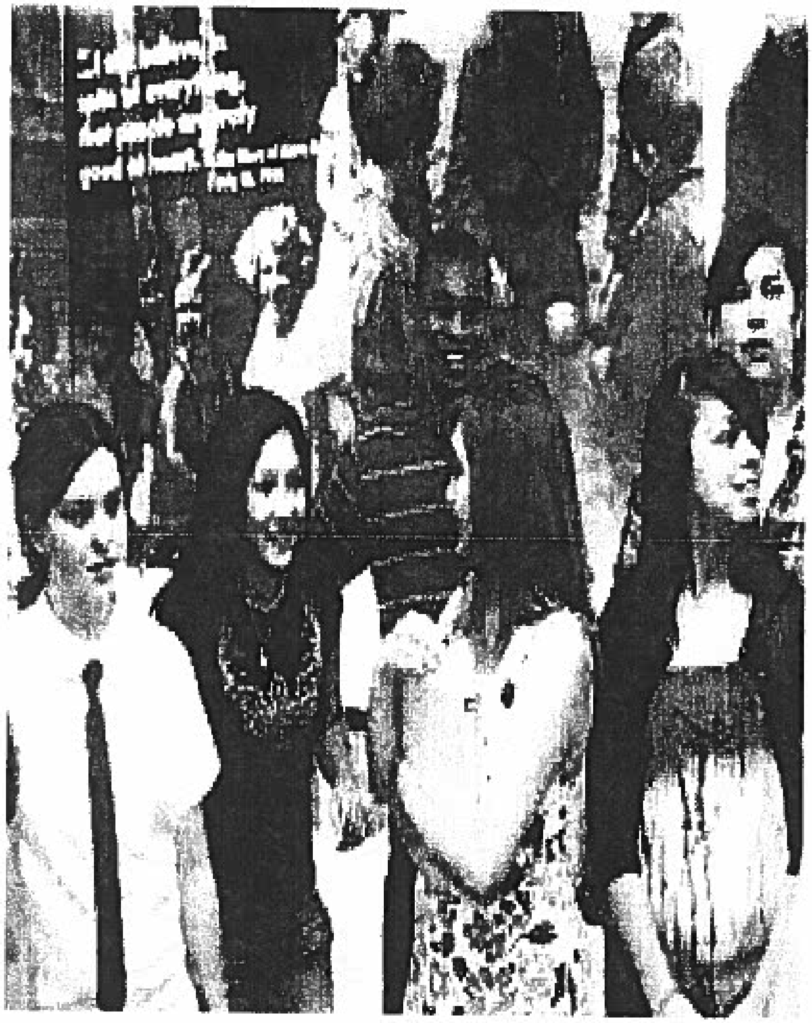


Solidify Content Knowledge Using Vocabulary and Questioning Strategies for Grades 5-8 Science

Arkansas Department of Education

Building Academic Vocabulary

Marzano & Pickering, 2005

1. Provide a description, explanation, or example of the new term.
2. Ask students to restate the description, explanation, or example in their own words.
3. Ask students to construct a picture, symbol, or graphic representing the term.
4. Engage students periodically in activities that help them add to their knowledge of the terms.
5. Periodically ask students to discuss the terms with one another.
6. Involve students periodically in games that allow them to play with terms.

