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ABSTRACT
        Curriculum in the United States is largely a
fragmented set of subjects and teachers to present them. Many Pacific
Northwestern educators are looking for innovative ways to organize
curriculum that over comes the traditional structure. As knowledge of
the learning process increases, integrative curriculum is being
employed more frequently. Several schools in Washington and Oregon
have explored using integrative curriculum. Integrating subjects was
one approach used to organize curriculum. Gladstone High School in
suburban Portland, Oregon, integrated English and science instruction
to create a "philosophy of care" for students to help them better
understand both subjects. Hudson's Bay High School in Vancouver,
Washington, created a school-within-a-school blending math, science,
and English projects. Integrating people in projects such as the
Haystack Rock(Oregon) Awareness Project is another curriculum
approach. Integrating activities can also provide innovative
approaches to curriculum. Seaside and Jewell high schools in Oregon
participated in the Native American Site Artifact Project to study
the archeological history of their area. Willamette Primary School in
West Linn, Oregon, uses inquiry investigation to integrate
curriculum. Integrative curriculum attempts to make learning more
natural and link subjects together. (Contains 39 references.)
(JPT)

Crossing Boundaries:
Explorations in
Integrative Curriculum

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Cover photo: Neal Maine

Crossing Boundaries:
Explorations in Integrative Curriculum

Jane Braunger and Sylvia Hart-Landsberg

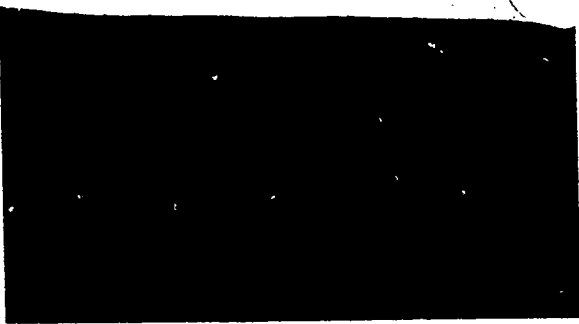Study should not lead directly, easily, or efficiently to terminal answers whose correctness can be pronounced immediately and externally. The need to learn springs from confusion, and real exploration leads into complexity, into webs of relationships and interrelationships calling forth the powers of analysis and synthesis and the sort of theory building that leads to further explorations.

—Stephen Lafer and Stephen Tchudi

The stories presented here are about explorers, professional educators who are risk-takers seeking to understand and celebrate the nature of meaningful experience in learning. These accounts represent K-12 classroom practice across the nation where teachers are willing and eager to learn with children—as big questions guide rich inquiry for teachers and students alike.
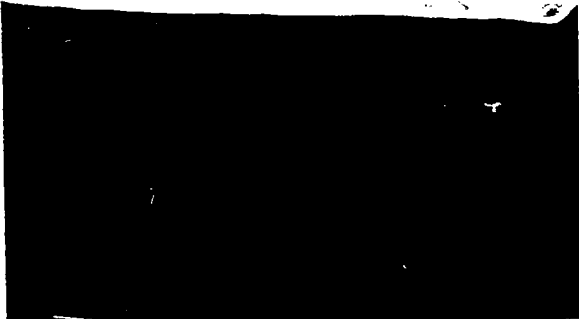
In producing *Crossing Boundaries: Explorations in Integrative Curriculum*, the authors and staff of the Northwest Consortium for Mathematics and Science Teaching (Northwest CMAST) have examined a question central to science and mathematics educational reform; that is, how to orchestrate intellectually robust learning environments and experiences which call upon guiding principles of systems thinking. In this volume we celebrate highly personal acts of teaching and learning. Led by the teachers and students featured here, we investigate connections between teaching methodology and student learning, examine patterns and relationships in dynamic curriculum planning, and see school practice as integrated systems operating on behalf of all children.

Integrative teaching is about unifying deeply meaningful experiences in learning for students, not about following a prescribed plan. It's teaching which "draws out and brings forth" capacity for children to be lifelong learners. It involves these learners in creative processes that often move them, with fluency, through traditional school subject boundaries. As a dynamic learning process, it naturally calls upon highly purposeful and related events where students see learning as a repertoire of strategies and experience, continuously guiding their participation and contribution as young citizens.

The stories and analyses within these pages offer inspiration, depicting possibilities in classroom practice where children's involvement and unlimited potential is central. In this regard, a sound science and mathematics education for all learners is one where the learner contributes to and is an equal partner in the design, implementation, and assessment of school and community experience.

I invite you to participate in this journey of instructional innovation, and trust that the inspiration found in these pages will invite reflection and pose questions for your further inquiry into the teaching and learning of science and mathematics.

Rob Larson, Director
Science and Mathematics Education Program, NWREL

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No longer is it rational to operate our schools as though learning were something that happens to, or is acquired by, an individual. In this new, more complex conception of learning, the learner is the active agent. No teacher- or program-centered curriculum can correspond to this understanding. Instruction in science, math, and all other subjects is effective only to the extent that it employs the rich human ability (indeed, the need) to socially construct knowledge.

The Call to
Explore Integrative
Curriculum

"Why did we break it up to begin with?" Two teachers we interviewed for this study pose this question as they struggle with the puzzle pieces that curriculum has become. Resolving to "put it back together," they have embarked on an integrative curriculum project. Like many others, these teachers are reacting against the fact that instruction in U.S. schools generally presents teachers and students with a fragmented set of subjects to study, categories of people to study them with, and ways to learn about them. Although this organization of curriculum represents traditions that educators and others have established across the centuries, it is not chiseled in stone. Throughout the Pacific Northwest, indeed the nation, educators are exploring ways that this set of traditions can and should be altered to better serve students and society. The aim of these efforts is to remove boundaries that rigidly demarcate activities and separate people with similar interests and purposes.

This kind of far-reaching innovation requires a careful search for the most effective tools to make education for integrated learning a reality. *Crossing Boundaries* is the product of such a search. This publication explores routes that a few adventurous educators in the Northwest and elsewhere are taking to eliminate barriers that limit learning. In this way we seek to promote discussion and implementation of changes which manifest a solid core of education values and theories.

The recent public and professional calls for reform, based in these solid values and theories, recognize that the categories schools impose on experience are at odds with the unity of all knowledge and therefore with its application in many arenas of life. Another impetus for reform is educators' growing insight into learning as a process in which the learner takes an active role. Reasons to

question present practice also come from current forays into integrative curriculum, as seen in language arts education. Particularly influential is the national movement for standards in mathematics and science, which is stimulating talk of the interrelationships among subjects. Each of these impulses for integrative work is discussed briefly in the following sections.

How Schools Fragment Experience

Throughout the 1980s and continuing today, concern about academic fragmentation has been growing across diverse sectors. The national movement for standards in education reinforces the common perception that traditional assessment methods are divorced from instruction. Teachers claim that in addition to over-compartmentalizing subjects, schools isolate professionals from each other. Various public interest groups seek greater participation in schools. Some graduates claim that inadequacies in their education separate them from decent job opportunities, even from basic life skills. Members of minority groups note that school staffs are still somewhat segregated, employing a disproportionately low percentage of minorities. And curricula, they claim, further segregate people by underrepresenting minority experiences. Many women perceive a devaluation of their ways of knowing, their distinct educational contributions and challenges.

Similar voices call from the world of scholarship. Education, they state, will flounder if it does not encompass more kinds of participants and experiences. Noddings (1992), on the one hand, finds it necessary to emphasize the affective element in our personal and professional lives, reminding us that all learning grows from human relationships. Hart (1983) and Caine and Caine (1991), on the other hand, re-emphasize the cogni-

tive element of learning, reminding us that all learning is "brain-based." (The very fact that we need to be reminded to keep feelings and thought in education suggests that our traditions have rent asunder basic aspects of life.) Supplementing calls for uniting many modes of experience are admonitions to reunite the academic disciplines. Thus, Moffett (1992) emphasizes our need to understand the interrelationships among these modes before revising the curriculum. Ringing through these academic voices are two messages. First, we must dismantle the barriers between schooling and life outside school. Second, in order to connect education to life outside of school, educators must incorporate diverse content, roles, and instructional approaches in school experiences.

Understanding the Learning Process

We know more about learning than we used to. The new knowledge is stimulating creative ideas about integrative instruction. Observant teachers and students have long perceived that human learning is a result of social interaction. Through this activity, humans continually make sense (or construct meaning) out of experience. In recent decades, however, scholars of cognitive psychology, linguistics, anthropology, and other fields have added fresh insight into just how social all intellectual activity really is. Studies of language acquisition, enculturation, and other interactive learnings reveal the ways knowledge and social interaction are inextricably intertwined (Prawat, 1993). These theoretical advances which have stimulated worldwide explorations also prompted our research in *Crossing Boundaries*. No longer is it rational to operate our schools as though learning were something that happens to, or is acquired by, an individual. In this new, more complex conception of learning, the learner

is the active agent. No teacher- or program-centered curriculum can correspond to this understanding. Instruction in science, math, and all other subjects is effective only to the extent that it employs the rich human ability (indeed, the need) to socially construct knowledge.

Successful Reform in Literacy Education

Language arts educators have blazed dramatic trails into the terrain of integrative curriculum. Impressed by recent successes in literacy education, teachers of other subjects (especially science, math, and technology) are looking at this area for inspiration and seeing that integration is fundamental to those successes.

Terms like "whole language" and "integrated language arts" describe literacy educators' endeavors to keep reading and writing instruction cohesive and to build it on the foundation of students' experience of language. The organization of instruction is moving away from divisions of oral language development, reading, and writing (each with subdivisions, such as grammar, spelling, and punctuation in writing). This is because adults who teach young children observe the interdependence of reading, writing, speaking, and listening. These professionals have replaced the notion of "reading readiness," implying that literacy is either present or absent, with the concept of "emerging literacy." This concept that literacy develops gradually is based on the fact that children arrive at school already knowing a great deal about language, meaning, and, often, print. Reading is language, as young children know. These nascent readers and writers become increasingly aware of the relationships among oral and written forms of language that surround them. To isolate their reading from other activities (e.g., writing, science, play) and break it down into a series of skills (e.g., phonics) is to miss the learning opportu-

nities provided by the interconnections among activities.

Much progress in the field of literacy in the last 10 years is based on this understanding—for example, efforts to teach in ways that keep language and literacy in meaningful wholes. One such effort is the use of literature instead of basal readers for reading instruction. The National Assessment of Educational Progress's (NAEP) most recent data (1992) from reading achievement tests administered to a national sample of students reveal that fourth-grade students who receive literature-based instruction perform better than their peers who receive skills-based (phonics) instruction.

New Standards in Science and Mathematics Education

Society is setting new, high standards for teachers and students. In response, a national movement toward curriculum standards is calling into question the rigid divisions among subjects, people, and types of activity that currently underpin curriculum, instruction, and assessment. Local efforts to enhance the outcomes of education (e.g., The Oregon Educational Act for the 21st Century and similar reform efforts under way in Washington) also focus on integration. The standards emphasize the importance of students' applying school learning to the tasks of self-development, citizenship, family life, and careers. The emphasis on quality and application in such reforms calls into question the traditional subject-centered curriculum.

Science and mathematics teachers are among those raising questions along these lines and exploring responses. For example, when the Northwest Consortium for Mathematics and Science Teaching (CMAST) held state forums to examine the proposed National Science Education Standards, participants noted a need for an in-depth integrated approach to science instruction. Their con-

viction is that an approach that contextualizes science in a wide array of society's activities and issues and relates science to other curriculum areas will lead to deeper scientific understandings. Dubbing this a "less is more" approach, they caution against the perception that teaching for conceptual understanding and application will "water down the curriculum" (Northwest Consortium for Mathematics and Science Teaching, 1993).

Crossing Boundaries offers an exploratory perspective to encourage teachers to develop their own integrative philosophies and practices. Because such exploration is necessary for growth in this complex area, this publication is not a how-to manual. Neither does it offer a set of exemplars, new curriculum model, typology of existing models, or literature review. Rather, it offers descriptions and discussions of projects that highlight some of the inspirations, complexities, and rewards involved in real-life attempts to integrate traditionally separate aspects of schooling. Our purpose is to foster thought, encourage experimentation, and tie theory to practice. While Crossing Boundaries draws broad, practical implications for teachers who may pursue integrative practices, it is the readers' explorations of the material, in light of their own work and thought, which has potential value.

We invite you to travel with the explorers whose integrative efforts are chronicled here. Join them as they cross educational boundaries, some as obvious as those between subject areas, others as subtle as those between teacher and learner, school and other public institutions, and content and process goals.

The teachers whose stories are summarized here live with the creative tension of balancing the apparently opposing demands of curriculum: to address both content and skills, place neither the teacher nor the student in charge of curriculum, and educate the mind as part of educating the whole person.

