memory, researchers suggest that the emotional climate of the room, particularly the stress level, has an impact on student learning. High levels of stress, which may trigger a fight-or-flight response, are not conducive to optimum learning.

CHECK YOUR UNDERSTANDING

Observe a classroom of your choice. Evaluate how well the teaching methods appeal to the brain's information processing, memory, and ways of constructing meaning. How brain-compatible is the classroom environment? Write a reflective paper that addresses each of these areas.

As you can tell, the ways you plan learning activities will greatly affect how readily students are able to learn and retain new ideas. Opportunities for learning are maximized when learning activities are at the appropriate level and tied to prior experiences with multiple opportunities for active involvement with content.

Practice Activity:

Practice Point

Classroom Observation

With a friend, review the information on learning theory in this section. Examine a lesson in a teacher's edition of a textbook or a sample lesson from one of the many Internet sites containing teaching materials. Analyze the extent to which the lesson optimizes the opportunity for student learning, and list its strengths and weaknesses.

SECTION 3. UNDERSTANDING AND AUTHENTIC LEARNING

Section 3 Objectives

After you have completed this chapter, you will be able to:

1. explain how real problems and authentic projects can promote student engagement in meaningful learning; and
2. plan authentic learning experiences for your students.

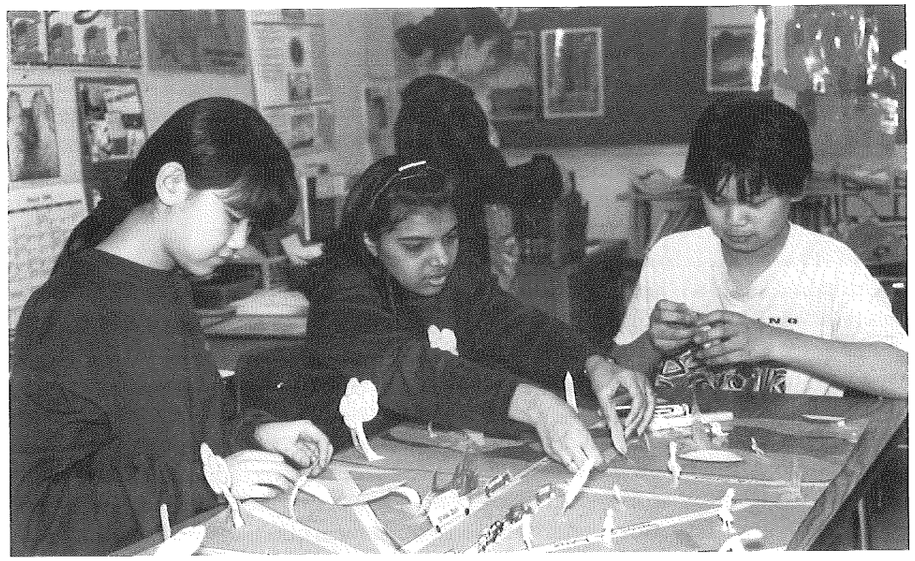
It is essential to plan instruction so that students will understand the content. At one level such a statement seems so obvious as to be ridiculous: Of course we want students to understand the content, that's why we are teaching. In fact, students are taught many things they do not really understand, even though they successfully answer test questions on that content. You probably have had this experience yourself. Think of a time you have taken a class in which some of the content never did make sense to you. This may have been a history class in which you learned a series of confusing events or a science class in which you learned a collection of rules or facts. In such circumstances,

what did you do? If you are like many students, you memorized the things you needed for the test and forgot them as soon as the class ended. You did not apply the things you learned to real life because you couldn't; you didn't understand what you had "learned."

Spending time in school in this type of learning is wasteful. If students cannot use what they've learned, what is the point of learning it? Contrast this to learning that produces understanding. When an individual understands a concept or skill, he or she can apply it appropriately in a new situation. For example, if I merely memorize the types and functions of simple machines, that information will not help me. However, if I understand that information, I can apply it, perhaps the next time I need to move a heavy piece of furniture. Gardner (1999) describes what he calls an "acid test" for understanding by "posing to students a topic or theme or demonstration that they have never before encountered, and determining what sense they can make of those phenomena" (p. 119). In other words, if students can use what they have learned to make sense of a new situation, they understand it.