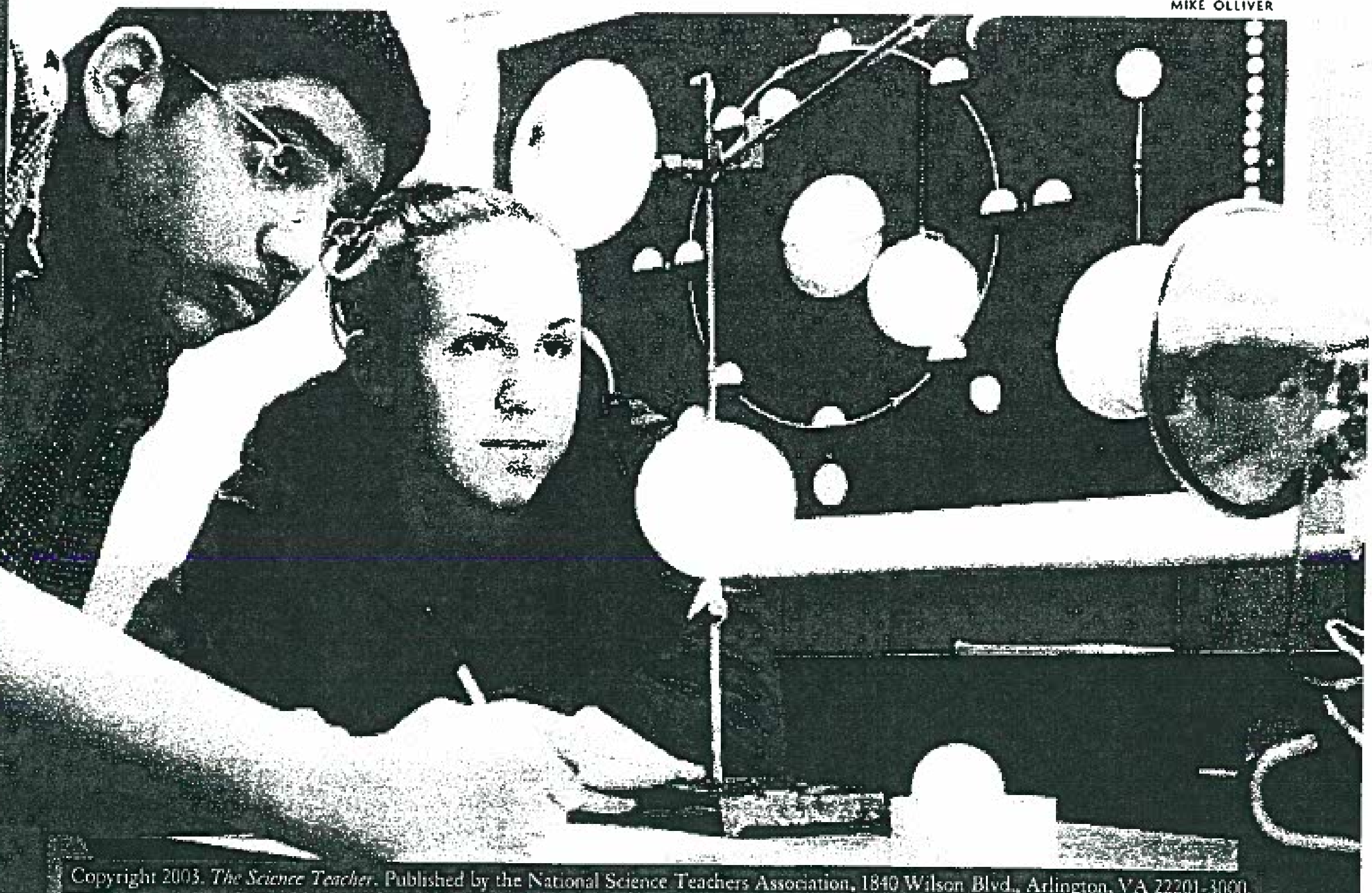
Expanding the 5E Model

A proposed 7E model emphasizes "transfer of learning" and the importance of eliciting prior understanding

Arthur Eisenkraft

Sometimes a current model must be amended to maintain its value after new information, insights, and knowledge have been gathered. Such is now the case with the highly successful 5E learning cycle and instructional model (Bybee 1997). Research on how people learn and the incorporation of that research into lesson plans and curriculum development demands that the 5E model be expanded to a 7E model.

MIKE OLLIVER



The 5E learning cycle model requires instruction to include the following discrete elements: *engage, explore, explain, elaborate,* and *evaluate.* The proposed 7E model expands the *engage* element into two components—*elicit* and *engage.* Similarly, the 7E model expands the two stages of *elaborate* and *evaluate* into three components—*elaborate, evaluate,* and *extend.* The transition from the 5E model to the 7E model is illustrated in Figure 1.

These changes are not suggested to add complexity, but rather to ensure instructors do not omit crucial elements for learning from their lessons while under the incorrect assumption they are meeting the requirements of the learning cycle.

Eliciting prior understandings

Current research in cognitive science has shown that eliciting prior understandings is a necessary component of the learning process. Research also has shown that expert learners are much more adept at the transfer of learning than novices and that practice in the transfer of learning is required in good instruction (Bransford, Brown, and Cocking 2000).

The *engage* component in the 5E model is intended to capture students' attention, get students thinking about the subject matter, raise questions in students' minds, stimulate thinking, and access prior knowledge. For example, teachers may engage students by creating surprise or doubt through a demonstration that shows a piece of steel sinking and a steel toy boat floating. Similarly, a teacher may place an ice cube into a glass of water and have the class observe it float while the same ice cube placed in a second glass of liquid sinks. The corresponding conversation with the students may access their prior learning. The students should have the opportunity to ask and attempt to answer, "Why is it that the toy boat does not sink?"

The engage component includes both accessing prior knowledge and generating enthusiasm for the subject matter. Teachers may excite students, get them interested and ready to learn, and believe they are fulfilling the engage phase of the learning cycle, while ignoring the need to find out what prior knowledge students bring to the topic. The importance of *eliciting* prior understandings in ascertaining what students know prior to a lesson is imperative. Recognizing that students construct knowledge from existing knowledge, teachers need to find out what existing knowledge their students possess. Failure to do so may result in students developing concepts very different from the ones the teacher intends (Bransford, Brown, and Cocking 2000).

A straightforward means by which teachers may elicit prior understandings is by framing a "what do you think" question at the outset of the lesson as is done consistently in some current curricula. For example, a common physics lesson on seat belts might begin with a question about designing seat belts for a racecar traveling at a high rate of speed (Figure 2, p. 58). "How would they be different from ones available on passenger cars?" Students responding to this question communicate what they know about seat belts and inform themselves, their classmates, and the teacher about their prior conceptions and understandings. There is no need to arrive at consensus or closure at this point. Students do not assume the teacher will tell them the "right" answer. The "what do you think" question is intended to begin the conversation.

The proposed expansion of the 5E model does not exchange the *engage* component for the *elicit* component; the engage component is still a necessary element in good instruction. The goal is to continue to excite and interest students in whatever ways possible and to identify prior conceptions. Therefore the elicit component should stand alone as a reminder of its importance in learning and constructing meaning.

Explore and explain

The *explore* phase of the learning cycle provides an opportunity for students to observe, record data, isolate variables, design and plan experiments, create graphs, interpret results, develop hypotheses, and organize their findings. Teachers may frame questions, suggest approaches, provide feedback, and assess understandings. An excellent example of teaching a lesson on the metabolic rate of water fleas (Lawson 2001) illustrates the

FIGURE 1

The proposed 7E learning cycle and instructional model.