Three Routes for

Exploring Integrative
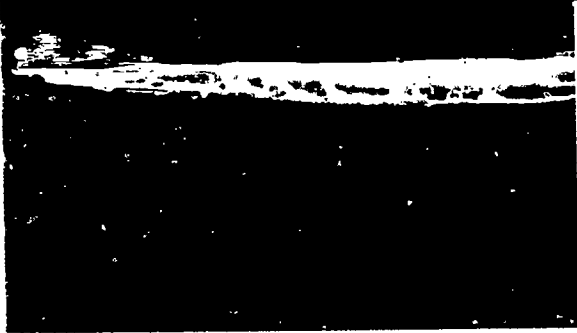
Curriculum

Countless Northwest educators are successfully taking risks to integrate curriculum. As scouts of uncharted terrain, they can help others decide which routes to take. We briefly joined a few of them in their explorations by visiting their schools and classes, listening to their accounts, and looking at their materials. In addition, we read widely about integrative efforts elsewhere, the theories of learning behind integration, and the support strategies that bolster teachers' efforts in this area.

Among educators the term "integration" usually refers to *subject* integration—for example, a unit that ties together astronomy, art, and trigonometry. We found, however, that developments in the vanguard of education reform tend to unite not only the subject of learning, but also the *participants* and *instructional approaches* that normally are separated in our school system. Therefore, we have grouped the following explorations into these three aspects of integration—people, subjects, and instructional activities. We discovered that any practice that makes inroads into one aspect of integration is apt to integrate other aspects as well. A case in point: Integrating *students* who have trouble learning math into a class with students who tend to excel in that subject often calls for the introduction of nontraditional math *activities* that span several *subjects* by applying math knowledge to real-world situations. Regardless of the route by which the explorers in *Crossing Boundaries* approach integration, they share the common goal of improving education by broadening school experience and relating it more directly to nonschool experience.
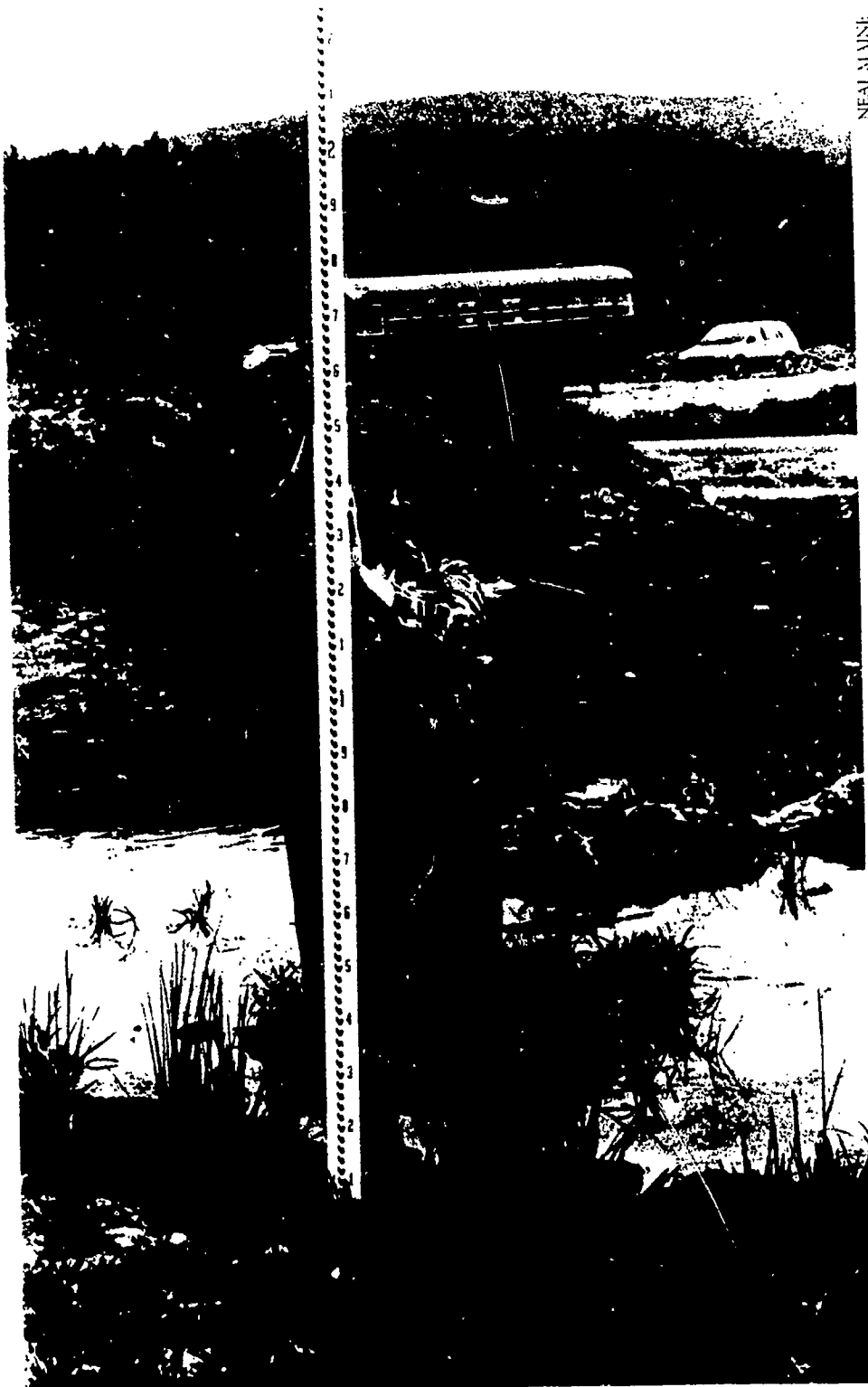
NEAL MAINE

> *The master argument for curricular integration is simply that life is not divided into subjects. This argument may be grounded in either personal or social reality. That is, academic departments fit neither the way individuals build their personal knowledge structures nor the way societal problems arise to which knowledge may be applied….Language educators now believe it's better to integrate listening, speaking, reading, and writing; science educators, biology, chemistry, physics, and earth sciences; arts educators, drama, music, dance, and art; math educators, arithmetic, algebra, geometry, and calculus. Perhaps it's time to intermix these major subjects themselves.*
>
> —James Moffett

INTEGRATING SUBJECTS

The traditional school subjects and scholarly disciplines are wonderfully useful for organizing the study of the "blooming and buzzing confusion" (Keesing, 1976, p. 201) that reality presents. Yet rigid categorization of strands of experience that are actually inextricable becomes simplistic, constraining rather than strengthening our grasp on skills and knowledge. Many teachers are recognizing the unity of knowledge with creative approaches ranging from partnerships between teachers of two science subjects, to ground-up reconstruction of curriculum based on project learning, to inquiry-led instruction in single classes. The terrain of integrative curriculum is not yet sufficiently charted to suggest that one approach is superior. However, the people described in this section agree that their journeys are yielding valuable instructional experiences. Certainly their curricula introduce "new" people and instructional activities into the learning process, but it is their innovations in uniting subjects that bear highlighting.

Gladstone High School English and Science

Creating coordinated English and biology studies. Biology teacher Bill Stewart and English teacher Nancy Wilson have combined their subjects in a block class for sophomores at Gladstone High School, a suburban high school of about 800 students 10 miles south of Portland, Oregon. Their primary aim is to teach students better in both subjects by relating them to each other in topic studies such as genetics and ecology. One of their methods for doing this uses a "philosophy of care" for the students and for each other as teaching partners.

Wilson and Stewart launched the class four years ago when they became aware that they taught many of the same students and saw the potential for developing their comprehension of relationships between English and biology. At the same time, they wanted to help students balance their workload by pacing assignments across the two classes. With the support of their administration, they began the English/biology block.

Scheduling their block class was a great challenge. In their original schedule, one teacher had a planning period while the other was teaching. This allowed them to observe each other's classes and work with students in both disciplines, but it meant that both instructors had to squeeze planning time into the hours before and after school. On inservice days they had to accomplish "marathon planning." In our interview they laughed when recalling the frequent, frantic "hallway conferences" between classes that supplemented these planning feats. The schedule that is currently more effective is a shared planning period followed by the two block classes with about 25 students each. Wilson teaches English to one group while Stewart holds biology class with the other group; then, at the end of the period, the student groups switch classrooms. Keeping the subjects as two separate classes works well for them. "Our paths cross," notes Stewart. "We don't run a parallel road, but we cross fairly rhythmically, in a reasonably coordinated way."

Curriculum as a double helix. Stewart and Wilson organize their curriculum around three or four topics each semester, including the scientific method, ecology issues, and evolution. Learning strategies flow from the topic being studied. For example, in the study of wolf behavior as part of a unit on scientific method, students learn to observe closely, record data on charts, and analyze data for report writing.

Since the class is college preparatory, the academic norm is advanced. Students who sign up for it know this. In an informal interview with a small group working together in Wilson's English block, the students agreed that they expect to learn a significant amount. One explained, "It's hard…but better [than learning in separate biology and English classes]. We learn more. We have a lot of homework, but we understand what we're doing."

The teaching partners describe the model behind this coordinated curriculum as resembling a double helix: English and biology remain distinct yet spiral together (like the two strands of a DNA molecule). An example occurs when students relate their interpretations of *Brave New World* and other utopian literature to their study of genetics. Stewart and Wilson like the fact that their spiraling approach communicates the importance of using multiple disciplines regularly, and still teaches discipline-specific ways of working. They speak of students learning to "draw in other experts" working on a problem. By this they mean learning to use perspectives from other disciplines to study topics in particular subjects. They want students to ask questions like "What insights does literature have to offer in the study of genetics?" and "How does a scientist use writing at various points in a behavioral study of wolves?"

The teachers strive to break free of restraining traditions while retaining valuable ones. Wilson takes a conventional instructional approach to certain works by Shakespeare, for instance. Most of her teaching time, however, she invests in the coordinated study of biology and English. An obligation to completely cover the curriculum (often a forced march through textbooks or across centuries) is tyranny, she asserts. "I don't believe you have to do everything of everything." Instead, she and her teaching partner have opted for

depth of understanding through a "less is more" approach, i.e., less material covered can render more time for thorough understanding.

Success in the expanded domain of English and biology. Both teachers think students in the block class perform better in traditional biology and traditional English skills, and exhibit more complex knowledge in both subjects than do students in their single-subject classes. One girl noted, "My friends who didn't have the block class didn't learn to write reports; this is a big help to me now. But I wish chemistry and math were taught in a block. It would be easier if teachers helped us relate the two."

Intertwining two subject strands has deepened the teachers' own comprehension of their disciplines. Wilson notes, "My own thinking about the proper domain of the English curriculum has expanded. If reading, writing, listening and speaking are the language processes English is supposed to cultivate and sharpen, then critical reading and thoughtful writing in science—or any other discipline—is appropriate." Enhancing her own abilities to read and respond to science allows her to guide students better. In fact, both teachers see their professional growth—hers by learning more science and his by learning more about English—as strengthening the block classes. Neither is an expert in the other's field, yet they have reaped benefits from broadening their repertoire.

Accounting for success. How do Wilson and Stewart account for students' improved performance in the block class? Stewart suggests, "I may enjoy the block class more and do a better job." Former block students interviewed for this publication credited "real connections" between subjects with the success of the class. Says one, "They were two subjects, but taught like one. The teachers constantly related new material to what we were studying in the other

class." Another former student said she appreciated the way Stewart and Wilson designed the classes so that biology and English support each other: "I liked how we read about the same topics in both classes and had real connections between them, like learning to write reports in science. I understood things better. What we learned in Ms. Wilson's class, we applied right away in Mr. Stewart's. And both of them set up supportive working groups in their classes."

The two teachers served as translators of each other's material. As one former student commented, having a science and English teacher collaborate helped students who were more comfortable in one or the other field. In a way, she says, Wilson could "sort of translate" for her, since this student was more confident of her abilities in English than in science. And she saw the same process between Stewart and the more science-oriented students.

A philosophy of care. Wilson and Stewart enact what they describe as a "philosophy of care" for their students. And, they add, "We [the two teachers] get along well—this helps!" One way that they care for students is by designing classes so that students can succeed: Opportunities are ample for revising papers and retaking tests, working in supportive groups, and getting help from both teachers. Although they set high standards and a fast pace, neither Stewart nor Wilson would collaborate with a teacher who equated high standards with harshness or aimed to weed out unsuccessful students. By the same token, they extend the effects of their philosophy by expecting students to work respectfully with each other.

For students, the increased contact with classmates and "having two teachers care" about them lends the program coherence. A former student expresses this: "I liked the closeness, the cooperation of the block class. Students had a lot of say, lots of discussions. The teach-

ers taught you how to learn in any kind of situation. They'd put you in groups with people you didn't usually work with—and you learned from each other."

Support for others spurs on Stewart and Wilson. Integrated curriculum is on the increase in their high school, and Stewart and Wilson look forward to a revamped schedule that will support their own and others' efforts. Another kind of support they hope to see is space for more combined sessions of block classes. Oregon's legislation to establish high school student learning outcomes that cross over traditional subject area boundaries also spurs on their own efforts.

The Mid-California Science Improvement Project

The need for science reform. Elementary school science instruction has long been a concern of curriculum reformers. One reason is that it has lacked the secure place in the curriculum accorded language arts. Another reason for this concern is that, more than language arts or even mathematics, science seems to intimidate many elementary teachers. A number of studies have pointed to the poor quality—and quantity—of science instruction at the elementary level, most recently *Science for All Americans*, which called for a revamping of science instruction from kindergarten through high school (AAAS, Rutherford et al., 1989).

