Take Thinking Apart and What to Look for When You Do* (Tomales, Calif.: The Foundation for Critical Thinking, 2012): http://www.criticalthinking.org.

Table 2. Components of Thought and Sample Questions

Components of Thought	Sample Questions
1. *Questioning Purposes:* All thought reflects an agenda or purpose. Questions that focus purpose include the following:	• What are we trying to accomplish? • What is our central agenda? • What other goals do we need to consider?
2. *Questioning Questions:* All thought is responsive to a question. Questions that focus on questioning are:	• Is this the best question to focus on at this point, or is there a more pressing question we need to address? • What important questions are embedded in this issue? • The question in my mind is this: How do you see the question?
3. *Questioning Information*: All thought presupposes an information base. Questions that focus on information in thinking include the following:	• On what information are you basing that comment? • What experience convinced you of this? Could your experience be distorted? • How do you know this information is accurate? How could we verify it? • Have we failed to consider any information or data?
4. *Questioning Inferences and Conclusions:* All thought requires the making of inferences, the drawing of conclusions, and the creation of meaning. Questions that focus on inferences include the following:	• How did you reach that conclusion? • Could you explain your reasoning? • Is there an alternative plausible conclusion? • Given all the facts, what is the best possible conclusion?
5. *Questioning Concepts and Ideas:* All thought involves the application of concepts. Questions that focus on concepts in thinking include the following:	• What is the main idea you are using in your reasoning? Could you explain that idea? • Are you using the appropriate concept, or do you need to re-conceptualize the problem? • Is the question a legal, a theological, or an ethical one?
6. *Questioning the Assumptions:* All thought rests upon assumptions. Questions that focus on assumptions in thinking include the following:	• What exactly are you taking for granted? • Why are you assuming that? Should you rather assume something different? • What assumptions underlie your point of view? What alternative assumptions might we make?
7. *Questioning Implications and Consequences:* All thought is headed in a direction. Questions that focus on implications include the following:	• What are you implying when you say . . . ? • Are you implying that . . . ? • If we do this, what is likely to happen as a result? • Have you considered the implications of this policy (or practice)?
8. *Questioning Viewpoints and Perspectives:* All thought takes place within a point of view or frame of reference. Questions that focus on point of view in thinking include the following:	• From what point of view are you looking at this? • Is there another point of view to consider? • Which of these possible viewpoints makes the most sense, given the situation?

Table adapted from Linda Elder and Richard Paul, *The Thinker's Guide to The Art of Asking Essential Questions* (Dillon Beach, Calif.: The Foundation of Critical Thinking, 2006):5-8: http://www.criticalthinking.org.

The elements of thought can be applied to a wide range of assignments and classroom activities such as exploring a topic of study, making a presentation, writing a paper, examining an author's work, reflecting on a service-learning activity, and similar activities. In completing assignments and activities, students engage in responses to compelling questions that they generate using elements of thought as a guide.

Table 2: *Components of Thought and Sample Questions*[29] provides a brief example of how questions generated within the framework of critical-thinking elements can guide a critical-thinking approach to inquiry. The descriptions and examples provided here address the challenges to implementation of inquiry-based learning. Preparation for implementing such a program can be adapted to the institution's needs and resources.

The critical-thinking/inquiry-based framework provides a variety of powerful questions that can be communicated as a common language across disciplines, classrooms, students, and instructors.[30]

Conclusion

We have discussed an approach to inquiry in higher education within the context of critical-thinking components. Our framework provides a systematic approach to learning that is concise and reflects essential analytic questions. Examples of this approach in higher-education institutions suggest a growing appreciation for its strengths in facilitating deeper understanding that outweigh the challenges. Applications of the inquiry-based approach can be found in biblical accounts of teaching and learning from Creation to Christ's teaching and also in Ellen G. White's writings.

White declared: "Every human being, created in the image of God, is endowed with a power akin to that of the Creator—individuality, power to think and do. . . . It is the work of true education to develop this power; to train the young people to be thinkers, and not mere reflectors of other people's thought."[31]

This article has been peer reviewed.

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The Future of Education: Are We Ready?

What are some specific thinking tools you like to use? How can you extend your repertoire of such tools?

It is imperative for teachers to address the needs of contemporary learners. Ellen White stated: "It is the work of true education . . . to train young people to be thinkers, and not mere reflectors of other people's thought."[1] This marked shift from simply acquiring facts to thinking and generating knowledge is one characteristic of a contemporary learner.

What else do we know about contemporary learners that has an impact on their development as thinkers? We know they are living and growing in the Information Age. We know they are often connected to other people and/or organizations using networks, media, and digital tools. We know they need to be professional learners to succeed in a world that changes rapidly. These factors prompt us, as professionals in the field of education, to challenge assumptions we hold about curriculum, instruction, and assessment. Dr. Heidi Hayes Jacobs and I have worked together to describe some of the impacts on education and how we look at contemporary learners based on these observations by authoring several resources, presenting workshops, and founding support systems for teachers and students such as Curriculum21 (Hayes Jacobs) and Tomorrow's Education Network (Alcock). This article explores some of our observations and shares what educators can consider as we all prepare to teach contemporary learners.