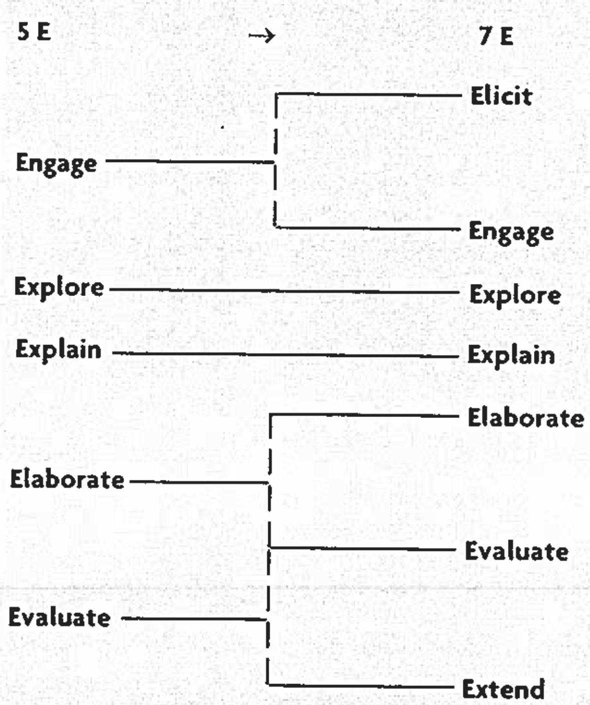


FIGURE 2

Seatbelt lesson using the 7E model.

Elicit prior understandings

- Students are asked, "Suppose you had to design seat belts for a racecar traveling at high speeds. How would they be different from ones available on passenger cars?" The students are required to write a brief response to this "What do you think?" question in their logs and then share with the person sitting next to them. The class then listens to some of the responses. This requires a few minutes of class time.

Engage

- Students relate car accidents they have witnessed in movies or in real life.

Explore

- The first part of the exploration requires students to construct a clay figure they can sit on a cart. The cart is then crashed into a wall. The clay figure hits the wall.

Explain

- Students are given a name for their observations. Newton's first law states, "Objects at rest stay at rest; objects in motion stay in motion unless acted upon by a force."

Engage

- Students view videos of crash test dummies during automobile crashes.

Explore

- Students are asked how they could save the clay figure from injury during the crash into the wall. The suggestion that the clay figure will require a seat belt leads to another experiment. A thin wire is used as a seat belt. The students construct a seat belt from the wire and ram the cart and figure into the wall again. The wire seat belt keeps the clay figure from hitting the wall, but the wire slices halfway through the midsection.

Explain

- Students recognize that a wider seatbelt is needed. The relationship of pressure, force, and area is introduced.

Elaborate

- Students then construct better seat belts and explain their value in terms of Newton's first law and forces.

Evaluate

- Students are asked to design a seat belt for a racing car that travels at 250 km/h. They compare their designs with actual safety belts used by NASCAR.

Extend

- Students are challenged to explore how airbags work and to compare and contrast airbags with seat belts. One of the questions explored is, "How does the airbag get triggered? Why does the airbag not inflate during a small fender-bender but does inflate when the car hits a tree?"

effectiveness of the learning cycle with varying amounts of teacher and learner ownership and control (Gil 2002).

Students are introduced to models, laws, and theories during the *explain* phase of the learning cycle. Students summarize results in terms of these new theories and models. The teacher guides students toward coherent and consistent generalizations, helps students with distinct scientific vocabulary, and provides questions that help students use this vocabulary to explain the results of their explorations. The distinction between the explore and explain components ensures that concepts precede terminology.

Applying knowledge

The *elaborate* phase of the learning cycle provides an opportunity for students to apply their knowledge to new domains, which may include raising new questions and hypotheses to explore. This phase may also include related numerical problems for students to solve. When students explore the heating curve of water and the related heats of fusion and vaporization, they can then perform a similar experiment with another liquid or, using data from a reference table, compare and contrast materials with respect to freezing and boiling points. A further elaboration may ask students to consider the specific heats of metals in comparison to water and to explain why pizza from the oven remains hot but aluminum foil beneath the pizza cools so rapidly.

The elaboration phase ties directly to the psychological construct called "transfer of learning" (Thorndike 1923). Schools are created and supported with the expectation that more general uses of knowledge will be found outside of school and beyond the school years (Hilgard and Bower 1975). Transfer of learning can range from transfer of one concept to another (e.g., Newton's law of gravitation and Coulomb's law of electrostatics); one school subject to another (e.g., math skills applied in scientific investigations); one year to another (e.g., significant figures, graphing, chemistry concepts in physics); and school to nonschool activities (e.g., using a graph to calculate whether it is cost effective to join a video club or pay a higher rate on rentals) (Bransford, Brown, and Cocking 2000).

Too often, the elaboration phase has come to mean an elaboration of the specific concepts. Teachers may provide the specific heat of a second substance and have students perform identical calculations. This practice in transfer of learning seems limited to near transfer as opposed to far or distant transfer (Mayer 1979). Even though teachers expect wonderful results when they limit themselves to near transfer with large similarities between the original task and the transfer task, they know students often find elaborations difficult. And as difficult as near transfer is for students, the distant transfer is usually a much harder road to traverse. Students who are quite able to discuss phase changes of substances and their related freezing points, melting points, and heats of fusion and vaporization may find it exceedingly difficult to transfer the concept of phase change as a means of explaining traffic congestion.