How can we account for the weak state of elementary science instruction? A 1987 survey of 350 elementary teachers in Monterey County, California, pointed to factors that are relevant nationwide: Many of the teachers lacked confidence in their ability to teach science, appropriate materials for science teaching, and know-how for integrating science into their already overcrowded curriculum (Greene, 1991).

Putting science at the center with theme-based integration. In what may seem a paradoxical response to problems of elementary science teaching, a number of Monterey County teachers have placed science at the *center* of their curriculum by participating in the Mid-California Science Improvement Project (MCSIP). The project, now in its seventh year, is based on Kovalik's integrated thematic learning model (Kovalik, 1986) and is supported by a grant from the Packard Foundation. According to early evaluations, MCSIP seems to have benefits beyond curriculum integration, specifically, (1) enhanced teacher enthusiasm and effectiveness in science instruction, and (2) significantly improved student achievement in science (NAEP, 1987).

The purpose of MCSIP is to assist elementary school teachers in teaching science on a daily basis. The project extends teachers' science understandings and helps them design and implement yearlong themes which use science as the integrating element, bringing together, for example, language arts, social studies, mathematics, and fine arts. Teachers' personal stamps are evident in such themes as The World Beneath My Feet, Keepers of the Earth, and Magic, Marbles, Motors: The Many Faces of Motion.

In one yearlong MCSIP study called Bit by Bit—Building It Together, Salinas first-graders followed the progress of a construction project at their school with their own construction-related studies. Science topics and activities included scale drawing, design and construction, rocks and soil, and the properties of sound. Writing and reading accompanied their science work, but they also integrated construction activities around literature, such as The Three Little Pigs and Mike Mulligan and His Steam Shovel. The problem of how to fit science into a full curriculum gave way to the realiza-

tion—for students as well as teachers— that science is all around them.

Increasing student choice. Integration of other subjects around scientific studies is just one of the project's principles. A hands-on, activity-based approach integrates physical, earth, and life science. Because learning springs from and extends personal meaning, students choose many of their own projects and materials. For the same reason, MCSIP teacher-participants are volunteers who choose the theme around which they plan their year's integrated curriculum. MCSIP encourages teachers to cultivate an atmosphere of trust and respect in their classrooms to support the collaboration and group work essential to integrated learning. Teachers also honor students' needs for time to learn at their own pace.

Teachers as learners. Teachers begin their MCSIP involvement with an intensive two-week summer institute. Participants, who may feel inadequate as science teachers, study science content appropriate to their students' grade level, learn effective strategies for teaching it, and develop a theme-based curriculum. Planning around this theme becomes the focus of the training. In addition, the teachers deepen their own understanding of the theme by relating it to other fields. On leaving the institute, the teachers take the curriculum which they have planned along with a stipend to purchase materials for its implementation. Once back in their own schools, they receive ongoing support from the other colleagues in their building who are program participants. MCSIP staff continue to offer help in the form of demonstration lessons, classroom observations, and periodic training sessions.

From risk-taking to confidence. The evaluation referred to at the beginning of this section points to project benefits for both teachers and students. A notable contribution is the project's success with students of multiple abilities

and experiences, particularly students whose first language is not English. A classroom where students work together to observe, hypothesize, and make connections is a fertile place for language— everybody's language—to blossom.

The project recognizes the need for teachers to be convinced of the merits of proposed changes if they are to make them enthusiastically. The goal of improving students' scientific literacy is inextricably linked to another goal: assisting teachers to integrate science, on a daily basis, into their curriculum. It is thus appropriate that the initial impact of the project has been on teachers. The training and follow-up support are tailored to teachers' interests and needs, building on the theme around which the teacher plans to integrate the curriculum.

MCSIP teachers report that they teach science more frequently and in greater depth as a result of their involvement in the project. Teachers also seem to overcome their sense of inadequacy in science. The first-grade teacher whose class monitored the construction project is a striking example. After MCSIP training, she enrolled in geology and conceptual physics classes at the local college— quite a turnaround from her avoidance of undergraduate science classes.

Connected learning: building on the known. Significant conclusions about integrative curriculum can be drawn from the MCSIP experience. Teachers take risks in a field they find challenging—science—and gain confidence as they discover conceptual links to other subjects in which they feel more secure, e.g., language arts, mathematics, and social studies. Planning themes and continuing to develop them based on students' responses nurture teachers' personal investment in science.

Students become engaged in the science-centered themes in much the same way that teachers do: by building on personal interest, drawing conrec-

tions to familiar material, and risking new experiences. For both teachers and students, the process of learning how to learn is an important product of their efforts. Theme-based inquiry also yields increasingly sophisticated conceptual understanding. By crossing the boundary between security and risk, participants extend their knowledge and increase their confidence as learners and as teachers.

Eagle's Wing

Creating an integrative alternative. Bret Loucks, science teacher at Hudson's Bay High School in Vancouver, Washington, devoted several years to collaboration with an English teacher. Loucks felt that the experience of integrating their two subjects had improved his teaching from an academic standpoint

and wanted to extend this kind of growth. With this in mind, he joined a Hudson's Bay faculty group to plan Eagle's Wing, a school-within-a-school. That new institution is now in its third year. Bret finds that teaching in Eagle's Wing, in addition to continuing his academic growth, has improved his ability to relate to students' social and emotional needs. This unforeseen advantage stems from his increased contact with students in the program. This results from its emphasis on the learning process, group projects, and student advising sessions.

The students. Eagle's Wing faculty members don't want their program to fit the common stereotype of alternative schools as backwaters composed of students who "can't make it in the regular program." The admissions policy is designed to keep the Eagle's Wing popula-

tion of about 218 representing a cross-section of the whole school. Many Eagle's Wing students take courses in other departments, and some Eagle's Wing faculty members also teach courses in other departments. There are no typical Eagle's Wing students. The following student profiles, taken from interviews in the spring of 1993, illustrate how important the program's extensive offerings and flexibility can be in individuals' lives:

• Marie (a pseudonym) arrived at Hudson's Bay High in the beginning of her senior year. Since she lived "on her own" and had minimal contact with her parents, she needed to earn money for rent. Marie also needed three credits for graduation. And she was trying to develop practical skills for her future. Eagle's Wing tried to answer these needs not only with support and credit for find-

ing and holding a part-time clerical job, but also by requiring her to extend the learning from her work to academic assignments. But Marie claimed that her greatest need was neither credits, money, job, nor skills. In order to achieve all these, she sought an "anchor" as she positioned herself in the education, employment, and family worlds. Access to teachers was the anchor that she found in Eagle's Wing. "They [the Eagle's Wing faculty] are willing to work with you. You can get help *as soon as you need help*. If they don't know how to help you they set you up with someone who does. But you are never left alone—until it's time to work. It's one-on-one, not one-against-thirty."

• Chad (a pseudonym) was a sophomore who, like Marie, needed active support from teachers who were in a position to be flexible and available. As a freshman, he "lost" many credits because he "got stuck in a rut." According to Chad, the rut was a result of "the standard pace" at which teachers expected him to proceed through material, his difficulty "seeking free time from teachers," and "homework I really didn't understand." Chad enrolled in Eagle's Wing to get his "own time to work on things," "hand-tailored" instruction, and "free discussions." "At first when I arrived I was worried about being motivated," he admitted, "but now I am wanting to learn." While Chad talked with Marie and the researcher about his career goal, computer repair, Marie handed him the business card of a computer repair person. Pocketing the card, Chad mentioned his intention to call the person for an interview about careers in that field.

Group projects. Eagle's Wing curriculum centers on group projects. In addition to integrating several traditional subjects, projects target learning in areas of experience that are not always recognized by the traditional curriculum, e.g., cooperative work, applied skills, and self-knowledge.

Projects have included The Electric Car, Home Repair (related to the Habitat for Humanity Program), Jurassic Park, Toys for the Homeless, Steel Drum Making, Llama Trek, Swing Dance, Composition and Construction of a Music Box, Survey Writing, The Stock Market, Clothing Construction, Earthquake-Safe Buildings, and Drug-Resistant Viruses. Each carries credit in relevant subjects (algebra, biology, P.E., and so forth). Individuals can adjust their project tasks to help them earn the particular credits they need. The faculty require students, in selecting projects, to respond first to their individual interests, and then to the credit requirements, which are the same for all the high school's students.

English teacher Therese Green shared with us "war stories" about some projects she has led. Laughing at her propensity to recall the struggles rather than the victories, she reasons, "I guess I remember these just because people learn so much from their mistakes!" While not describing the projects in detail, these episodes reveal the unexpected learning that accompanies planned lessons in Eagle's Wing:

• *The writing process.* A student had worked diligently on all aspects of report writing but had not completed his report for a project on The History of the Telephone. Knowing that he had failed according to the criteria he and Green had set, he became upset during the final evaluation session. Green, fearing that a negative interaction would trigger his leaving the education system altogether, did not focus on the narrow project outcome (the report), but discussed the entire learning episode with him. He came to realize that he *had* learned important lessons—research and writing skills, and insights into his own work process. By these criteria he had not failed. After the evaluation, he continued trying to improve his writing.

• *Directing discussions.* In an English pro-

ject for seniors who wanted to work seriously on reading and writing literature, Green found her students holding the kind of chat sessions they might have had at Denny's—fun, but far-flung from the subject. After she told them that she could not, with integrity, participate in these sessions, they began setting agendas and trying to stick to them, thus learning about the role of planning in group dynamics.

• *Admitting emotions.* A boy in the same senior seminar was writing poetry filled with abusive language and reading it to the class. Green felt very uncomfortable about this and suspected that some of the girls felt the same way. After she told the poet so, he was moved to write a long account of abuse he had actually received and show it to Green. This response opened an avenue for professional help for him. The female students followed their teacher's example and became more assertive in limiting the kinds of material they were willing to listen to.

A wider curriculum. Project work is only one component of a wider curriculum that includes workshops on specific skills (ranging from library research and report writing to time management and self-motivation), individual and group conferences with advisors, career planning, community service work, and student governance. In Loucks' words, this comprehensive approach pays off because "teachers are free from hassling kids about how they spend their minutes...[the teachers] are looking at the entire production process and the learning." Students who have particular problems with procrastination and negative attitudes that keep them from reaching their full potential learn to understand their work styles. The program even teaches stress reduction. Instruction in teamwork also alleviates stress by teaching students how to assign roles, build community, and hone their contributions to a group. These skills are more complex

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than those in a typical classroom, exercise of "cooperative learning" because Eagle's Wing projects are long-term, student-initiated endeavors that integrate many people, subjects, and activities.

Let the students ask the questions. A theory of learning underpins Eagle's Wing. The way Loucks sees it, curriculum should "let the students ask the questions" because "the competencies we need are reasoning, problem solving, and asking questions." In an interview, he points out that "society needs students who can access, make sense of, and question information. So, the goals for the student are process goals: collecting and analyzing data, developing questions (hypotheses), designing tests (experiments), and applying sampling techniques and risk assessment."

This emphasis on reuniting the learning process with the course content involves a "leap of faith" that students will not be disadvantaged by turning away from facts, by risking omission of some concepts or subjects. Carefully examining the alternatives of focusing on the narrow outcomes of scientific investigation or on its processes has led Loucks to conclude that "the process [of learning] is so rewarding" that it creates people who continue to pursue scientific knowledge all their lives. "I can't afford to take the attitude that if they don't get a certain content here they are lost. Instead, they'll become productive and committed to others and able to get what they want out of life."

Multiple yardsticks. Students earn credit on the basis of their project work. At the beginning of a project, each participating student confers with his/her faculty advisor to establish evaluation criteria. The two may change the criteria if the project takes on new dimensions. Multiple yardsticks are employed—customary factors like time spent on the work and quality of outcome count. So do innovative indica-

tors like students' improvement relative to baseline data. Negotiating credits in this way furthers the Eagle's Wing aim of teaching students to articulate their own goals, to perceive and express the value in their activities.

"Our assessment [takes into account] the learning process," notes Loucks. "Shy students don't always ask for what they need to get the project done, present the project in its best light, or get the credit justified." So, it is important to acknowledge students' growth in these abilities as well as learning content.

The final assessment step is the Credit Justification Statement, a translation by the student and advisor of the project work into the credit system of Hudson's Bay High School. One complaint of some Eagle's Wing participants (both teachers and students) is that this translation requires too much paperwork. Learning activities still tend to be constrained by the way the high school credit structure limits students' choices,

as well as their perceptions of what's important to learn.

Concern over credits gives rise to the inevitable challenge: *Is the Eagle's Wing flexibility just a way for students (and teachers) to get (and give) credit for sloughing off?* To this challenge the students with whom we talked answered a resounding "No!" Chad observed that Eagle's Wing "is not for all students—if you need teachers telling you when to work and what to learn [Eagle's Wing is not for you]. This is for independent students." Other students pointed to the grading policy as evidence of high standards: Any work which deserves less than a B grade is returned for revision. Some who have attended "the regular high school program" attest to working longer hours for Eagle's Wing credits. Loucks agreed that Eagle's Wing students "work harder to earn the credits." Plus, they have to "figure out for themselves what they need to learn."