Authentic learning allows students to have learning experiences that are grounded in the appropriate context and used in purposeful ways, both powerful assets to learning (Wolfe, 2001). Research on inner-city New York high school students showed that they increased their attendance, learning, and college-admission rates when they were taught with more authentic activities and performance assessments (Darling-Hammond, Ancess & Ort, 2002). The following paragraphs provide several examples of authentic learning within the context of middle and high school classrooms.

In Chicopee, Massachusetts, middle school students studied the problem facing their community since the state had banned the burning of sludge from factories and sewage (Lewis, 1991). During the winter, the sludge froze before it could be hauled to the landfills.



Adolescents like "authentic" schoolwork.

Officials suggested building a brick storage facility to keep the sludge warm, but the $120,000 expense was beyond the city's budget. After study, the students submitted a list of possible alternatives to the chief officer of the sludge plant, including plans for a makeshift solar greenhouse. The city adopted the greenhouse plan at a cost of $500. The student's project provided good opportunities for learning about waste management, city government, and energy conservation, and it saved the community $119,500!

In a different school, seventh-grade students used systematic sampling to plan and conduct phone and door-to-door polls prior to a presidential election. They used the results to predict local election results and, after the election, analyzed the predicted and actual percentages for each candidate.

In some high schools, students have tested the water quality of local streams for a public commission; created communication devices for students with severe impairments; studied whether anaerobic weight training produced aerobic benefits; and written plays to teach younger students about issues such as conservation, child abuse, and drugs. They have lobbied for changes in local laws, created oral histories for the public library, persuaded banks to create art galleries, and conducted population studies of wildlife on school grounds. In each case, students had the opportunity to use the information they gained in schools to solve a problem, investigate an issue, or create something of value to themselves or others. This process, in which teaching is organized around meaningful use of content, is sometimes called **authentic learning** or **authentic achievement**.

Others have defined related constructs. Gardner (1991) distinguished between "rote, ritualistic or conventional performances . . . [that] occur when students simply respond . . . by spewing back the particular facts, concepts, or problem sets they have been taught" and "performances of disciplinary (or genuine) understanding" (p. 9). Performances that demonstrate understanding require students to use information appropriately in a new situation. They may range from physics students using the laws they learned in class to explain a newly encountered game to a first grader to using capital letters and punctuation appropriately in writing a letter to a grandparent or community leader. Perkins (1992) describes "generative knowledge" as a combination of retention, understanding and active use of knowledge "that does not just sit there but functions richly in people's lives to help them understand and deal with the world" (p. 5). In each case, theorists emphasize the importance of knowledge that is related to contexts the students understand and use in meaningful ways.

Newmann (1991, 1996) identified three characteristics of authentic achievement. First, authentic achievement requires the production rather than the reproduction of knowledge. Most traditional learning tasks have asked students merely to reproduce information provided them by the teacher. The teacher gave students the facts; the students gave them back. In authentic achievement, students must go further and do something with the facts, such as create something new, solve a problem, or investigate a question. In this mode of teaching, it is not enough to know something about your community, you must do something to investigate the community or make it a better place.

Second, authentic achievement requires **disciplined inquiry**. In disciplined inquiry, students investigate problems or questions within a particular discipline. Such investigation demands both in-depth knowledge of content and knowledge of how one conducts inquiry within a content area. Students studying the community need to know what kinds of questions professionals ask about communities and how they gather information. Clearly, the sophistication with which students approach this inquiry will vary considerably from sixth to twelfth grade, but at all levels students can be taught to ask questions about content and investigate the answers. In making this decision, the teacher should consider, How do professionals in my discipline gather information, solve problems, and address issues? In many cases, the strategies that allow adults to address authentic tasks can be appropriately taught to students.