Practicing the transfer of learning

The addition of the *extend* phase to the *elaborate* phase is intended to explicitly remind teachers of the importance for students to practice the transfer of learning. Teachers need to make sure that knowledge is applied in a new context and is not limited to simple elaboration. For instance, in another common activity students may be required to invent a sport that can be played on the moon. An activity on friction informs students that friction increases with weight. Because objects weigh less on the moon, frictional forces are expected to be less on the moon. That elaboration is useful. Students must go one step further and extend this friction concept to the unique sports and corresponding play they are developing for the moon environment.

The *evaluate* phase of the learning cycle continues to include both formative and summative evaluations of student learning. If teachers truly value the learning cycle and experiments that students conduct in the classroom, then teachers should be sure to include aspects of these investigations on tests. Tests should include questions from the lab and should ask students questions about the laboratory activities. Students should be asked to interpret data from a lab similar to the one they completed. Students should also be asked to design experiments as part of their assessment (Colburn and Clough 1997).

Formative evaluation should not be limited to a particular phase of the cycle. The cycle should not be linear. Formative evaluation must take place during all interactions with students. The *elicit* phase is a formative evaluation. The *explore* phase and *explain* phase must always be accompanied by techniques whereby the teacher checks for student understanding.

Replacing *elaborate* and *evaluate* with *elaborate, extend,* and *evaluate* as shown in Figure 1, p. 57, is a way to emphasize that the transfer of learning, as required in the extend phase, may also be used as part of the evaluation phase in the learning cycle.

Enhancing the instructional model

Adopting a 7E model ensures that eliciting prior understandings and opportunities for transfer of learning are not omitted. With a 7E model, teachers will *engage* and *elicit* and students will *elaborate* and *extend*. This is not the first enhancement of instructional models, nor will it be the last. Readers should not reject the enhancement because they are used to the traditional 5E model, or worse yet, because they hold the 5E model sacred. The 5E model is itself an enhancement of the three-phrase learning cycle that included exploration, invention, and discovery (Karplus and Thier 1967.) In the 5E model, these phases were initially referred to as explore, explain, and expand. In another learning cycle, they are referred to as exploration, term introduction, and concept application (Lawson 1995).

The 5E learning cycle has been shown to be an extremely effective approach to learning (Lawson 1995; Guzzetti et al. 1993). The goal of the 7E learning model is to emphasize the increasing importance of eliciting prior understandings and the extending, or transfer, of concepts. With this new model, teachers should no longer overlook these essential requirements for student learning. ■

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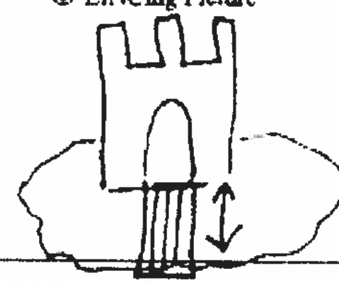
LINCS Tables

① Term / ③ Reminding Word	④ LINCing Story	⑤ LINCing Picture	② Definition
① Term: Kinetic Energy ③ Reminding Word: Tic	The boys tic was his body wouldn't stop moving.		the energy of a body in motion,
① Term: Potential Energy ③ Reminding Word: Tent	When we slept in the tent we were very still.		stored energy - an object not moving
① Term: Motion ③ Reminding Word: ~~Mote~~ Moat	The ~~mote~~ moat goes up and down to change position.		the action of changing place or position
① Term: Force ③ Reminding Word: Horse	The horse used great power to pull the cart.		power exerted upon an object

List the parts **I**dentify a Reminding Word **N**ote a LINCing Story **C**reate a LINCing Picture **S**elf-test

Scientific Prefixes and Suffixes

Prefix/Suffix	Meaning
a or an	not or non
meso	middle
endo	inner, inside
aero	needing oxygen or air
anti	against
amphi	both, doubly
aqua	water
arthro	joint
auto	self
bi	two, twice, double
bio	life, living
cephal	head
chloro	green
chromo	color
cide	killer, kill, killing
cyto	cell
derm	skin
di	two, double
ecto (exo)	outer, external
endo	internal
epi	above
gastro	stomach
genesis	origin, beginning
herba	plants
hetero	different
homo	alike, similar
hydro	water

Word	Meaning
hemo	blood
hyper	above
hypo	below
intra	within, inside
itis	disease, inflammation
lateral	side
logy	study of
lys	break down
meter	measurement
mono	one, single
morph	form
micro	small
macro	large
multi	many
pod	foot
phobia	dislike, fear
philia	like
plasm	form
proto	first
photo	light
poly	many
synthesis	to make
sub	lesser, below
troph	eat, consume
therm	heat
tri	three
zoo, zoa	animal

Reflecting as a Reader

Do you like to read? Why or why not?

When you are reading, what do you do when you come to something you don't know?

What do you do when you read something that doesn't make sense?

What do you do when come to a word you don't know?

What do you like best, reading aloud or reading silently? Why?

Do you read at home? How often?

What is a good reader?

"Rethinking the Role of Literacy in the Content Areas"
Content Literacy
Questioning

Literacy Instruction in the Content Areas: Getting to the Core of Middle and High School Improvement

Rafael Heller and Cynthia L. Greenleaf June 2007

RETHINKING THE ROLE OF LITERACY IN THE CONTENT AREAS
Section 1

There's much more to reading than the basics, and that becomes especially clear as soon as students start to study the academic content areas. After the elementary years, not only do reading assignments become longer and more full of content; they also become increasingly varied in their style, vocabulary, text structure, purpose, and intended audience. For instance, science textbooks differ from textbooks in history and math, and all textbooks differ from the whole universe of other materials that teachers might assign, from newspaper columns to historical documents, reference materials, Internet-based hypertexts, and on and on.