INTEGRATING PEOPLE

It does no good to relate subjects to one another unless they in turn are related to students' lives. And schools must forge links to the lives of people besides students, including students' families and diverse citizen groups and individuals. The term "integration" already calls to mind this concept of *social* integration—uniting groups who are perceived to be different from one another, and doing so in such a way that each voice can be heard. Our study reveals that such social integration is a route to broadening school experience and strengthening its impact on society. By uniting people who are isolated from one another, schools are opening new avenues of learning. The schools with which we became acquainted in our exploration were increasing *equitable participation* by attempting to:

• Collaborate on a regular basis with diverse institutions (government agencies, nonprofit organizations, businesses, community groups and individuals) to hear what they need from the education system and encourage their contributions
• Alter traditional school roles when new experiences or associations will bestow educational benefits
• Create new roles within the school for more types of people (parents, nonprofessionals, seniors, experts, etc.) to render learning broader and more effective
• Eliminate practices based on labeling students as being suited for particular learning environments (or tracks) when such assignments seem to limit students' opportunities
• Incorporate experiences of diverse ethnic, gender, and age groups in goals, materials, and instructional approaches in order to enrich the schooling and honor all its participants

The educators' explorations described in this section involve integration not only of people, but also of subjects and types of activities. Their most exciting features, however, are the ways they bring new players (e.g., business employees) into education or elicit new contributions from players who are often overlooked (e.g., students of a particular cultural heritage). Therefore, we highlight the integration of people in this section.

Haystack Rock Awareness Project

Counting crabs. Haystack Rock at the south end of Cannon Beach, Oregon, perennially attracts tourists to climb, observe life in tide pools, and view sunsets over the ocean. In the early hours of a soft gray morning, a handful of Seaside High School students made up the majority of visitors. A man talking with two of them held a meter stick against one of the many cliffs Haystack extends toward the dank sea air. The adolescent scientists placed a transparent grid at various heights along the stick, inspecting the organisms appearing in each square. They were practicing a technique for counting the crabs within each square and relating the changes in population density to the way the tide, twice daily, covers, then exposes, the rock. They were getting ready to teach the technique to a group of students from a high school 100 miles inland.

The center. The adult who led this session is Neal Maine, coordinator of the Coastal Studies and Technology Center. Maine works with students, faculty, business people, and other citizens on local environmental awareness and preservation. The center is a nonprofit corporation staffed solely by students. In the Haystack Rock Awareness Project, one of many center projects, the students offer educational tours of Haystack and nearby beach sites to a variety of groups, including students, foreign tourists, and

senior citizens. From an educational standpoint, the center's student employees who lead the tours develop knowledge of physical and life sciences as well as communication skills. Full-time students, they earn academic credit for their participation. According to Maine's educational philosophy, however, it is not credit that drives their learning, but access to adult community life (through their application of knowledge to fill the community's need).

The visitors. The group touring Haystack came from a classroom that contrasted sharply with the Coastal Studies Center: It concentrated on one subject, biology. A high proportion of its students faced serious educational challenges. To come on the field trip, each student had to turn in parental permission slips. According to their teacher, the class members who did not bring slips were those who either couldn't afford to miss other classes or have drug lifestyles that kept them away. One boy who had complained all year about the need for a field trip never got around to making the necessary arrangements. Thus, the very individuals who most needed an academic boost were the ones left behind at their home school. Those who did show up for the trip were rather subdued at first. Whether listening politely to Maine's introduction, scrambling over the rocks after center student guides, or staring through the microscope at an intricate creature on a station table, they took little initiative and asked few questions.

The tour. After the visiting students had straggled across the sand toward Haystack, Maine gave a brief lecture on major elements of the environment—sea level, tides, currents, and four nesting bird species. Describing the energy cycle in the panorama before them, he presented sophisticated terms and concepts in simple fashion. The diatoms are the pasture of the ocean, he explained. Countless birds inhabit the rocks and

tively avoided looking toward the telescope until an adult visitor directly offered it to him. After sauntering to the telescope, he took a peek, then shrugged. "It's a bird," he said, without showing any emotion. Later, as the group hiked along another beach, this lad who had been so indifferent about the puffin stood alone for a long time, peering through binoculars at a rocky islet crowded with seabirds.

By the end of the tour, the visiting group was livelier. Their voices could be heard across the beach. A few were running around. A boy patted a classmate on the back. A couple tussled on the way back to their bus.

cliffs in the scene. "Every pound of bird represents 100 pounds of diatoms at the bottom of the energy pyramid."

The young Seaside guides had set up five learning stations in crannies of the castle-sized rock. One was the arrangement for counting crabs described above. Another displayed specimens they collected from tide pools earlier in the morning. (These organisms were returned to their habitats at the end of the tour.) Each station invited the observers to touch, measure, and examine the details of marine life. The guides led small groups from the visiting class on tours of the rock and stations, pointing out objects for scrutiny. Often the guides waited for questions from the visitors, providing low-key answers (e.g., "That's starfish poop"). Single file, the students wound over and around the huge boulders at the base of Haystack. One girl took up the end of the line to nervously tackle each boulder. After finishing the climb her legs were shaking, but she also glowed as she exclaimed that she had never done anything like this before.

Inviting participation. Center staff member Josh skillfully encouraged students to become active data gatherers. After demonstrating how to count crabs on the vertical rock face and record the

data "to take home and graph and stuff," he called for a volunteer to give it a try. No takers. "I have doctor's handwriting," was one boy's excuse. "How about one of you tall guys?" Josh flattered. A tall boy emerged to count the crabs at the top of the meter stick where few could reach. Then others took positions to count crabs in the lower squares, thus crossing the boundary from observation to participation.

Sparing use of scientific language was another way the staff invited the learners to become engaged. Maine cautions the guides, "Don't get caught up with the name game." The purpose of the tour, he said, was to experience the diversity in the thousands of organisms on view. "They can begin to learn about categories without overemphasizing classification." During the tour, a guide knelt down to point out an anemone. His partner supplied the creature's name, but only as an afterthought. Another guide, who carried a single laminated sheet for identifying Northwest coastal species, showed it to a few people.

A Seaside student focused a telescope on a bird and commented, "That's a tufted puffin," encouraging a visiting girl to take a look. "It's a white bird," she observed. One boy standing nearby ac-

The Amesville Thinkers, Water Chemists, and Math Maniacs

Bill Elasky currently teaches at the middle school in Amesville, a rural Appalachian community in Athens County, Ohio. In the elementary school in this community, between the years 1986 and 1990, Elasky taught the self-contained sixth-grade classes in which he created the projects described here. His goal was a combined science and mathematics curriculum that would help his students learn skills and strategies in these and related fields while pursuing their own goals. By crossing the boundary between school and community, Elasky employed the relationships among people to fuel the learning process. The Amesville elementary students studied and helped to solve community problems in ways similar to their high school counterparts at the Coastal Studies and Technology Center in Seaside, Oregon. Like Neal Maine from that center, Bill Elasky found that students' access to their community was the starting place for a journey to cross curricular boundaries.

The Amesville Thinkers. During the 1986-87 school year, Elasky invited

his students to survey Athens County adults to determine the problems they were most concerned about. It turned out that the main problem—unemployment—wasn't one that they could do much about. However, another serious problem—public uncertainty about elected local officials' responsibilities—was an issue the group felt it could address. About half the class participated, calling themselves the Amesville Thinkers. As interest grew, more students joined until the entire class took part. Social integration issues were basic to the project—working together to draft an interview protocol, interview citizens, analyze results of the interviews, incorporate class members who joined the project later, prepare public service announcements on elected officials' responsibilities, and work with the volunteer fire department on a recruitment pamphlet.

The Water Chemists. The next year (1987-88), the new sixth-grade students organized themselves into the Amesville Sixth-Grade Water Chemists. An oil company's accidental spill of solvent into the creek near the school had resulted in an EPA cleanup, but students and other residents were still concerned about the quality of the water. The class contacted community members, including experts in the county health department and university chemistry departments, for information. In the process, students learned appropriate phone techniques and business and thank-you letter protocols. They used some of the grant money, which Elasky had obtained to support his "real world" math and science curriculum, to purchase water test kits. Then they planned ways to gain support for their water testing project. Elasky notes that "because they wanted to be taken seriously, students did not become too discouraged with revisions in the phone scripts and written reports of their findings" (Elasky, 1990, p. 97). Students also took the responsibility to

draft, revise, and edit an article on the project for the district's curriculum newsletter.

The introduction to the Amesville Sixth-Grade Water Chemists' statement of purpose shows how well they found their voice:

We think what we are doing is important and fun. The importance of this project is to let people know what pollutants are in the water.

What is poisonous about these chemicals? That is what we will find out.

The fun is that we know we are helping others. You may think we are too young. Well, we are young. But we are trying our very best and it works.

So put your trust in us.

—Shawn, Lee, Denny, Summer, Carrie, and Becky Amesville Sixth-Grade Water Chemists

Working together for ownership. Learning to work with each other in groups that were new, i.e., not based on friendship or ability, was a big part of the project. In writings and conferences Elasky has pointed out that this took time, but encouraged students to "appreciate, help, and even like students who were different from themselves." The dialogue between two students who presented the project at a conference at Ohio University reflected this view. First student: "It used to be that there were two groups in our grade...the tough kids and the smart kids. And we sat in different parts of the room and didn't do anything together...but not this year...'cause in class we are all working together on projects and helping each other and you can't tell who's smart or tough or whatever, you know." Second student: "Yeah, we're like a real team, you know" (Elasky, 1990, p. 98).

Elasky saw himself as a member of this team, not the director. In fact, when he was invited to present a workshop on integrating science, mathematics, and language arts to teachers in the

Portland Public School District in Oregon, he insisted that representative students from the Amesville Thinkers and the Amesville Sixth-Grade Water Chemists conduct the workshop with him. For the middle and high school science and mathematics teachers who attended, this inservice experience was unusual in several ways:

• Teachers had to pay the "price of admission" by bringing one or two students to participate in the workshop with them
• The Amesville students, ages 13 and 14, led the full-day workshop, after Elasky's brief introduction
• Small groups of teachers and students brainstormed useful community projects to integrate science and math as well as other subjects (language arts, social studies, etc.)

Participants' reactions showed that they were not used to such an active role for students. In most of the groups, the facilitators (Elasky, his students, and two Portland curriculum specialists) had to work hard to elicit student input and get the adults to acknowledge it. By way of contrast, it was clear that close-knit teamwork was customary for Elasky and his students.

Structure and democracy. An important principle underlying Elasky's model is democracy. His students come to see that democracy is organic, involving responsibilities as well as rights. Elasky believes that a democratic model requires him to lead students in organizing themselves and their materials. An effective structure for problem identification and project planning is valuable for helping students to accomplish worthwhile goals, he attests. It is essential, however, "to include as many people as possible in designing and implementing the structure, and to make sure that it supports people and is a natural and logical outgrowth of what is happening in the classroom. It [the structure] should affirm people's dignity and allow them to do things that they cannot do without

it" (Elasky, 1990, p. 99). This notion of classroom structure to empower students echoes the thinking of other teachers attempting to put students at the center of the learning environment. Such teachers have pointed out that although their classrooms may look strange with no teacher standing at the front directing activities, the students do have structure to guide their work. In democratic classrooms, the students are essential to developing and sustaining the structure.

According to Elasky, student discussion is crucial for establishing a democratic structure, as well as for developing the thinking and communication skills needed to move investigative work along. Discussion enables students to work through controversial issues in an orderly and fair manner, to conscientiously listen to and respect each other's opinions.

Math Maniacs. The booklet *Math Mania: Math in Your Future* was the work of Elasky's sixth-grade class in 1988-89. Students used math textbooks from sixth grade and above to compile a list of 40 types of mathematics. Next, they devised a survey to use with adults in various professions (bank teller, store manager, nurse, photographer, etc.) to find out which types of math adults used in their work. In addition, they conducted in-depth interviews with six people from different jobs. The written interviews and the charted and graphed survey data were published together in the booklet.

Elasky writes in the booklet's afterword about the learning that occurs in projects like "math in the real world." Through such projects students come to experience school as "a place where we not only see why it is important to learn, but also a place where we use what we learn." After listing the many mathematics and communication skills students learned in the project, he emphasizes that "...[students] learned firsthand about democracy: how to work with others, how to make sure no one is left out, how

to develop a commitment to a group, how to analyze and solve group problems, and much more." He stresses that they learned the math and science and language arts skills in the process of doing serious and responsible real-world work.

Humanitas

Building a learning community. A program that speaks to the need for relationship, among teachers and between teachers and students, is Humanitas. This integrated humanities program, operating in a number of Los Angeles high schools, seeks to create a community of scholars within the larger, impersonal school context. Based on a model developed by Neal Anstead, an art history teacher, Humanitas was first offered in selected Los Angeles high schools in 1986 as a thematically organized interdisciplinary curriculum. By 1991, the program had spread to 29 of the district's 49 high schools, and involved more than 180 teachers and 3,500 students. Students may participate in Humanitas for one or more years.