The third and fourth characteristics of authentic learning go hand in hand. Authentic learning includes assembling, interpreting, and synthesizing knowledge and results in products that have aesthetic, utilitarian, or personal value. Many traditional school projects have been summaries of information: students read a convenient reference book or encyclopedia, restated the information in their own words, and created some kind of product. In most cases this was the ever-present school "report." In other cases the information might be more creatively communicated through a poster, bulletin board, or display, but it was still basically a reproduction of someone else's ideas. An authentic product contains the student's own thoughts, questions, data, and interpretations in addition to the ideas of others.

Interestingly, the characteristics of authentic learning parallel those identified in a study that asked young adolescents to identify their most memorable and engaging work (Wasserstein, 1995). While some teachers might have guessed that students preferred easy assignments, "Again and again, students equated hard work with success and satisfaction. Moreover, they suggested that challenge is the essence of engagement; when students feel they are doing important work, they are more likely to buy in than not" (Wasserstein, 1995, p. 41). When students were exploring ideas in ways that seemed meaningful and important, they worked hard and felt proud of their efforts. When assignments were perceived as busywork, or unrelated to the real world, students were resentful and uninterested.

What Makes a Problem Real or Authentic?

If we are to engage students in authentic learning, finding and solving problems, and producing information, it is important to first consider, What is a problem? What characteristics define "real" or "authentic" problems or tasks, and how are they distinct from the kinds of problems typically addressed in schools? While Newmann's guidelines provide a beginning, helpful insights can be found in the work of Renzulli (1977), whose Enrichment Triad Model centers on individual and small-group investigations of real problems. While the Triad model was originally developed for education of the gifted and talented (see Chapter 9), many of its components are appropriate for all students, and the strategies for pursuit of real problems can hold the key to authentic learning in many arenas.

First, a real problem has personal interest and value to the student or students who pursue it. Clearly, individual students can be engaged in authentic problems or tasks based on personal interests. The class involved in gathering data for the sludge project utilized the group's shared interest in solving a local problem (particularly one that had stymied local adults) as well as diverse individual interests and skills. The project required students to gather and analyze energy data; communicate with local officials; organize and display ideas in a presentation suitable for a professional audience. At least some part of the project could be interesting to virtually every student.

Second, a real problem does not have a predetermined, correct response. It involves processes for which there cannot be an answer key. As we consider the real problems with which our students have become involved, they seem to fall into three general categories.

1. Some real problems are *research questions.* They involve gathering and analyzing data and drawing conclusions. True research questions entail collecting information from primary sources through observation, surveys, interviews, or document analysis. The students who surveyed food preferences in the school cafeteria, those who interviewed local citizens on life in the community during World War II, and those who observed the effects of various cleaning solutions on bacteria growth on school desks all investigated research questions. Students involved in Ken Cowan's unit on Zimbabwe might become curious as to whether the first settlers in their own geographic area had attitudes towards the native peoples similar to people arriving in Zimbabwe. This interest could lead to a project involving historical research (see Chapter 6); for example, reading the diaries of early settlers and analyzing their beliefs.
2. Other real problems might be categorized as service learning or **activism**. In these activities, students work in the community and/or attempt to improve some aspect of the world around them. Students who organize clothing drives for the homeless, teach peers what to do if they suspect a friend is being abused, set up community hot lines for teens, or lobby for student representation on the school board are pursuing this type of real problem.
3. Finally, real problems in the arts entail the *expression* of some theme, aesthetic, or idea. Adult creators use words, movement, paint, or clay as tools for expression. Students whose art explores the changing light, whose stories reflect their ideas about racism, or whose dance reflects their pursuit of an identity as young adults all address real problems in meaningful ways. Students who create masks to synthesize their understanding of Zimbabwe tackle a similarly authentic problem.

In pursuing real problems, students should use, as much as possible, authentic methodology; that is, they should address the problem as much as possible in the way a professional adult would address it. Newmann's (1991) criterion of "disciplined inquiry" reflects this idea. The students who want to survey cafeteria preferences must learn something about survey design. Those who want to study bacteria on school desks must learn about maintaining cultures and strategies for quantifying bacteria. It will be much easier for students to use authentic historical research techniques in a local history project than one on a distant locale (although electronic networks are making this process more feasible). Even the student with limited access to primary sources can use professional techniques for sharing information in a manner that is appropriate to the discipline. For example, prior to students creating PowerPoint presentations, they need to learn how to use the format to best share what they have learned with others.