Middle and high school students must learn that in some classes they are expected to follow written instructions to the letter, while in others they are expected to read skeptically, or to question the author's assumptions, or to analyze the writer's style. Moving from one subject area to the next, they must tap into entirely different sets of vocabulary and background knowledge. They must learn to write well in many genres, as well as realize that chemists, historians, mathematicians, journalists, and members of every other profession have their own unique ways of sharing information, getting people's attention, debating, responding to criticism, reporting facts, and establishing authority.

Section 2

It has become common among literacy researchers to describe the distinct ways of reading and writing and communicating among different groups as "social practices" (Barton, 1994, 2003; Greenleaf, 1994; New London Group, 1996; Scribner and Cole, 1981; Street, 1995). That is, researchers have challenged the assumption that literacy learning is basically a solitary activity. Rather, people learn by interacting with others (especially with people who are more knowledgeable in the area than they are), gradually becoming familiar with and internalizing their ways of doing things (their "practices"). Every academic discipline, or content area, has its own set of characteristic literacy practices. Students won't learn how to read and write and become comfortable in the field of biology, for example, unless they spend a lot of time reading, writing, and talking about biology, ideally with interested peers and well-trained teachers.

To enter any academic discipline is to become comfortable with its ways of looking at and communicating about the world. Algebra, for instance, focuses on interactions among real or imagined objects, and it translates those interactions into a simple shorthand language that permits description of how any given "A" relates to a "B" or a "C." By contrast, historians choose to zero in on events rich in human significance, and instead of condensing those events into a formal shorthand, they prefer to elaborate on them by means of description, narrative, and logical exposition, so as to flesh out an overarching thesis. Chemists, on the other hand, tend to prize an extremely precise sort of description and narrative, meant not to elaborate a thesis but to compose an accurate record of a procedure and its results. In each case, writers choose particular sorts of words, arrange them in particular sorts of ways, imagine a particular sort of audience, and otherwise bend their language to suit the particular purposes and values of the discipline.

Section 3

Over the last few decades, education researchers have become increasingly aware of the varied ways in which people use written materials to communicate with one another, define themselves as individuals, and identify themselves as belonging to particular groups, both in and outside of the classroom. Gradually, it has become clear that being "literate" means very different things in differing contexts and content areas (Barton et al., 2002; Borasi and Seigel, 2000; Saul, 2004; Wineburg, 2001). Yet educators often take a somewhat narrower view of what it means to be literate. Over the last few decades, appeals to teach "reading across the content areas" have tended to translate into courses, textbooks, and workshops that encourage all content area teachers to help their students learn a core set of reading comprehension strategies, and "writing across the curriculum" has tended to mean instruction in a single, all-purpose writing process. Less common have been efforts to help teachers address the literacy demands that are specific to their content areas. Research suggests that the teaching of generic reading comprehension strategies does have merit, and that students can learn a number of routines that can help them comprehend many different kinds of written documents (reviewed in Kamil, 2003; Biancarosa and Snow, 2004; RAND Reading Study Group, 2002; Brown, Palincsar, and Armbruster, 1994). These include pre-reading activities such as reviewing vocabulary to be found in the text, making predictions as to what the text is likely to say, and identifying text features such as tables of contents, headings, illustrations, and authors' biographical statements. These strategies also include things that students can do while reading, such as drawing a visual representation of the unfolding argument, or asking questions about main ideas as they unfold, or making note of unfamiliar words, concepts, or ideas to research after reading. And they include post-reading activities such as summarizing and restating the text's main points, or comparing notes with other students.

Section 4

Moreover, numerous studies over the past few decades have demonstrated that it is most helpful to teach comprehension strategies, text structures, and word-level strategies while students are engaged in reading challenging, content-rich texts. Such skills don't stick when practiced for their own sake. Rather, students learn those skills best when they have compelling reasons—such as the desire to make sense of interesting materials—to use them (Alvermann, 2002; Guthrie and Wigfield, 1997; Vacca and Vacca, 1998; Wilhelm and Smith, 2002).

Given that content area reading materials are often quite difficult—in fact, many of the most popular middle and high school textbooks rival the complexity of college-level materials in their syntax, vocabulary, content, and presentation—it makes good sense to encourage all teachers to become familiar with these strategies. Students will need advanced literacy skills in order to do the sorts of intellectual work that the academic disciplines require, such as conducting and reporting scientific experiments, analyzing historical sources, or proving mathematical theorems. If teachers want their students to be able to handle such assignments, they would do well to help them become more competent in reading difficult texts in general.

However, a sole emphasis on generic reading comprehension strategies may also lead students to believe that all academic texts are more or less the same, as though the reading that students do in math class were identical to the reading they do in history, or as though good writing in biology were identical to good writing in English.

Section 5

Not all literacy skills can be transferred easily from one field to another (Alvermann and Moore, 1991; Hynd, 1998; Bazerman and Russell, 2003; Moje, 2006). The ways in which successful students read algebra textbooks (for example, working to translate word problems into an understanding of the problem being posed and a representation of the problem in algebraic terms, then working to arrive at a single, correct mathematical solution) don't apply to reading and interpreting modern poetry (which calls for sustained attention to word choice, tone, the relationship of form to content, narrative voice, the use of metaphor and symbol, and other aspects of language that don't often come into play when studying algebra). And the ways in which students write up their chemistry notes (crafting a detailed, impersonal, accurate record of steps taken and reactions observed) may not be helpful when trying to write a history paper or a literary analysis.