In each participating school, a Humanitas teaching team designs a highly integrated core of courses around large themes. The courses involved are usually English, social studies, and art, but often include philosophy, mathematics, and dance as well. Two examples are Women, Race, and Social Protest and The Protestant Ethic and the Spirit of Capitalism. The program particularly recruits racial, ethnic, and language minority students, "average," and even academically unsuccessful students, in the belief that *all* students can learn better when important concepts are approached in an integrated manner. Students who choose to participate become part of the Humanitas program for three hours of their school day. The coursework is demanding; class readings, discussions, and written assignments push stu-

dents to develop analytical and critical judgment skills. But Humanitas students say they prefer to work harder because they learn more in the program.

Sound evidence confirms that Humanitas is an effective teaching model. As one student stated, "It [Humanitas] has really helped me understand the world better, and myself too. I can't wait 'til next year!" (Aschbacher, 1991, p. 16). Research carried out by the UCLA Center for the Study of Evaluation from 1988 to 1991 points to positive benefits which include improved conceptual understanding and writing ability, improved attendance rates, and increased satisfaction with school.

Social relationships as the key to learning. A striking feature of the program is the underlying belief in social interaction as basic to learning. Students report that teachers and classmates in Humanitas know them better and care about them more than did their teachers and peers in regular classes. Given the cultural, linguistic, and academic differences that characterize the program's population, this is a strong statement. The program's strengths seem to lie in this access to and interaction with a supportive group of people, this crossing of boundaries between social and status groups.

Students and teachers as learners. For teachers, the program requires a high degree of individual effort as well as collaboration, including special summer training and daily team planning sessions during the school year. Just like their students, Humanitas teachers report that they welcome the opportunity to work hard because it pays off. The results teachers mention are deeper understanding of connections among disciplines, increased teaching repertoire, and professional growth as part of a supportive team. They also relish the chance to get to know their Humanitas students so well.

The process of risk-taking in a suppor-

tive atmosphere runs parallel for students and teachers. Humanitas teachers can model the culture that they want students to join, one characterized by intellectual curiosity, risk-taking, an ethic of care, and pride in one's work. Students and teachers also need a willingness to learn from others, for example, in class discussion or small writing-response groups. Working in teams, teachers sometimes even model intellectual disagreements over course content or ideas; students benefit from this example of grappling with intellectual positions. The care involved here is central to the learning in Humanitas: A spirited discussion, even disagreement, about ideas is productive and stimulating when the people care about each other as well as their ideas.

The Caribou Study*

Michele Bifelt, seventh- through 12th-grade science teacher at Jimmy Huntington School in Huslia, Alaska, an isolated Athabascan Indian village, wanted to provide a science experience that would be culturally significant to her students. "By studying the spring caribou hunt, instead of a commercially prepared activity set," she says, "students would see that science is already an integral part of their lives, not something imposed by another culture." Inviting the children's elders to share their knowledge reinforced the idea that this academic work proceeded from their own heritage. The Science and Math Academies for Rural Teachers (SMART), a project of the Northwest Regional Educational Laboratory funded by the U.S. Department of Education, provided support.

Questions about caribou. Bifelt let the 14 students from the combined fifth- and sixth-grade class set the direction for the caribou study. After an introduction to the project, students generated a list of questions they wanted to answer

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about caribou. "The list was a page long, and covered almost everything I would have listed anyway," Bifelt enthuses. Their questions targeted:

- Anatomy and physiology. Examples: What size are their hooves? Can caribou digest meat and milk?
- Behavior. Examples: How does a herd choose a leader? What happens to a calf when the mother dies?
- Interactions with humans. Examples: Do Eskimos use caribou differently than Indians? What are local legends about caribou?

Bifelt was similarly impressed with the students' thoroughness in brainstorming possible sources for answers to the questions. "Again, they were amazingly complete in covering most of the sources I had expected to consider," she says. Students began their research with a week of letter writing to outside sources, including the Fish and Wildlife Service, University of Alaska, and the Cooperative Extension Service. While waiting for responses, they prepared interview questions for the local experts, the village elders and hunters. During the interviews elders told stories which the students compared with legends of other Athabascan Indian tribes and Eskimos. Catherine Attla, a Huslia elder, shared the following story with a couple of young interviewers: "This year the caribou were close to town, the first time since 1970. Back then, the caribou were on the runway. Some young men chased them with snow-goes. The caribou have spirit. Chief Henry said you aren't supposed to tease the caribou. He said they won't come back for a long time. He didn't blame the boys, though. The elders should have taught them to respect the caribou."

Continuous flow from one study area to the next. Elders came to school as guest presenters during special cultural events. One afternoon a grandmother of two of the students showed the class how to scrape a caribou skin to make a mat-

tress. "They experienced a tradition which the c.. munity wishes to preserve," reports Bifelt. "They even used traditional bone tools made and donated to the class by one of the elders."

The highlight of the project was an overnight field trip to a cabin 45 miles away. "It was in early April when the herds begin their migration back to the coast," Bifelt says. "This is also the time of the spring hunt, an important event for people who depend on caribou and moose for food. A small caribou herd of about 70 animals was only two miles from the cabin. This was fortunate; we might have had to go as many as 10 miles to do any observations."

Prior to leaving, Bifelt had prepared the class for field work with practice observations and discussions of what to expect. The students observed the herd under pressure as two parents hunted, then "learned how to clean a caribou carcass, a survival skill for this subsistence culture," says Bifelt. They also examined the internal organs and the parasite pupae under the caribou's skin.

Back in the classroom, integrating other disciplines was easy. In addition to writing letters, the students wrote a research summary and a news story. They practiced map reading and made their own maps of the range of northern Alaska herds. They developed graphs that compared the sizes of different herds in Alaska and that depicted the data they collected in interviews about the number of caribou taken in the village in two different years. Mathematics was also used to estimate the time it would take to reach the herd for the field trip.

Bifelt reflects on the project, "A major goal was accomplished; the students had more science instruction integrated into other disciplines. The beauty of this arrangement is the continuous flow from one study area to the next, with no interruption in the thought process." Furthermore, this relatively seamless integration allowed the class to study a meaningful topic that put Athabascan culture and individuals at center stage of their curriculum. Crossing the boundary between formal schooling and community knowledge provided students with a rich and meaningful learning experience.

It's important to provide what I call "multiple entry points." Kids don't all learn in the same way; they don't all find the same things interesting....I'd say that you can approach almost any rich topic in a whole variety of ways. We need to give kids a chance in school to enter the room by different windows, so to speak—but to be able to see the relationships among the different types of windows.

—Howard Gardner

INTEGRATING ACTIVITIES

Multiple approaches to learning. Orchestrating diverse instructional methods increases educational effectiveness. Traditionally, schools have emphasized academic studies over applications to practical life, cognitive skills over affective development, and individual pursuits over cooperative activity. Reducing these disparities can support students' attempts to *act* effectively on the world and to *think* clearly. This interactive development of reflection and action in education, one of the greatest benefits of integrating the curriculum, fosters application of skills and knowledge in every arena of life.

The Native American Site Artifact Project

What scholarly activities can secondary students do that answer a community need, develop multiple academic and social skills, and build comprehension not only of basic scientific concepts but also of their application in highly specialized fields? This is a tall order—one that the Native American Site Artifact Project of Oregon's Seaside and Jewell high schools has found that archeology can fill. Through archeology—a science that draws from geology, botany, biology, mathematics, meteorology, chemistry, anthropology, and other disciplines—students are crossing the boundary from the present to the past by constructing a prehistory of their area.

Students involved in the project categorize, count, mark, and record the faunal dietary remains of a 3,600-year-old archeological site which was excavated in a 1970s dig funded by the Smithsonian Institute. The prehistoric inhabitants worked some of these bones to make tools—bi-point projectile points

(probably for harpoons) are one example. The students' analysis of the evidence of diet and tools contributes pieces to the puzzle of social evolution in a changing environment. Kay Longo, the professional archeologist who directs the project, describes important components of the young archeologists' process for establishing what happened to these early coastal residents and their habitat.

Collaboration with an outside professional. Longo says, "As students began to classify the dozens of boxes of faunal remains in the school district office basement, I brought in a zoo archeologist to show them how to identify species from bones. The aim of the lesson was to establish the activity along professional archeological lines."

Teamwork around a bag of bones. "When we start our workday we get a bag of bones and start talking [about the pieces in it]: 'What [species] do you think this is?' and 'What do you think that is?' It takes us about half an hour to warm up, and then we break into at least two teams, maybe four, depending on the number [of students]. One team sorts. They'll have a teacher with them and put the things into four piles. Then, if we can, we take [the categorization] further than that preliminary sort. We say, 'Well, these are femurs and these are vertebrae and these are whatever.' And then we put those into smaller bags and [label them] with a hope that a professional will be able to take that information and go much further [analyzing the materials]. The students are motivated to do this [sometimes tedious] work because they know they are making a valuable knowledge resource available to current residents. Information on prehistoric coastal populations has been scarce."

Analysis and recording. Longo continues, "Then we have people mark. We do it in a simple fashion because it's really tedious. You just have to do it over and over and over. We have students

who really like to do that—they get the nail polish and paint the protective cover on and let it dry and use the ink to mark the site number, level in the excavation, and location within the level over the cover, put everything back into the right bag and count while they're doing that. And then we have two students who record on a fairly complicated map of the site. We want the students to see how the analysis proceeds across the site. First they go through all the faunal remains in a unit five feet by five feet large, from level five to level 11, [all the levels] of the dig. When they have finished one unit they start on the one next to it. We have them mark their work on the map as they go. This is the same procedure professional archeologists would use."

Evolutionary theory through the back door. "We also have a modern-day collection of bones [to aid in identification of species]. Students who find bones along the highway—deer, duck, and others—bring those in. One student is really interested in shellfish. He dives, so he's really latched onto the shellfish side of it. We have shellfish and butter clams in this site that are no longer found in this environment. They live in a bay, a fairly quiet area with sand and mud, and, of course, there's nothing like that in Seaside now—the coast is very rocky today. So, [that leads us to talk about] change in an informal way: 'Well, this is sturgeon, and [the site population] used a fairly large net, so we're really only finding sturgeon, cod, gigantic salmon. Everything else—the rockfish—probably fell away. So where would you find sturgeon today?' Some of the guys fish—they're real familiar with the Columbia River and John Day [River]. 'Where else could you find sturgeon?' Then we start to talk about what the ancient site might have looked like. 'How could sturgeon have lived there?' And so we start to reconstruct the environment."

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"When the students look at the similarity in the form of bones [of different species] they start to comment, 'Oh, this one diagnostically has a little knob on the top and that one is just a little bit different—this is a sea lion and that's [another species].' In another example, they examined a tibia from a marine mammal and one from a bird. They asked about the resemblance and how the bones that at first looked alike are actually shaped differently according to the locomotory function they serve. This is evolution through the back door! It gets into the whole concept of homology and evolutionary change and the function of muscle. There are two lessons here: The prehistoric environment differed from our own, and within the years uncovered by the dig itself there was change in species. So, it [the processing of the remains] has its spin-offs that are just incredible."

Writing about one's own interests. "[For] writing up the final report, each student in this group has a totally different interest. Somebody wants to do soil samples, somebody wants to draw, somebody wants to work on diets, somebody wants to work on fish...it's flexible enough that a student can bring their own interests and develop those. We are not trying to make archeologists out of the students but rather use this project as a vehicle for them to learn the methods and techniques [of science]."

Logistics. Longo explained to us that several arrangements are possible for students to fit this project into their course schedules. In one arrangement, individuals who add it to an already full slate of classes must arrange their absences and make up missed work. Several teachers have encouraged the project participants to combine their archeological work with assignments for other classes. In health and English, for example, student archeologists wrote papers related to archeological methods and findings. As they bend over their

bags of bones to conceptualize the big picture of human history from minute distinctions in form, the complex logistics behind this instruction seem well worthwhile.

The Coastal Geographic

At Seaside's Gearhart Elementary School, fourth-grade teachers Jan Wieting and Larry Nelson, along with Neal Maine, coordinator of the district's teacher support program, gathered around a child-sized table to tell us about their experiences with curriculum integration. While conversing, we browsed through past issues of the prize-winning magazine Coastal Geographic that Wieting's and Nelson's classes have published together for several years. For Wieting and Nelson, each issue elicited memories of the power that interviewing holds as a teaching and learning activity:

Nelson: "In this issue, the children wrote about people in the area whose jobs were in some way tied to the coast. This is as good as it gets. It was dynamic. We took the kids in small groups to do formal interviews with tape recorders. We did the interviews all on site, too. None of these people came to us—we came to them."

Wieting: "This was a wonderful interview in the helicopter hanger at the Coast Guard station. [Here's an interview on a man] who works in physical therapy because of the surf—that's just a way of being able to support his surfing. You know that [interview] was really fun, too, because it's an interview of a park ranger the students knew. We read this interview to the students and compared it to interviews in which they did not know the person first. They learned much more from the interview with the familiar person. Remember the one [interview] with Bobby?"

