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Designing Effective Interdisciplinary Anchors

When focused on a problem worth solving, interdisciplinary units provide common ground, motivate students, and offer opportunities for a multitude of learning activities and modes.

A group of high school students recently prepared environmental impact studies for their state legislature. They were so impressed with the magnitude of their responsibility to be accurate and fair in representing both environmental and economic concerns that they began to see themselves as public servants rather than students. It did not occur to them until they submitted their beautifully designed reports that they had been learning skills, facts, and principles associated with the fields of ecology, chemistry, biology, statistics, economics, government, computer applications, and graphic design.

Recent findings in cognitive neuroscience confirm what perceptive practitioners have long known: there are as many ways of learning as there are learners, and knowledge is inextricably tied to the context in which it is used. The problem is: How can one teacher, presenting one curriculum, hope to reach 20 or 30 students whose neurological makeup and life experiences vary widely?

The teacher could individualize instruction or organize students into groups with similar learning styles and life experiences. Or the teacher could answer a simple question: Outside of the classroom, how and why do these diverse learners master the vast range of information and skills needed in our astoundingly complex world ?

The answer is that children learn by mobilizing their innate capacities to meet everyday challenges they perceive as meaningful. Skills and concepts are most often learned as tools to meet present demands rather than as facts to be memorized today in hopes of application tomorrow. Further, daily life is not separated into academic disciplines or divided into discrete time units; instead, the environment presents problems that one must address in an interdisciplinary, free-flowing way, usually in collaboration with peers and mentors.

These lines of. reasoning .point toward curriculum units that are problem-centered; interdisciplinary; presented in an interactive, cooperative format; and appeal to a multitude of students. Indeed, school districts across North America are encouraging and supporting interdisciplinary curriculums in order to respond to student diversity in all its forms—cultural, developmental, cognitive, motivational, and stylistic.

The Organizing Hub

We, our students, and our colleagues have developed interdisciplinary curriculums that not only draw upon multiple disciplines but also transform students' appreciation of the content they are learning. We view these interdisciplinary units as Heidi Jacobs (1989) does—units in which teachers use language, principles, and methodologies associated with more than one discipline to explore a central theme, problem, issue, topic, or experience—a focus that is frequently referred to as the *hub* or organizing center.

In addition, these hubs demonstrate the relevance of mastering a set of skills and concepts. With this emphasis in mind, we have borrowed the notion of an *anchor's* a metaphor for conceiving and designing interdisciplinary units (Cognition and Technology Group at Vanderbilt (CTGV] 1993). The most successful curricular hubs closely correspond to how the brain perceives and manipulates the environment—not to how a computer stores facts. From this perspective, the brain is continuously constructing meanings that are linked to the situations in which they are learned and used, a process that is mediated by our individual neurophysiology and experience (Clancey 1993, Edelman 1992, Gazzaniga 1995).

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These findings present us with two challenges in designing interdisciplinary curricular hubs. The hub must (1) provide a meaningful *anchor,* a focused

problem or question that both students and teacher can agree is worth addressing; and (2) the hub must be complex enough to accommodate a wide range of entry points and activities.

Students are the best source of topics that interest them, although they often cannot frame their ideas in ways that capture the multiple demands of successful interdisciplinary curriculums. Elementary school students along seacoasts often want to study whales; in mountainous areas, wolves are popular. Favorite middle school themes in Olympia, Washington, Hartford, Connecticut, and Independence, Missouri, include civil rights, child abuse, Native Americans, and immigration. One group of primary school students in rural Cheyenne, Wyoming, insisted on learning about spiders and butterflies, stoutly resisting efforts to expand or integrate their interests. By contrast, high school students' preferences tend to run toward the general and the abstract: justice, the environment, and the future.

Framing for Maximum Learning

Skillful teachers frame these topics in ways that provide common ground, facilitate insights into why specific proficiencies and information are important, and offer ample opportunities for an abundance of learning activities and learning modes.