To become competent in a number of academic content areas requires more than just applying the same old skills and comprehension strategies to new kinds of texts. It also requires skills and knowledge and reasoning processes that are specific to particular disciplines.

By way of illustration, consider two of the core subject areas, science and history. To some extent, the challenges involved in reading the texts of these disciplines are the same. For example, whether students have to read a chemistry paper or a political speech from the Civil War, they will probably need to learn new terms and phrases, pay close attention to detail, and work their way through long, complex sentences, written in a style that sounds nothing like contemporary spoken English. Likewise, when assigned to write a term paper on either of these subjects, they will probably want to generate ideas and organize what they intend to write, write more than one draft, and cite prior sources and include them in a bibliography. In many other ways, though, science texts are very different from texts in history, and each discipline emphasizes particular kinds of language and particular approaches to reading and writing. In chemistry textbooks, for example, language tends to be extremely precise with respect to things and events in the physical world, and students must learn to read those parts of the text with exactitude, taking care to note whether a reaction occurred at 31.9 degrees Fahrenheit or 32.1 degrees Fahrenheit, or whether a solution turned orange or yellow. However, students likely will have no reason to ask whether a particular experiment was conducted in New Hampshire or Georgia, or whether it happened to occur in 2001 or 2003.

Section 6

At times, historians may pay close attention to these sorts of physical details, too, but their reasons for doing so are different from those that motivate chemists (Wineburg, 2001; Wilson and Wineburg, 1988). In particular, historians tend to be more exacting readers than chemists when it comes to details that made an important difference in people's lives, and they tend to take a special interest in the circumstances in which written documents were produced, particularly when reading primary source materials. Here, the context in which materials were written matters as much as the literal meaning of the text itself, and students need to know that it is crucial to take note of who wrote the given document, under what circumstances, for whose eyes and ears, and to what ends. To fully comprehend the significance of a Civil War–era speech, for example, students must understand that it matters greatly whether it was composed in 1860 or 1862, or whether it was delivered by a senator from New Hampshire or one from Georgia.

All teachers, in every discipline, have reasons to emphasize certain kinds of reading and writing over others, depending on the nature of the specific content and skills they want their students to learn. Some kinds of details matter more when reading in history class than in chemistry, or in biology class more than in algebra. Certain forms of writing (interpretive essays, for example) tend to be required in American Literature even though they would be considered inappropriate in Earth Science, where an extended scientific explanation of data would be expected.

If the goal of content area instruction were simply to get students to memorize facts and crunch numbers, there would be little reason to show them that they need to pay attention to different things when reading algebra textbooks and geometry textbooks, or that a lab report requires a different narrative voice than a historical essay. However, the goal of content area instruction is instead to introduce students to the ways in which experts in the core academic disciplines look at the world, investigate it, and communicate to one another about what they see and learn.

Section 7

This is not to say that middle and high school students should be expected to become fully expert in the ways that scientists, historians, and other disciplinary specialists read and write. To produce an expert level of fluency in the literacy of any profession or content area is a goal better left to professional training programs, college majors, and graduate schools.

But as adolescents move up through the middle and high school curriculum, they will have to read and write in increasingly varied ways in various content areas. And in the best of circumstances— where the secondary school curriculum is properly aligned with authentic disciplinary endeavors and builds the academic dispositions and skills that will be important to postsecondary pursuits— students' reading and writing assignments become increasingly similar to the ones they will encounter at college and in the workforce.

Moreover, even if students still need help developing fluency, increasing their vocabularies, and learning reading comprehension strategies, they must receive content area literacy instruction at the same time. Teachers may be tempted to take them out of the regular curriculum and to drill them in basic literacy skills (or to dumb down their assignments or even to excuse them from coursework altogether). However, abundant evidence shows that students tend to be ill-served by having to do basic, skills-focused reading exercises at the expense of time spent engaged in reading, writing, and talking about academic content. Such empty, remedial exercises tend to be intellectually bland, and they only reinforce certain common misconceptions, such as the notion that skillful reading amounts to nothing more than pronouncing the words on the page (Allington, 2001; Alvermann and Moore, 1991; Carbonaro and Gamoran, 2002; Hull and Rose, 1989; Knapp, 1995).

Section 8

The role of knowledge and domain- specific vocabulary in reading comprehension is well known (Alexander and Jesson, 2000). If students do not have the opportunity to learn subject area concepts and vocabulary, their word knowledge and capacity to read a broader range of texts will be further diminished. In fact, research sponsored by ETS found that inequalities in students' access to a rigorous academic curriculum contribute significantly to the achievement gaps that separate relatively affluent and/or white students from low-income and minority students (Barton, 2003). Likewise, research from ACT (2006) found that exposure to rigorous, well-written materials in science, history, and other disciplines is the best available predictor of students' ability to succeed in introductory college courses.

It is certainly challenging to work with students who need help understanding textbooks, but rather than excusing those students from demanding assignments, teachers would do better to find ways to engage them in reading, writing, and talking about compelling issues and problems related to the particular academic discipline.

They can do this by, for instance, providing materials that are related to the subject matter and are written at a level of complexity that the given students can manage; such texts are becoming increasingly available today, now that the major textbook companies have begun to respond to the current attention to adolescent literacy. And instead of focusing only on students' deficiencies in reading and writing, teachers would be well advised to look for the cognitive, social, and personal strengths students bring with them from home, which can be used to build connections to academic content and interest them in the reading and writing that go on at school (Greenleaf, Brown, and Litman, 2004; Guthrie, 2004; Moje, 2006). Simply put, teachers should assume that all students are capable of doing rigorous academic work—even if they struggle with fluency, vocabulary, reading comprehension, or decoding— and they should provide every student with meaningful and interesting opportunities to learn high-level skills by reading, writing, and talking about rich intellectual content.