Finally, when pursuing real problems, students eventually share information with a real audience. The makeup of a real audience will vary enormously with the age of the students and the sophistication of their problems. The key is that the audience should have a genuine interest in the product, rather than viewing it as a source for a grade or other evaluation. Some real audiences are part of the natural school environment. For example, a group of seniors may write an original play and produce it for the rest of the senior class. Other audiences may be created within schools to provide a vehicle for student efforts: art exhibits, literary magazines, invention conventions, or science fairs (see Schack & Starko, 1998; Starko & Schack, 1992). Many extracurricular activities provide opportunities and/or audiences for addressing real problems. Students who produce a yearbook, argue their case before the student council, or perform the class musical are working for real audiences.

Still other audiences may be part of the local community. In one community, the local chamber of commerce was pleased to display a student-produced brochure on the history of local buildings along with other pamphlets. In another, results of a water pollution study were shared with interested faculty at a local university. In yet another, the radio station often aired student-generated public service announcements. Local access cable TV, historical societies, and other community organizations can provide enthusiastic audiences for appropriate student products.

Certainly, the types of problems pursued, the methodology employed, and the audiences approached will vary enormously from a middle-school student's garden experiment to the high school students' archeological research or investigation of pollution in a local stream. However, at each stage, students may be nudged just one notch closer to professionalism: the seventh grader to consider various question formats in designing a survey, the ninth grader to assess the impact of different types of sampling on survey results, the senior to consider the pros and cons of differing statistical analyses. Each represents a legitimate step toward pursuing real problems.

During instructional planning it would be wise to consider authentic learning activities and projects when designing major objectives and assessments. Whatever the subject, the ultimate goal should be to have students use the content in meaningful ways. Students will learn better when more aspects of real-world problem solving are incorporated into the process. Of course, various types of authentic learning activities can be planned. For example, tenth-grade students studying the Vietnam War could interview local citizens about community events during the war, question veterans about their experiences in the field and upon returning home, study lyrics of popular music of the period, and examine newspaper and magazine coverage of the time. Primary source material would be readily available in most communities. The students would also have many potential opportunities to use their information in meaningful ways, such as creating local histories for the community library or working to provide needed services to veterans.

A unit on Greek mythology would not offer parallel opportunities for activism. However, if a teacher wished to teach techniques of historical research, students might learn to analyze photographs of Greek artworks for evidence of the influence of myth. Their results might be compiled in an "archeologist's report." Alternatively, the teacher might plan to engage students in personally meaningful problem solving by helping students make ties between mythological heroes and heroes today. Students may examine the mythology surrounding contemporary heroes in sports or entertainment and analyze how those heroes influence our lives. Such analyses could result in a variety of literary or artistic products.

Several of the objectives created in the interdisciplinary unit on Zimbabwe involve authentic problems, for example, creating masks or writing contemporary folk tales.

The unit might also serve as a springboard for other real problems. Students may wonder about the impact of expanding modern culture into more traditional cultures today. This could lead to interviews with immigrants from various countries, a study of the history of local Amish communities, or other investigations.

REFLECTING ON THE IDEAS

Think about your own learning experiences in and out of school. When have you been involved in authentic learning? Were most of your experiences in class, in extracurricular activities, or outside of school? In what ways were your experiences powerful for you? What implications does that have for your teaching?

Planning for Authentic Learning

The next section will provide examples for creating authentic learning experiences for students in order to increase the number of connections to their own lives, experiences, and interests.

Gardner (1999) suggested four approaches that appear promising in teaching for understanding. The first recommends that we learn from "suggestive institutions" (p. 126). By examining institutions outside schools in which understanding is fostered, we may gain clues that will enhance our repertoire of teaching strategies. For example, considering how learners function in apprenticeships or how children engage with content in museums may provide models for teaching. The experimentation facilitated in good science museums is very different from the science teaching experienced by many students.