For example, teachers in Spokane, Washington, broadened a request to study wolves to include all wild canids. They developed a series of organizing questions around other topics—pack and family structures, habitats, and relations among predators. While specific questions kept the theme anchored to students' interests, broadening the curricular hub opened doors to disciplines and activities beyond ecology and biology—to mythology, art, dance, music, anthropology, and history.

The range of activities is what serves diverse learners. For example, a suburban school included dogs in its unit on local fauna. A student with attention deficit disorder was so excited over the unit that she proceeded to crack a real dog on its journeys through the neighborhood. She read Elizabeth Marshall Thomas's *The Hidden Life of Dogs* as a guide to interpreting the dog's behavior, created a journal of the dog's life, and trained younger kids in the basics of naturalistic observation.

For once, that student wandered with a purpose. For many distractible students, active experience is not just a doorway to learning; it is the only way to learn.

A Problem Worth Solving

A curricular *anchor* is a complex problem that the student acknowledges as worth solving and that validates the learning of a set of relevant skills and concepts. The notion of an anchor was developed by the Cognition and Technology Group at Vanderbilt University (CTGV 1990, 1993). The group's extensive research suggests that carefully designed anchors help students learn techniques, facts, and ideas in long-term and transferable ways.

Anchors can be invented or natural, narrative or analytical problems, as long as they fulfill four requirements. They must

- capture the imagination,
- be perceived as important by learners,
- legitimize the disciplinary content they integrate, and
- accommodate a variety of learning approaches.

"Rescuing Rocky," a computerized lesson developed to research the power of anchors, is an example of an invented anchor (Barab et al. 1996). The lesson is presented through text, pictures, videos, and animated stories. It begins with a one-minute QuickTime® video explaining that a monkey, Rocky, is dying of simian AIDS contracted in a government lab experiment. The video informs viewers that a scientist in the Brazilian rain forests has discovered a cure for AIDS, but her research data and the area of rain forest where she had been working was destroyed by fire. Just before the disaster, she had written to a colleague, giving clues to the AIDS cure.

Students read the scientist's letter and decide which information they would like to explore to regenerate the cure themselves. To solve the anchor problem, they must travel to the rain forest, and to do that they must learn

about customs, international laws, and exchange rates. To experiment with various plants and insects, they must learn about viruses, immunizations, AIDS, simian immuno-deficiency virus, deforestation, plants and animals of the rain forest, ethics, and chemical interactions. They do not learn these concepts as objective facts to be memorized; they learn them as important tools that they must understand and properly apply to save Rocky.

Significantly, students learning the content to address the anchor problem scored higher on achievement questions and evidenced more transfer of knowledge than did students who studied the information without the anchor. More important, students learning in the context of an engaging anchor made connections among various disciplinary concepts, even seeing relations between the computerized lesson and other lessons, and between the lesson and personal experiences. For example, one student told us that his mother worked in the "underground," helping to make available various medicines for AIDS patients who could not afford the expensive new combinations of drugs.

An example of a more natural anchor is a Bill of Rights that a group of middle school students recently created. The students enthusiastically researched the struggles of Martin Luther King Jr. and studied the U.S. Constitution and the *Sheff v. O'Neill* case, in which the U.S. Supreme Court ruled on equal educational opportunity in the students' local community and more globally. They learned information and skills from an array of disciplines—history, government, law, economics, philosophy, communications, computers, desktop publishing, and mathematics.

These imaginative projects suggest several questions to ask when designing interdisciplinary anchors/hubs:

1. Will the anchor require students to draw on principles and skills associated with more than one discipline?

2. Will both students and teachers view the content as a legitimate area to study?

3. Will the anchor generate developmentally appropriate activities?

4. Will the activities provide entry points and opportunities for success for learners with diverse learning styles and cultural experiences?

Children learn by mobilizing their innate capacities to meet everyday challenges that they perceive as meaningful.

Orchestrating the Disciplines

No matter how well integrated interdisciplinary curriculums are, in most, a single broad domain serves as the mortar that holds the project together. Can you teach physics while studying wild canids? Sure. anything that moves follows the laws of motion. But when animals are at the core of the curriculum, the life sciences demand and deserve centrality.