Nelson: "Yeah, he's still living. Yeah, he's the best clam digger in the area. Earned his living since 1940 dig-

ging clams—but he only has one arm! (Reads from the issue.) 'To catch a clam you must find out where one is, then dig quickly.' They did this interview on the beach with him and it was classic of the older person with all these experiences communicating with children. I mean it just couldn't get any better. It was just wonderful."

Wieting: "The next journal will be on Hamlet, a nearby village. It has a fabulous history and some people who are resources of information about that history. And, the magazine staff [students] can go there and feel like they are reliving that history. The interaction between the students and the Hamlet residents will become a sort of textbook for learning Oregon history."

Willamette Primary School

Inquiry investigation. "How are we going to create learning? How will we foster dispositions—in teachers and in students—to continually inquire and learn?" From its founding in September of 1991, dialogue on these questions shaped the vision of Willamette Primary School in West Linn, a rapidly growing city southwest of Portland, Oregon. The school serves 500 kindergarten through fifth-grade students. We talked with principal Jane Stickney, curriculum director Susan Dunn, and teachers Gail Aldridge and Janice Leonetti about their process of becoming a school. Schools with more history than Willamette often don't ask questions about educational purposes or philosophy, or perhaps they leave the answers to curriculum guidelines and textbook publishers. For Willamette, grappling with these big questions was fundamental. Deliberation over education philosophy and practice continues to be the theme of their staff meetings, curriculum planning sessions, and teacher conversation.

"Inquiry investigation" is Stickney's term for Willamette's guiding curriculum

principle and major learning activity. The staff have developed integrative curriculum not so much as a goal in itself, but as one of many educational decisions that have sprung from their vision of inquiry at the heart of learning. From the school's founding, this vision has informed decisions. In hiring staff, Stickney looked for the same eagerness to learn that she hoped to cultivate in students: a desire to make sense out of experience, take risks, work collaboratively with students and colleagues, and seek connections. Since then, the teachers' foundation in inquiry-based learning has led them to introduce a number of innovations that enhance integrative curriculum, such as multi-age grouping and narrative report cards. Multi-age grouping erases some of the boundaries between children of different ages. Narrative report cards, by addressing conceptual understandings, attitudes, and learning strategies, present a view of children's work that looks across traditional boundaries between subjects.

Centering curriculum planning on learning. As we visited their classrooms, the staff described and demonstrated ways that viewing learning as the center of curriculum planning can integrate curriculum. Their model promotes collaboration. Faculty meetings allow teachers with a shared interest or idea for investigation to plan what Stickney describes as "worthy work for children," learning about things that matter to them. It is in the process of this learning that children acquire the skills, processes, and strategies they need to do the work, and which they'll develop further in subsequent investigations.

Planning groups often involve teachers from different grade levels. Teachers—and students—flow in and out of working groups depending on interests and needs. An example of these "limited partnerships," as Stickney describes them, is one in which an older student seeks expertise from a younger one: As

some fourth- and fifth-graders began planning a study of systems, they invited a first-grader, who had studied the human body as a system, to explain his work to them.

An observer at Willamette might wonder how classroom-based curriculum planning manages to avoid repetition or duplication of content across the grades. Regular staff meetings devoted to planning inquiry investigations and reports on those already under way, a school curriculum newsletter with updates, and elaborate wall displays of students' work as a study proceeds keep teachers, students, and parents apprised of who's doing what.

Anticipating curriculum connections. When we visited her fourth- and fifth-grade classroom, Janice Leonetti showed us two planning webs on which she has organized learning around the theme of time. The concept web depicts

relationships between time and related concepts, including change, patterns, perspective, and systems. The subject web does the same to anticipate the interrelationships of time and such content areas as science, language, social studies, and mathematics. The webs anticipate connections, but Leonetti's plans do not constitute her curriculum plans. Rather, the webs set out a boundless vision of learning. In working with students, Leonetti negotiates the curriculum with them, eliciting their questions on the theme, and building on their experiences. The large, unifying ideas are planned, but the specific topics and strategies are open to decision, depending on students' needs and interests.

By June, Leonetti's classroom was bursting with evidence of students' understanding and application of the concept of time. Perspective drawings and reflective templates from design technol-

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ogy projects lined one wall; timelines from history and literature decorated another wall; a small group of students were determining measurements for desk organizers using scale drawings they had already done; individuals were writing in their journals on a design technology project (recording the sequence of their work, noting problems encountered and what they did to overcome the difficulties); marble rolls constructed by students displayed what they learned about incline, speed, and time.

Going with the flow: building on students' interests. Gail Aldridge, who teaches a class of second- and third-graders, talks about students' motivation, built on their genuine interest in a topic, as the driving force in her integrative curriculum. She shares Glasser's definition of effective teachers as those who can get all of their students to do quality work, and sees her task as fostering and directing that engagement in learning (Glasser, 1992). Ownership is important. Explorations or projects must build on students' real questions and experiences.

Her students' current excitement about a river study is this type of inquiry—*their* questions have shaped the study. Students have explored the river which flows just behind the school, investigating its history, graphing the water's pH balance, doing perspective drawings of the river, and writing to record findings and generate new questions for investigation. The students have located all the storm drains in the city, and the city is using their information for important labeling and information work in the community. Following her students' lead, Aldridge has altered the usual class schedule, freeing time usually reserved for reading and writing workshops so that students can work on their river study. Her student intern still struggles to fit other curriculum activities into the schedule, but Aldridge told us that she is comfortable letting the children's engage-

ment with the river project determine the way class time is spent for now. She knows that they are using reading and writing meaningfully as they pursue their river study.

Aldridge described the curriculum as process-oriented and organized around broad themes or concepts. Within the river study, for example, her students learn the necessary skills and strategies of observational note-taking and chart-making. In an earlier study of ocean life, she taught students writing (creating paragraphs, organizing, and other skills that were especially important to that pursuit). Aldridge is confident that her knowledge about teaching and learning allow her to use district curriculum documents and textbooks in a consultative way that reflects the dynamic process she believes curriculum to be.

The district model. The West Linn-Wilsonville School District's *Primary Social and Scientific Studies Framework* illustrates the integration of concepts, subject areas, topics, and learning skills. The document affirms the district's belief that children most effectively develop skills when they are needed for a particular study in which the children are actively engaged. The framework also addresses the basic elements of learning—concepts, perspectives, topics, processes of inquiry, and attitudes. For example, the major *concepts* (themes) for students ages seven to nine are patterns, predictions, and organization; community and culture; diversity and harmony; and mapping and recording. The *perspectives* (sometimes thought of as school subjects) from which they can study these concepts include history, geography, sociology, health, and environmental science. The *Framework* offers sample *topics*, but suggests that teachers choose topics according to children's experiences and interests. Sample topics for the theme of patterns, predictions, and organization are earth patterns, weather, and batteries and bulbs.

The document outlines *processes of inquiry* (skills and strategies) for the children to develop as they engage in inquiry investigations: how to make and use charts, graphs, and maps; how to cite information sources; and how to create and use time charts using scale. While the processes of inquiry are familiar to readers of curriculum documents, *attitudes* (habits of mind), as important education outcomes, are new in such a document. An ethic of craftsmanship, a willingness to question assumptions, and an appreciation for the richness of diversity are examples of the attitudes to be taught. The *Framework*, like our classroom visits and conversations with Willamette staff, reflects the centrality of inquiry about "big ideas"—essential concepts—to learning. Such learning crosses the boundaries between subject areas, grade levels, class periods, and learning activities.

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OBSERVATIONS ON THE EXPLORATIONS

The illustrations we have presented of students and teachers "crossing boundaries" to integrate formerly divided disciplines, groups, and teaching approaches vary greatly in their emphases. Thus, the Gladstone High School project in which two teachers of different subjects unite their courses *recognizes traditional school subjects* much more (and in different ways) than does the Willamette Primary School project that ties all subjects to a common theme. The Native American Site Artifact Project *brings together previously separated people* by inviting professionals from fields outside education, whereas Humanitas bridges the diversity among its own students. The

Amesville Sixth-Grade Water Chemists *take an approach to learning* from solving a practical problem (pollution), while the high school archeologists start by seeking knowledge (of social and environmental change) that is not for an immediate practical purpose.

Two other ways that these efforts at integration vary is in *scope* and *organization*. Scope ranges from a single teacher's relatively short unit on caribou to an entire school curriculum within a larger school (Eagle's Wing). The organization behind the Coastal Studies and Technology Center is a nonprofit corporation; backing Willamette's inquiry approach is a committed faculty and a supportive district; other organizations include teacher partnerships and school district projects funded by grants.

The rich variations among the explorations are accompanied by shared features that have great promise for showing other educators effective routes for crossing the boundaries that narrowly define subjects, categorize people, and limit learning approaches. These shared features are:

• *Learners' interest and risk-taking builds on a base of experience and understanding.* Teachers and students alike discover relationships between what they already know and what they are learning. This often means revising old notions. In pursuing science learning with students, the Seaside coastal studies teachers took learning outside of the classroom. This increased everyone's awareness of the links between science and citizenship. Since the fourth- and fifth-graders at Willamette Primary School were aware of what they already knew about the forces of motion and gravity, they were able to ask good questions for creating a marble roll.

• *Skills and strategies develop in the pro-*

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cess of accomplishing work which has meaning to the individual. This was true for teachers learning how to design science-centered themes in MCSIP and how to incorporate writing into high school biology at Gladstone High School. It was true for the Amesville Sixth-Grade Water Chemists learning how to compose good interview questions and the Willamette first- and second-graders learning how to publish their findings about the river behind the school.

• *Group process skills are an important component of learning.* For the two Gladstone teachers, a benefit of their close cooperation was the ability to see their own disciplines through the perspective of a partner teacher. Similarly, the Amesville and Humanitas students learned lessons about teamwork: They felt pride in their accomplishment as a group and realized that their learning was a result of working as a team.
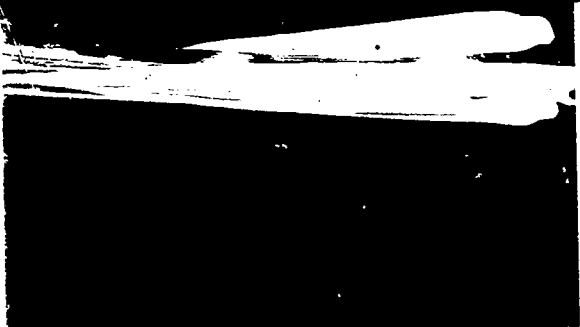
• *The process of learning, whether during curriculum planning or classroom inquiry, is negotiated.* People in any educational situation need to work out their learning and teaching roles, for both teacher and student can play the part of expert or learner, depending on their prior knowledge. In working out these roles, individuals need to take appropriate responsibility. This requires the active engagement of both the learner (who could be an adult) and the "expert" (who could be the young person). Teachers in the Eagle's Wing program needed to help students learn appropriate discussion skills and topics, while Humanitas teachers needed to give and take when designing a multicourse study of a theme. Similarly, Willamette's first- and second-graders needed extended time for their river study and Gladstone students needed time when their English assignments could not get in the way of their biology projects. In Amesville, when the group decided on project tasks, individuals took responsibility to complete them.

• *Language is the primary vehicle for learning as well as demonstrating learning.* All the teachers featured in *Crossing Boundaries* used discussion with their colleagues to fuel curriculum integration. As they talked, teachers saw others' perspectives and clarified their own thinking. Programs like MCSIP provided ongoing support from consulting teachers, building understanding through dialogue. Eagle's Wing and Willamette teachers depended on regular meetings to spark ideas and illuminate relationships among disciplines. Students in all the examples learned through discussion in pairs, and in small and large groups. Communicating in writing also supported teachers' curriculum planning and students' learning. In addition to producing a finished product or demonstration piece, students often used writing to think. Humanitas students demonstrated this in their written responses to readings and discussions. Student journals and learning webs at Willamette Primary captured this effective process. Through these products, the students proclaim, "We're learning here; we're not finished!"