The second avenue is illustrated again by the example of students having a conversation with someone from a different race—direct confrontations with erroneous conceptions. In this strategy, students are given experiences that force them to examine their current concepts. If students believe that metal sinks and wood floats, experimentation with a variety of toy boats can challenge that belief. If students believe all leaders are generals or team captains, that belief may be challenged when they learn how the Daughters of Liberty organized spinning bees that allowed the boycott of English textiles.

The third avenue is a framework for creating activities that demonstrate understanding as instructional goals, or performances of understanding. Chapters 3 and 4 discuss choosing understanding goals and planning for performances of understanding. The fourth avenue suggests that understanding is enhanced as students are provided with learning through multiple intelligences. This is discussed in more detail in Chapter 6.

It can be helpful to think of a series of moments that can occur when we encounter new information in ways that promote understanding. The first moment comes when we say to ourselves, "Oh, wow!" An "oh, wow" moment occurs when we approach new experiences or ideas with curiosity and openness. It allows us to look at things that we do not understand and consequently think, "How interesting," "How curious," or "How puzzling." An experience that encourages students to be curious can serve to motivate them to learn and help them recognize the need for additional understanding. An

activity in which students read and discuss historical documents written by different groups of people encourages that type of curiosity and leads to further investigation of conflicting information.

Many adolescents will express a varying level of the "oh, wow" attitude at any given moment, prompt, or encounter. Some will be concerned that showing too much public enthusiasm or interest will cause their peers to think they are "uncool" or a "teacher's pet." As a teacher of middle and high school students, you will need to be mindful that some students will be hesitant to show you their real level of intrigue, but do not make the mistake of thinking they are not curious, interested, or motivated to learn. If we are to facilitate our students' understanding, we must provide them with experiences that prompt curiosity and inquiry.

The second type of moment is one in which new connections and insights occur. It is the moment of, "Aha!" An "aha" moment is one in which the student says (or thinks), "Of course," "How logical," or "Now I see why that happened." You have probably experienced this type of moment, when information that had previously been confusing suddenly made sense. You had enough connections to see a more fully formed logical pattern.

In order for "aha" moments to occur, students must have enough encounters with the information that purposes and patterns emerge. For example, students may have never understood how the teaching of history from a western European cultural perspective could provide them insight into other cultures, their worldviews, and histories, but they may have an "aha" moment when they learn about events from an African's point of view. Simply saying, "The people of Zimbabwe have meaningful rituals that are different than many of those practiced by Americans" is not likely to generate understanding. Students can have a richer context for experiencing their culture by envisioning the people of Zimbabwe, reading literature about their culture, hearing their music, and studying their ways of life. Aha moments can occur when students make sense of how scientific principles are exemplified in the world around them, why historical figures acted the way they did, and why countries with particular geography or history develop. They can make the difference between viewing another culture's traditions as strange and seeing them as logical from another point of view. For example, one group of middle school students thought it was strange that Japanese students ate so much rice, especially for lunch. Why didn't Japanese students eat sandwiches like they did? Once they studied how rice grows and how wheat grows, and compared that information to the geography of the two countries, it all made sense. Rather than viewing the use of this traditional food as peculiar, they saw it as a clever use of the available land.

The final type of moment may not occur often, but it is an important goal for many teaching situations. In this moment a student looks at a new understanding and thinks, "How wonderful!" or "How beautiful!" Every discipline has patterns that are beautiful to those who are immersed in that world. Mathematicians find beauty in elegant equations, anthropologists in the traditions of diverse cultures, biologists in the complex interactions of living things. One of the finest moments of teaching can be helping students find appreciation when they learn things that are beautiful, true, or good.