The Information Age

Today's American education system was created in 1892 by the Committee of Ten in Saratoga Springs, New York.[2] They came together to face the challenges in a new and growing industrialized world. The council realized they had to upgrade the agricultural model to prepare children for their future—one that was so different that it would challenge the very structure of the education model at the time. Instead of a single multiage classroom, they would sort children by age. Instead of the day being organized into large chunks of learning time, it would be neatly divided into periods separated by bells to prepare learners for the factory. Instead of developing basic skills in all learners until they showed some degree of mastery, the school would design tasks that would be used to distinguish learners who performed well quickly from those who did not or who took longer to learn.

Thus, a sorting method was established to be certain that "A students" would be qualified for higher levels of leadership in the industrialized world. The 100-point scale and the policy of averaging grades were embraced. Not long thereafter, in 1916, standardized tests were created to help find talent in the learner population and earmark those students for future opportunities to lead and succeed. This is the legacy of the industrialized model of education. It is time for a new model—one that is dedicated to preparing learners for a place in the Information Age.

This new model will have to meet the different needs of contemporary learners as well as the requirements of an information-saturated society and job market. Finally, it will have to prepare learners to think, communicate, and take action in a globally connected world. A model like this will shed the structures of both the agricultural and industrial models and embrace or invent new forms and structures.

BY MARIE ALCOCK

School Program Structures

In her book *Curriculum21: Essential Education for a Changing World,*[3] Heidi Hayes Jacobs describes four interconnected program structures that educators can use as they prepare contemporary learners:

- Schedule (long-term and short-term)
- Grouping patterns of learners (institutional and instructional)
- Grouping patterns of adults (multiple affiliations)
- Space (both physical and virtual)

The current policies, practices, and habits we have surrounding these program structures largely determine the ability of a school to respond to the needs of the contemporary learner. "To move our school structures into more open, fluid, and correspondingly inventive forms, we need new forms, not reform."[4] We recognize that we cannot simply "tweak" or "adjust" our industrial schedule, groupings, or even buildings to meet the needs of the 21st century. To think in fresh ways about these structures can open doors to innovative ideas and new models of schools for the Information Age.

What will these models look like? Some models may have spaces that are not defined as "classrooms" but rather defined by the type of learning that occurs there. Teachers will move groups of learners between spaces without having one space being specifically "theirs" or for certain "grades." The spaces might be called direct instruction or lecture spaces, inspiration spaces, maker spaces, and motivation spaces. Teachers will identify the kind of thinking they want the learners to develop and then plan to use the space designed to support that kind of thinking. Teachers will schedule the lecture space in the same way they schedule computer labs today. The notion that one box-shaped space can serve all the different types of thinking we are working to develop in learners limits and frustrates educators functioning within the current model.

Some models may need to have both physical and virtual space available for learning 24/7. For example, learners may experience or complete half of their program online and half of their program in garages as they build prototypes for a local oil refinery. Using space to facilitate connections and collaboration on processes that require a team, while using virtual space to connect around questions, networks, and organizational tools or apps is both logical and cost effective. An Information Age model of education can support learners as they develop the skills to self-navigate their learning, become media makers and media critics, as well as innovative designers.

Some models may develop schedules that simply move from a morning program to an afternoon program, and learners will dedicate time to granular skills development (skills such as critical thinking, collaboration, and self-management), as well as larger quest-based or project-based learning. The development of questions worth learning about will be collaboratively co-created by learner and teacher. The meeting of standards and passing of standardized tests will be a byproduct of an engaging and rich curriculum experience. In contrast with the current system, neither student nor teacher will know the outcome of the learning experience as it responds to the information found and the connections made along the way.

This notion—that a teacher must know everything before the learner does and must plan the learning experience completely since the learners will simply obey the teacher and learn what is delivered—has frustrated both teachers and learners. A pre-planned learning experience that fits all the needs and levels of students in a classroom is no longer the norm; in fact, it is not even feasible. The antiquated model based on these notions cannot keep up with the vast amount of information that is readily available to learners today.

It is clear that teachers do not need to know all of the information before students do. Rather, they need to model the learning process of how to learn and fail properly. Because failure is a basic and intricate part of the learning process, it is important that learners know exactly how to do it well and avoid the negative behaviors associated with failure such as blaming, giving up, and cheating. Teachers can model this in a curriculum where they are not expected to know everything first, but rather strive to design questions and learning experiences where they can model professional learning and exactly how it should be done. Professional development and training designed to assist teachers in learning how to model these practices is the path to developing lifelong professional learners who are prepared for the Information Age.

This article was commissioned for this issue.

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