These accounts of curricular explorations indicate the excitement that integrative practices can stimulate. But the purpose of *Crossing Boundaries* is not to promote *integration for its own sake*—be it integration of subjects, people, or curriculum. On the contrary, our exploration shows how *integrative practices that stem from sound theories about learning* (discussed in the following section) *can increase the value and effectiveness of education.*
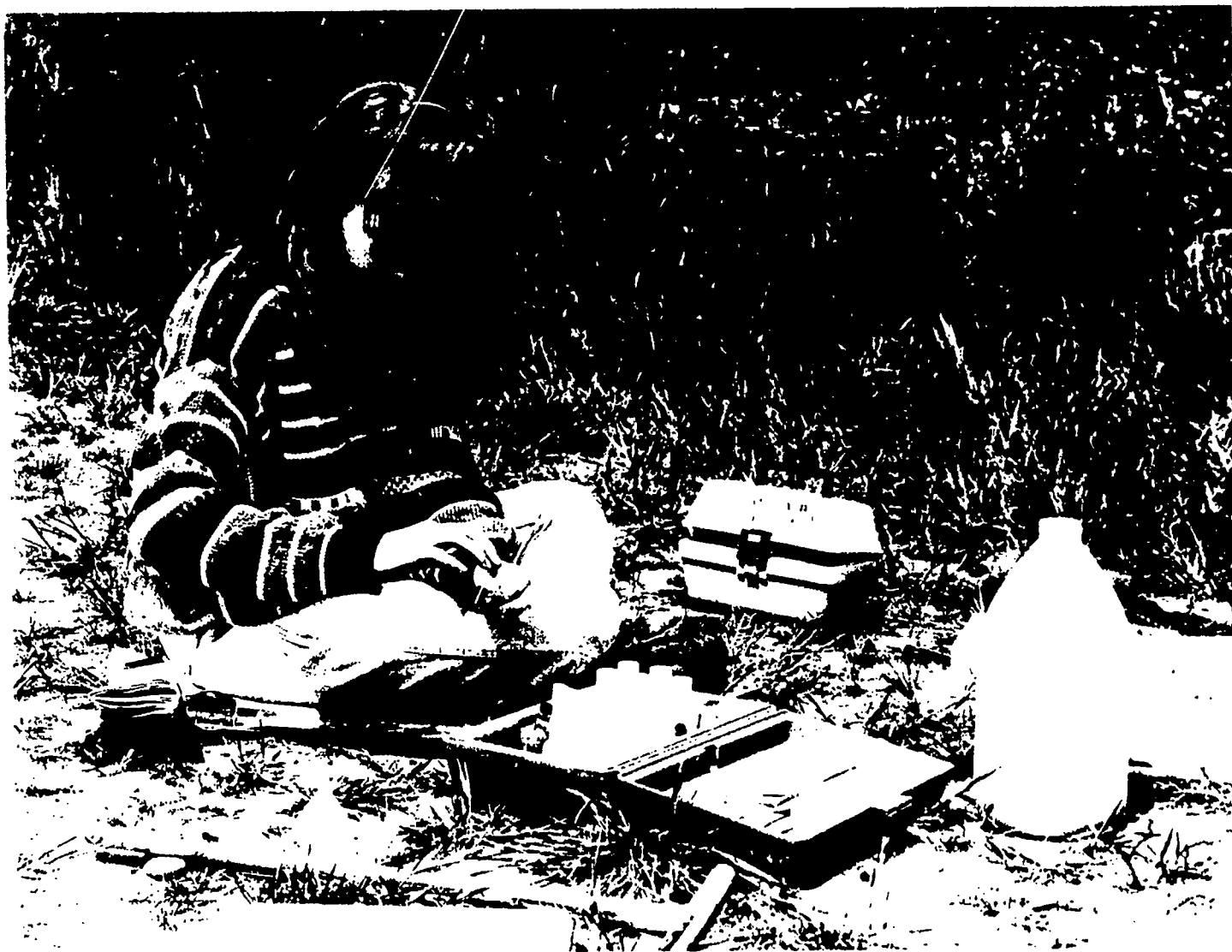
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In contrast to "integrated curriculum," the term "integrative curriculum" emphasizes the process of teaching and learning in which the student and teacher make meaning together.

Charting the

Theoretical Territory

for Integrative Curriculum

The explorations we have chronicled illustrate particular ways in which the participants (teachers, administrators, students) are living curriculum as a process, rather than as a set body of content or activities. These efforts are based on a solid understarding of learning. As noted educational researcher Frank Smith reminds us, "There is nothing so practical as a good theory" (Smith, 1986). This section spotlights some of the beliefs about teaching and learning which underlie classroom, program, and school efforts to integrate subjects, people, and activities. We draw some conclusions about the theoretical understandings that drive these educators' innovations, and note how their beliefs help them find a balance among conflicting curricular demands. Finally, we suggest that these innovations occur on a continuum of educational change, leading toward highly integrative curriculum.

Curriculum Theory: Learning as a Transaction

For the teachers we observed in our explorations, creating curriculum involves putting into action a system of beliefs about learning, knowing, and social relationships. Common to all the explorations outlined is a vision of curriculum as a process in which teachers and students make meaning of experiences, that is, construct understandings in collaboration with each other. In this process, the student is at the center of a learning interaction which is based in:
• Continual negotiation—involving the teacher and students
• Inquiry—a genuine desire to know, not an obligation to cover content
• Students' experiences—with an effort to extend their knowledge and its application
• Reflection in action—a cycle of thought leading to action leading to more thought

These notions of learning as a socially interactive process that requires very active thinking are consonant with a theory of learning as *transaction*. Central to contemporary education practices, this theory contrasts with the long dominant theory of learning as *transmission*. According to the transmission model, supported largely by behaviorist theory, learning results from the delivery of information, usually in sequential pieces, from the teacher to the student. In the contrasting transactional model, "learners engaged with their environments are active participants in constructing their knowledge" (Pace, 1992, p.1). Learning doesn't happen to students; students control their learning. Thus, curriculum may be defined as "a prediction concerning how people learn, what people should be learning, and the contexts that will support that learning" (Short and Burke, 1991, p. 33). Much of the research supporting a transactional view of learning comes from studies of language acquisition and literacy development. Since language is the major system for developing and communicating meaning in any field, the theory has great potential for application in all areas of learning.

Constructivism. Piaget's research provides a rich picture of the child as active learner. Educators often emphasize his stage theory of cognitive development which outlines children's gradual progression from pre-operational to concrete to abstract thinking capabilities. For our purposes, it is Piaget's illustration of the learner *actively constructing meanings in and with the environment* at all stages of development that we want to focus on. Some basic premises of constructivism, as Piaget's learning theory is called, include:
• People are always learning, seeking and actively constructing new meanings
• Learners' experiences and reflections drive new learning
• Activities that have meaning and pur-

pose are the primary motivators for learning

Contemporary Piagetians, like Eleanor Duckworth (1987), provide numerous examples of classroom environments and curriculum organization that support constructivist theory. In these cases, educators have embedded instruction in skills and strategies within student-initiated inquiries that lead to purposeful activities and theory-building.

Social interaction. Lev Vygotsky's contribution to transactional learning theory is the idea that social interaction is essential to learning. His research on language acquisition (1962) adds an important dimension to constructivism by showing how children learn language through social interaction with proficient language users. Vygotsky's work and subsequent research by Bruner (1986) and others have revealed that all knowledge is mediated through language. While we usually think of knowledge as being "located" in the minds of individuals, it is actually a matter of socially constructed and shared understandings (Prawat, 1993; Pappas et al., 1990). Quite simply, we need to interact with others in order to acquire knowledge. So, the power of classrooms lies in the access they give learners to other people and their ideas. Social interaction is also essential for self-reflection, and thus for assessment and continued learning. The school's uniqueness as a learning context lies in the opportunities it provides for communities of learners to reflect on their development (Short and Burke, 1991).

Applying the Theory in Classrooms

In describing classroom instruction that is consistent with social-constructivist theory, Glennellen Pace (1992) provides a lens for viewing the integrative explorations described in *Crossing*

Boundaries. According to her, such instruction entails:

- Interactive communities of learners—students and teachers—in which "all the players are trusted to contribute their varied experiences and knowledge to construct multiple shared and personal meanings" (p. 4)
- Organizational structures that promote interaction among learners with contrasting experiences and abilities, so that learners are supported by working with others with greater knowledge or skills
- Diversity—of experience, culture, ability—treated as an asset, contributing to the variety of meanings that drive intellectual and social development

Striking a Balance

Viewing curriculum as a process that demands social interaction for construction of meaning allows the teachers in our chronicle to strike a balance between curricular absolutes. This perspective permits educators to step out of what Neal Maine of Seaside calls the "boxing ring model of curriculum," in which advocates of contrasting emphases argue that their own orientation must shape classrooms to the exclusion of supposedly opposing orientations. In this section we discuss three common sets of curricular absolutes and show how both sides hold truths which must be combined for a positive educational climate. The teachers whose stories are summarized here live with the creative tension of balancing the apparently opposing demands of curriculum: to address both content and skills, place neither the teacher nor the student totally in charge of curriculum, and educate the mind as part of educating the whole person.

Content vs. skills. Is the aim of curriculum to impart knowledge to students or to teach them skills and strategies they must have for continual learning? In science, as in other fields, the debate

over this question rages as both the amount of information (content) and the toolbox of skills (process) expand: In which grade does the study of rocks belong? How much technology should be available for mathematics? Should physics precede biology and chemistry in high school? Can they be integrated? According to the explorers we met, curriculum must take on the dual aim of teaching content *and* process, because learning processes are best developed in purposeful learning about content that matters, "worthy work for children," as Jane Stickney of Willamette Primary describes it.

In the Gladstone High School English/biology block, writing is a vital tool both for learning scientific content and articulating understandings. Students at Willamette Primary learn skills described

as "processes of inquiry" because their investigations of multidisciplinary topics require skills such as making and testing hypotheses, drawing conclusions from print and other media, and identifying cause and effect. Topics under study are vehicles for learning larger ideas. Necessary skills are harnessed to accomplish that conceptual development. Gail Aldridge of Willamette taught her second- and third-graders how to organize their writing in paragraphs at the point when they needed that skill to report their findings from an ocean life study. Bill Elasky's Amesville Sixth-Grade Water Chemists learned to read scientific articles expressly because they needed the information to carry out their water quality study. Humanitas students learned effective discussion skills in the process of grappling with ideas

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about cultures' cosmologies; they developed analytical and critical skills because they were studying complex issues that demanded such thought.

In making curricular decisions, these teachers ask first whether a topic is worth pursuing, then what skills will best support its pursuit. Beware of shallow connections, cautions principal Jane Stickney, in which topics for study are chosen mainly because they dictate instruction in particular skills or lead to certain activities. Consider, for example, "The Research Paper" as a standard piece of curriculum that teachers often select to teach certain skills, e.g., how to take notes from a reference work, cite sources, and construct a bibliography. Many of the teachers we studied teach these valuable skills by engaging their students in authentic inquiry. Students then develop research skills from a base of interest in an investigation in which they have ownership.

Teacher-centered vs. student-centered. Should the teacher preplan the curriculum or let it evolve from student interests and questions? Many of our integrative examples rely on constant interaction among teachers and between teacher and students to determine the amount and type of structure needed from the teacher and the degree of independent inquiry necessary. As described above, the West Linn-Wilsonville School District's *Primary Social and Scientific Studies Framework* outlines broad conceptual themes and gives examples of appropriate topics, but classroom teachers themselves determine which topics will draw out children's experience, interest, and questions. This negotiation of curriculum presupposes a belief that the learners have a role in determining the content of instruction. Gail Aldridge honors students' investment in their topics: When interest is high and significant learning is occurring, she holds off on other instructional plans to allow stu-

dents extended time to pursue their inquiry.

The balance Bill Elasky achieved between teacher direction and student initiative is illustrative here. During the water quality study, he decided that the group needed to formulate a statement of purpose to guide their efforts and communicate their purpose. But the resulting statement, and the process of drafting and revising it, came from the students. As the project continued, Elasky's roles included specific skill instruction relevant to the study, e.g., teaching map- and chart-making; conferencing with individuals and groups to help decide next steps in the project, and helping groups work out interpersonal problems. In addition, Elasky often directed students to relevant chapters in their science book. He saw his role as providing needed, and desired, support: "When decisions were made, it was my job to help create structures to implement them" (Elasky, 1990, p. 98). Seemingly speaking for many of the teacher/explorers we encountered, he asserts that the teacher does not preplan and impose curriculum, but works with students to insert his expertise and direct them to additional sources appropriate to their work.

Educating the mind vs. the whole person. Is school the domain of the intellect only, or should it involve the whole person, i.e., feelings, beliefs, and attitudes as well? Noddings (1992) suggests that a curriculum which balances thought and rationality with affect, conviction, and application of knowledge in everyday life would allow all students to discover their talents. Moreover, it would engender respect for a wider variety of talents and ways of knowing, even ones that some traditionally successful students have not cultivated. In *Multiple Intelligences* (1983), Gardner argues for a broader definition of learning that includes these diverse strengths which often go unrecognized.

Our explorers of integrative curricu-

lum have broadened the meaning of "learning" in Gardner's sense. The framework described earlier for social and scientific studies in West Linn-Wilsonville does so by considering the development of attitudes as important a piece of the curriculum as are knowledge and skills. Notable examples from the document are "willingness to listen to others, delight in the process of learning, a sense of efficacy, and personal responsibility." Neal Maine's student-as-citizen model conveys the importance of another mode of experience: involvement in community service. The emphasis Bill Elasky places on democratic practice in his classroom is a manifestation of the commitment to educate the whole person. Group work in his class, and in the Gladstone English/biology block class, reflects the value these teachers place on interpersonal support and collaborative learning. Students interviewed in the Gladstone class spoke of the value they found in learning to work with a variety of people. The boys in Bill Elasky's science project echoed this theme: They learned to value and respect each other as they worked in groups.

What integrating curriculum involves. Although the exploring teachers we have described are on different journeys exploring the terrain of integrative curriculum, they agree that integrating curriculum is not only about superficially pasting together parts of a school program. It is "about interacting with other human beings and understanding their ways of thinking" (Shanahan et al., 1993).