Teachers need to understand that literacy proficiency grows through developmental processes that continue over a lifetime (Alexander, 2007).

In order for students to become proficient in the long term, they must be willing to ride out short-term mistakes, take risks, accept a certain amount of confusion and error, and remain confident that things will in time come to seem easier and more "natural" (Bartholomae, 1985; Lave and Wenger, 1991). Content area teachers must be patient in supporting students as they make their way through a complex reading assignment, learn the vocabulary specific to the content area, or compose a thoughtful and well-constructed essay.

Questioning the Author (QtA)

Questioning the Author: An Approach for Enhancing Student Engagement with Text (Beck McKeown, Hamilton, & Kugan)

Background

Question the Author (QtA) is a comprehension strategy that requires students to pose queries while reading the text in order to challenge their understanding and solidify their knowledge (Beck et al., 1997).

Primarily used with nonfiction text, QtA allows students critique the author's writing and in doing so engage with the text to create a deeper meaning.

Benefits

QtA aims to engage all students with the text. Although it requires a bit of prep work, you will reap the rewards of your labor through the student interactions and discussions in your classroom.

Create and use the strategy

Beck et al. (1997) identify specific steps you should follow during a QtA lesson:

1. Select a passage that is both interesting and can spur a good conversation.
2. Decide appropriate stopping points where you think your students need to delve deeper and gain a greater understanding.
3. Create queries (questions to encourage critical thinking) for each stopping point.
   - Ex: What is the author trying to say?
   - Ex: Why do you think the author used the following phrase?
   - Ex: Does this make sense to you?

To introduce the strategy, display a short passage to your students along with one or two queries you have designed ahead of time. Model for your students how you think through the queries. Invite individual students or small groups to read and work through the queries you have prepared for their readings. Remember that your role as the teacher during this strategy is to facilitate the discussion, not lead it. When students ask questions that go unanswered, try to restate them and encourage students to work to determine the answer.

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Motorcycle Helmet Use Laws

March 2010

Compared with cars, motorcycles are an especially dangerous form of travel. The federal government estimates that per mile traveled, the number of deaths on motorcycles in 2009 was about 37 times the number in cars. Motorcyclist deaths have been rising in recent years—more than doubling by 2008 from the record low in 1997. In 2008, more motorcyclists died in crashes than in any year since the National Highway Traffic Safety Administration (NHTSA) began collecting these fatal crash data. In contrast, passenger vehicle occupant deaths reached a record low in 2008.

In the event of a crash, unhelmeted motorcyclists are three times more likely than helmeted riders to suffer traumatic brain injuries.

Motorcycles often have excessive performance capabilities, including especially rapid acceleration and high top speeds. They are less stable than cars in emergency braking and less visible to other motorists. Motorcyclists are more prone to crash injuries than car occupants because motorcycles are unenclosed, leaving riders vulnerable to contact with hard road surfaces.

Helmets decrease the severity of head injuries, the likelihood of death, and the overall cost of medical care. They are designed to cushion and protect riders' heads from the impact of a crash. Just like safety belts in cars, helmets cannot provide total protection against head injury or death, but they do reduce the incidence of both. The NHTSA estimates that motorcycle helmets reduce the likelihood of crash fatality by 37 percent. Helmets are highly effective in preventing brain injuries, which often require extensive treatment and may result in lifelong disability. In the event of a crash, unhelmeted motorcyclists are three times more likely than helmeted riders to suffer traumatic brain injuries.

Only 20 American states have laws requiring riders to wear helmets, while the rest have no laws or only require young riders (usually under 18) to wear helmets. Laws requiring motorcyclists to wear helmets are in effect in most countries outside the United States. Among them are Andorra, Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, India, Indonesia, Ireland, Italy, Japan, Latvia, Liechtenstein, Luxembourg, Malaysia, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, San Marino, Singapore, Slovakia, South Africa, Spain, Sweden, Switzerland, Thailand, United Kingdom, and Venezuela.

Questioning the Author Model Lesson: "Motorcycle Helmet Use Laws"

Materials	Text: Select a passage that is both interesting and can spur good conversation. For this lesson "Motorcycle Helmet Use Laws"
Direct Explanation Explain what the strategy is and why and when to use it.	What: Today we will practice the strategy of Questioning the Author as we read "Motorcycle Helmet Use Laws." Why: This strategy prompts critical reading that skilled readers use in order to deeply understand texts. Questioning the Author keeps a reader thinking and monitoring his/her own reading. When: We use questioning when we need to read for deep understanding and as we problem-solve during reading.
Model or Demonstrate Show how to use the strategy.	How: *"When we read something, if we're really going to put the ideas together so we understand what we read, we have to work and figure it out as we go along. You can think of it as a little like talking to yourself about what you're reading and deciding whether the ideas are clear. Let's read this short piece of text, because it has some things in it that seem pretty confusing at first."* To introduce the strategy, display the text for students. Model for students how you read and think through the passage. Using a think-aloud-demonstration is one way to do this directly. Read aloud and then stop to think aloud. Use explicit language to explain your thinking as you apply the strategy. For example: *Compared with cars, motorcycles are an especially dangerous form of travel. The federal government estimates that per mile traveled, the number of deaths on motorcycles in 2009 was about 37 times the number in cars. "What makes motorcycles so dangerous? Why might this be? Would helmets change this?"* *Motorcyclist deaths have been rising in recent years—more than doubling by 2008 from the record low in 1997. "What caused the rise? Are motorcycles more popular? Did the laws change during this period?"* *In 2008, more motorcyclists died in crashes than in any year since the National Highway Traffic Safety Administration (NHSTA) began collecting these fatal crash data. In contrast, passenger vehicle occupant deaths reached a record low in 2008. "Are these two related? Do safer passenger vehicles make motorcycles more dangerous?"*