In a middle school unit on electricity and electric invention, physics and mechanics were central, although teachers were able to include math (measurement), blueprint design, history, and writing. Similarly, an ongoing land management project in a rural school is basically a school wide ecology or environmental studies program. But the project, in which students are implementing the state conservation plan in several acres of meadow and woodland, also legitimately includes plant and animal science, forestry and horticulture, and photography and surveying. In a multiage project, students have turned the walls of their school into a museum, reproducing works from cave paintings to Picasso and accompanying them with historical and biographical information.

This curriculum was built on art and art history, but it easily accommodated many other subjects—cultural and political history, biographical research, writing and editing, video production, business skills, and all the construction skills. Visitors may view and purchase a video about the museum and buy postcards and reproductions of the art works. Each year, students add a new era or culture and teachers are expanding the disciplinary reach by including crafts and industrial design.

In striving for an interdisciplinary approach, the question is not how many disciplines one can integrate but rather, "Will the unit provide a diversity of learners opportunities to try difficult tasks and learn new skills in a motivating and rewarding context?" The unit on electricity, for example, provided a discouraged 13-year-old with a chance to develop and display his strong visual and spatial abilities. It also required him to use language, one of his weaker areas, to write up experiments and display projects. His home-room teacher reported that he "went from

doing no work to completing all his work." Classmates whose primary intelligence was musical or verbal (as described by Howard Gardner, 1983), didn't make great leaps in the electricity unit. But they did experience a more narrative, less narrowly logical and mathematical way of learning subject matter that they ordinarily did not find congenial.

Structuring, Scheduling, and Finding Time Although interdisciplinary units are a creative and effective way of motivating students and engaging more learners, they present obstacles—both practical and philosophical—to designing and implementing them. Legitimate questions include

• *What happens to "the structure of the disciplines" that Jerome Bruner (1968) has described so eloquently?* If canids or electricity are the real topic, how can math or music be taught in a properly structured sequence? Here are two suggestions.

First, teachers should design interdisciplinary units to follow the sequence of the disciplines they integrate. In other words, 5th graders publishing a newspaper would circulate and analyze a survey to determine how many copies to print; would decide how many 500-page reams of paper to order given the size of the page and number of issues; and would create a budget, estimating their expenses and generating a per-paper cost. Seventh graders would need a project that calls for a more complex sequence of math concepts and skills, perhaps a design-and-build project that combines geometry with formulas for determining the properties and capabilities of various building materials.

To preserve the structure of the appropriate disciplines for middle school and high school, the teacher could follow the Federated Learning Communities model that Gabelnick and colleagues (1990) described. The model weaves the integrating theme or anchor into several existing courses. The model also calls for a seminar or forum that helps students integrate information and ideas from the various disciplines into the curricular hub and provides a setting for special projects and presentations.

Racial prejudice and world hunger are two popular anchors in this model because their urgency travels easily across disciplines. The unit on environmental impact studies was also taught in a Learning Communities format. Learning communities often result in student-generated projects that are time-consuming and hard to administer, but worth their weight in learning opportunities and public relations.

• *What happens to the school schedule?* A self-contained classroom easily accommodates interdisciplinary units. In the upper grades, however, where a whole school is scheduled in 40- or 50-minute blocks, scheduling can be more difficult. The Learning Communities model eliminates scheduling problems, but does require the school to set aside one or two periods each week for the seminars.

Another scheduling strategy for middle and high schools is to combine class periods, creating a double-time block during which students can consider the theme or anchor from two disciplinary perspectives. One example is an AIDS unit that a joint history and English class designed. The students imported the information they needed through guest lectures, videos, and field trips, while concentrating on the historical and communications aspects of understanding and preventing the disease. They prepared two AIDS curriculums, one for younger students and the other for their parents.

• *How can teachers find time for interdisciplinary curriculums?* We concede that these curriculums are time-consuming, and we have no easy answers. We do know that many teachers use this approach despite the time it takes. They do so for several reasons: It is exhilarating; it brings their creativity into play; it enables them to collaborate imaginatively with colleagues; and it is a reliable way to bring all students into the circle of successful learners. •

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