Projects, whether done in groups or individually, are an imaginative way to build meaning. You might think of a project as the creation of a real-life (authentic) product that represents a synthesis of relevant learning. For example, students in Ken Cowan's unit on Zimbabwe may decide to survey community adults on their knowledge of

African culture or set up a display of the class's sculptures in a local school. Alternatively, they may create a virtual museum on the history of Zimbabwe or create a Hypercard presentation comparing the history of Zimbabwe with other examples of colonialism. In each case, students synthesize a body of information through the creation of some type of product.

To complete projects successfully, students must integrate and apply a variety of skills and understandings. In the examples above, such skills could include survey design, statistics, HyperCard, or museum display techniques. An inventive teacher who favors student-directed learning may encourage students to begin the project, let them discover the need for specific skills and concepts, and then enable them to seek out their own learning materials (already prepared by the teacher). This approach would be similar to the strategy of problem-based learning discussed in Chapter 7. Another teacher might explain the information on survey design directly.

Projects allow students to bring skills, concepts, and generalizations together in a product that is useful to them and is conducted in real-life settings. For example, the survey gives students the opportunity to apply new ideas and gain a deeper understanding of how local attitudes toward Africa may relate to knowledge of African culture. It also demonstrates to the students the real-life utility of data gathering and analysis.

Further Reflecting

In order to plan effectively for the class you are observing, it will be important to learn as much as you can about the students. Learn as much as you can about the general developmental characteristics of the age and grade you are preparing to teach. Through reading and observation, consider how those developmental characteristics will affect the types of lessons that are most effective. Compare your findings with a classmate studying the same grade. Next, consider the characteristics of the specific class for which you are planning. Learn about the major cultural groups represented. Discuss with the teacher any students who have special needs or interests related to your unit topic. If you have the opportunity to correct student work, use it as a chance to analyze student thinking and try to anticipate ways to make your teaching as clear as possible. Think about an authentic project that might serve as the culminating activity or authentic assessment for your unit.

While it certainly will be impossible to learn everything possible about the class, this study will help you remember that unit planning must always focus on students' needs, interests, and characteristics in order to be successful.

CHAPTER SUMMARY

This chapter considered the characteristics of students that influence how they learn, what is known about the process of learning itself, and what it means to understand something one has learned. In making decisions about learning activities, teachers must consider students' intellectual abilities, prior knowledge and life experiences, cultural background, interests, and learning styles. Teachers also must understand that students do not learn by passively receiving information. They construct their own meaning out

of what they experience, and this meaning is profoundly influenced by what they already know and have experienced. If students are to understand content, teachers must provide a variety of authentic, complex experiences that allow students to encounter information in many ways and have the opportunity to use it meaningfully.

The examples provided in the last section encourage you to think about alternatives to teaching using the traditional strategies. Field trips, role-play exercises, the use of media and technology, projects, and learning centers are just a few examples to help you, first, think more broadly about how to connect with students, assess their learning readiness, and evaluate their abilities and needs and, second, design activities that respond to them.

Practice Activity

Student Interviews

Practice Point

Select a middle or high school student to interview three times during the term. Conduct your first interview while studying this chapter. Each interview should take no more than 10 to 15 minutes. For each interview, choose something the student has been learning about in school, then try to determine the student's understanding of the topic and how he or she acquired it. Write a case study, including the following information in your study:

- Age, grade, gender of student
- Topic(s) discussed
- Understandings, misconceptions, and interesting ideas you identified
- Ways the student used prior knowledge to construct understanding
- Teaching strategies that were or were not helpful.

Do not use the student's real name in the case study. Maintaining confidentiality regarding student characteristics and behaviors is an important professional standard you should begin now.

Unit Preparation

Prepare a classroom portrait describing the composition of the class for whom you are preparing your unit. Describe the ages and grade level(s) of the students, the communities from which they come, economic level, ethnicity, and gender. Also describe their learning styles, interests, and other relevant characteristics. Begin thinking about how you will adapt your unit for this particular group of students.

Portfolio Activity

In your field placement or other school setting, conduct an assessment of student interests. Prepare a summary for your portfolio. Be prepared to discuss how you will use this information in instruction. Create a "Classroom portrait" describing all relevant characteristics of the students for whom you are planning your unit.

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