Guided Practice ***Scaffold the use of the strategy.***	(Continue model until students catch on.) Have students work together in small groups to read another section of the short passage and create questions. Students practice and the teacher provides feedback.
Apply Use the strategy	Have students practice creating questions with other short passages.

Question-Answer Relationships (QAR) What is it?

QAR (Raphael, 1982; 1986) is a strategy that is designed to demystify the questioning process, providing teachers and students with a common vocabulary to discuss different types of questions and sources of information for answering these questions. There are four levels of questions during strategy use and practice.

Two are text-based QAR's :

"Right There" questions ask students to respond on a literal level; the words used to formulate the question and the answer can be found "right there" in a sentence of the text. "Right There" questions begin with words or statements such as "who is," "where is," "list," "when is," "how many," "when did," "name," "what kind of." These questions usually elicit a one-word or short response and require one right answer. Sample questions are "Who discovered America?" or "Who was the first man to walk on the moon?"

"Think and Search" questions require students to know how the information or ideas in the text relate to one another and to "search" through the entire passage they read to find information that applies. "Think and Search" questions begin with words or statements such as "summarize," "what caused," "contrast," "retell," "how did," "explain," "find two examples," "for what reason," or "compare." A sample question could be, "Which strategies could the individual described in this chapter use to improve his financial situation?"

The other QAR's could be called knowledge-based because students must use their prior knowledge to answer the question.

"Author and You" questions require students to answer with information not in the text; however, students must read the text material to understand what the question is asking. A sample question is, "The topic of the passage was cloning. In what instances, if ever, do you think cloning should be used?"

"On My Own" questions can be answered with information from the students' background knowledge and do not require reading the text.

Students who become skilled at this strategy recognize the relationship between the questions teachers ask and the answers they expect; therefore, they know where to find information needed for a correct response. Although teaching this strategy can take time, Richardson and Morgan (1994) report that students who learned and practiced this strategy for as little as eight weeks showed significant gains in reading comprehension.

Anthony and Raphael assert that QAR can also facilitate the transfer of control of the questioning process from teacher to learner. That is, when students become skilled at QAR, they need to rely less on their teacher because they are able to generate different level of questions themselves during independent reading.

How to use it:

1. Introduce the strategy by giving students a written and verbal of each question-answer relationship.

2. Assign short passages to be read from the textbook. As students finish reading each passage, ask them one question from each QAR category. Point out the differences between each question and the kind of answer it requires.

3. After students demonstrate that they understand the differences among the four QAR levels, assign several more short passages to be read. Again, ask one question for each category of QAR per passage, provide students with answers, and identify each question's QAR type. Discuss why the questions represent one QAR but not another.

4. Next, assign short text passages, and provide the questions and the answers. This time, however, have students identify each question as a particular QAR and explain their answer. Repeat the reading and questioning process, but have students work in groups to determine which QAR each question represents and write out their answers, accordingly.

5. At this point have students read a longer text passage. Give them several questions, not necessarily one per QAR level. Have students individually determine the QAR and write their answers. Continue assigning longer passages and various QARs for students to identify and answer.

6. Eventually, when reading is assigned in class, students should generate various QARs on their own that they present to the rest of the class for identification and answers.

How could QAR be used in science instruction?

This strategy focuses on the relationship between questions and answers. It teaches students that answering different kinds of questions requires different reading behaviors and thought processes. That is, some questions require students to explore text to find an answer; some questions require students to explain something they have read; some questions require students to elaborate on what they have learned; and some questions ask students to evaluate their own thinking about a topic.

QAR Examples that apply to science content:

· **Right There Questions**

What is a warm-blooded animal? □Name the device that changes solar energy into electrical energy. □What is the movement of air from land to water called? □List the three types of muscles.

· **Think and Search**

Describe the characteristics of a reptile. □Compare and contrast solution and suspension. □Explain the four kinds of air masses. □Summarize how the blood moves through the body.

· **Author and You**

Based on the author's description of mollusks, identify animals that you have seen that fit that classification. □What evidence have you seen over the past three years that confirms or refutes the information that you just read about global warming? □Based on the author's information about energy sources, which resource would be most efficient for you to use if you were designing a home? □Relate what you have read about potential and kinetic energy to experiences that you have had at an amusement park.

· **On My Own**

Describe a bone or muscle injury that you have experienced. □What can you do to help stop water pollution? □Identify constellations that you have observed. □What are your thoughts about nuclear energy?

Question-Answer Relationships (QAR)

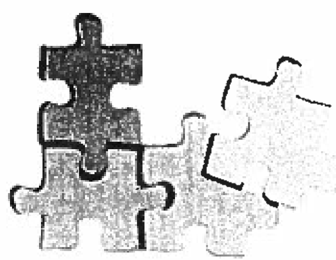
In the Book

Right There

Answer directly in text

Think & Search

Put it together from the text



In My Head

Author & Me

Reader figures out meaning from text

On My Own

Wouldn't have to read text