As they struggle to balance sometimes competing curricular demands, all these teachers "scaffold" students' learning (Vygotsky, 1962; Bruner, 1979). One way they do this is by providing the context or frame within which the young or less experienced learner can safely take risks that challenge him or her—intellectually, socially, emotionally, and aesthetically. Another way

teachers provide a "scaffold" is to negotiate the learning process with the student so that the student can build on what he/she already knows. The support always includes a teacher who acts as guide and cotraveler.

When teachers see this design of an interactive, supportive learning environment as their major task, they can approach integrative curriculum in various ways with successful results. They can be flexible in their roles, at times providing more leadership, at other times letting students direct themselves. Just as, in architectural construction, a scaffold becomes unnecessary when the building is complete, so, in education, the scaffold of guided instruction becomes unnecessary when the student no longer needs assistance to grasp the new ideas or perform the new skills. Depending on the pace and type of learning, the guide may walk ahead, fall in with the group, or observe from the end of the line.
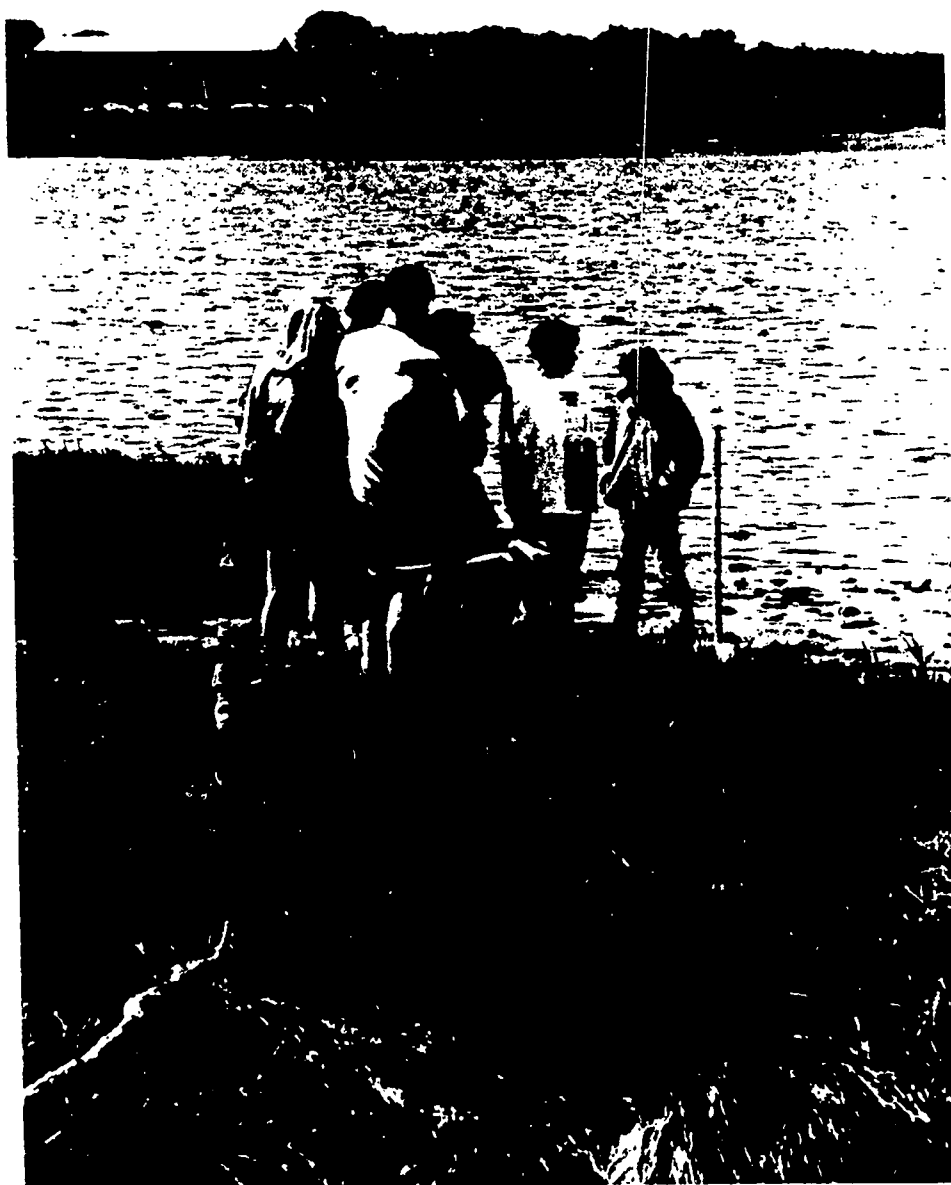
How can educators create a harmonious whole from traditionally separate pieces of curriculum if they are set apart from colleagues, expected to follow a rigid scope and sequence, or "educated" on the basis of administrative decree?
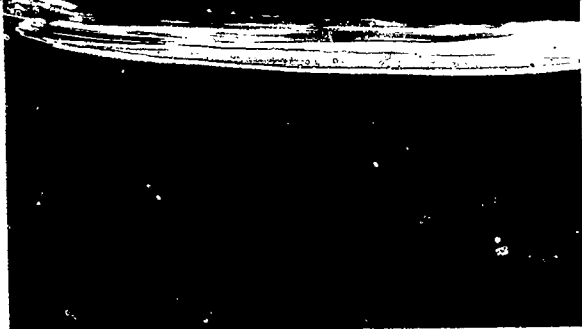
Outfitting Explorers
of Integrative
Curriculum

The Need for Support to Integrate Curriculum

Because integrative education is neither simple nor standard practice, it requires continual support for envisioning and designing curricula. Our exploration reveals that significant innovations do not spring up simply because teachers who are saints and geniuses call them forth. Rather, teachers' successes are the result of specific support strategies they form with their colleagues, administrators, and communities. Teachers' successes in turn give rise to further supportive practices, in an upward spiral of success. In Seaside, Oregon, curriculum specialist Neal Maine and elementary teachers Larry Nelson and Jan Wieting discussed a few of the reasons teachers can't "go it alone."

Maine: "Both *Coastal Geographic* and *Earth Odyssey* [another integrative project that Nelson and Wieting have led] point up some of the...opportunities [for curriculum integration]....Teachers can't always go where they might want to go [develop their teaching in desired ways] unless they have a support system. One teacher/one class, stand alone forever, has been a mentality we've been stuck with [because we haven't been] thinking about the support systems that would be necessary [to change it]....Frustrations come with doing something that has a high level of [innovation], and the schools are not set up [to deal with that]. They are set up for administration and for teaching information—which is what we can do just fine...but what happens when you break off of that, looking for the support systems, for the mechanisms to provide authentic experiences? Then things break apart very fast."

Nelson: (to Maine) "We would have died the first year [of publishing the *Coastal Geographic*] without the kind of support you provided on the end of the phone."

Maine: "That was the concept of teacher support. Defining that support system [increases student] access to the rest of the entire system, top to bottom."

Wieting: "If you want to do things like this [integrative teaching], you just have to have access to somebody who can come to you and help out with some things, because we [teachers] just can't leave [our students]. We can't just get in the car and go downtown and get the film or—"

Nelson: "Simple stuff like that you just can't get done [when you have to be with the children]."

Wieting: "So I think a lot of teachers just don't plan anything like these things that we do because it's just impossible. It's not their fault, it's just impossible."

Kinds of Support Integrative Curriculum Demands

In our conversations, observations, and reading about support for integrative practices, certain opportunities stand out as vital elements for fueling exploration: access to resources, including people in a variety of roles; participation in making decisions that affect all aspects of education; and meaningful professional dialogue. The reason that these elements can make or break reform is simple. Just as students learn (construct meaning) only when they have a hand in negotiating the curriculum, so teachers are successful only when they have substantial control over their own work. How can educators create a harmonious whole from traditionally separate pieces of curriculum if they are set apart from colleagues, expected to follow a rigid scope and sequence, or "educated" on the basis of administrative decree?

Access to people in a variety of roles. Teachers' success rests on their continual learning, a social act. Access to professionals and others who want to travel toward integration requires time.

One way many schools increase time for collaboration is to manipulate schedules, establishing common preps among those who need access to each other. Interaction also demands its proper *place*. The Eagle's Wing faculty room, with its dilapidated couches and crowded desks, represents an attempt to coordinate limited space with teachers' and students' needs to meet throughout the day. *Associations* that increase access include parent involvement programs, site-based councils, school-business partnerships, and other social programs. *Technology* (especially phones, electronic mail, and fax machines) extends teachers' reach to other educators, parents, social service providers, businesses, and government agencies. These kinds of resources translate into advantages for students.

As teachers' isolation breaks down, their freedom to choose their own alliances becomes crucial. Nelson expresses the conviction that curriculum benefits most when partnerships develop from the partners' own professional goals. "It takes people who click in their educational philosophies," he explains. "[Jan's and my] philosophies of education, our expectations for the kids, our dedication to our job—these things match up...it doesn't happen very often in a career." Since Nelson and Wieting have found such a "match" in working styles to be rare, they appreciate the chance to "go with it." The environment they need is one that grants them ownership of their collective potential, not one where an administrator or program chooses the personnel and purposes of collaboration.

Jane Stickney and Susan Dunn at Willamette Primary echo this desire to recognize individuals' preferences in team make-up. While encouraging teachers to form partnerships and small research and action groups, they carefully refrain from dictating that those alliances be based on common grade level assignment or subject areas, the usual arrangement in schools.

Teachers' involvement in decision-making. For the needs of students to drive education, teachers' autonomy to form support groups must extend to full participation in setting school policies. Areas in which teachers need a voice to bring about opportunities for integrative curriculum include materials selection, hiring, scheduling, determining class size and composition, and interacting with people outside the school.

Opportunities for reflection. A benefit for teachers trying out integrative approaches is the opportunity and challenge to delve into interests close to their own hearts—long-abandoned childhood hobbies, college research they haven't had time to resume since specializing to earn a credential, undeveloped talents, and so forth. Larry Nelson rel-

ishes this engagement: "When Jan and I see something like a [canned] program, we cannot approach it that way, so we take it and make it our own. [Some canned programs are] wonderful, nothing wrong with them whatsoever, except the fact that I didn't have anything to do with [creating] them....Both of us can get bored very easily, so we can't do the same thing the same way two years in a row. We just can't—it just drives me crazy. And so it forces you to be creative because you stand to put yourself through three more weeks of doing something you've done twice already." Wieting concurs, "There's just no way I could do a magazine on Coastal Indians again. I just couldn't do that." Nelson continues, "And that's what both of these programs [*Coastal Geographic* and

Odyssey] have done for us. With Neal's help we have kept ourselves so pumped." Thumbing through an old *Coastal Geographic* issue, Wieting chimes in, "This issue was on something that both of us were real interested in—conservation....It was something that was part of my life anyway, so that made it a lot easier to do."

Positive curricular change rests on ongoing dialogue. Teachers need opportunities to discuss the ultimate goals of schooling and creative ways to fulfill them. Interchange on standardized testing, for example, could be the basis for replacing, improving or justifying current testing practices.

Social structures that broaden participation. Just as students' learning is a matter of social interaction, so teachers'

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development can occur only in the context of communication. Around the region, teachers are experimenting with many kinds of collegial networks for support and intellectual stimulation. Structures that have successfully supported integrative approaches described in this publication include:

- *Parent volunteer programs*. According to Wieting, *Coastal Geographic's* success is based partly on the support of "a great volunteer group of parents who have worked with us a lot and are pretty tuned in to what we do in classes." These adults bolster photography, field trips, children's reading and writing, and other activities.

- *Teaching teams*. The Gladstone teachers formally changed the school schedule. Their combined classes operate in a back-to-back arrangement, and the teachers share a planning period for weaving their curricula together.

- *Teacher research groups*. In Willamette Primary, small faculty groups form to research particular topics and ways of working with students. The students' schedules are not affected by teachers' teamwork. Faculty meetings are devoted entirely to teacher planning and shared research time. By contrast, meeting time in many schools is eaten up by announcements and administration-directed development *of* staff rather than *teachers'* own development of themselves and each other.

- *Focus groups for planning systematic change*. A small group of Hudson's Bay faculty, discovering that they held similar visions for education, used collective inspiration to carry them through the hard work of planning a daunting innovation—a school-within-a-school. Such agreed-upon goals and inspiration are needed for the zeal required to plan systematic change (Wagner, 1993).

- *Grant-supported development*. At first glance, high school teacher Michele Bifelt's integrated unit on caribou for fifth- and sixth-graders appears to be in-

dividual work. But part of her success lay in finding a broader project to support her innovation. By joining the Northwest Regional Educational Laboratory's Science and Math Academies for Rural Teachers (SMART), she became a member of a group with a wealth of ideas and experience.

Such supportive networks are sometimes the result of broad restructuring efforts. In many cases, however, they are modest steps taken by a few people who don't want to wait for perfect conditions before exploring integration.

NEAL MAINE

The problem of how to fit science into a full curriculum gave way to the realization—for students as well as teachers—that science is all around them.

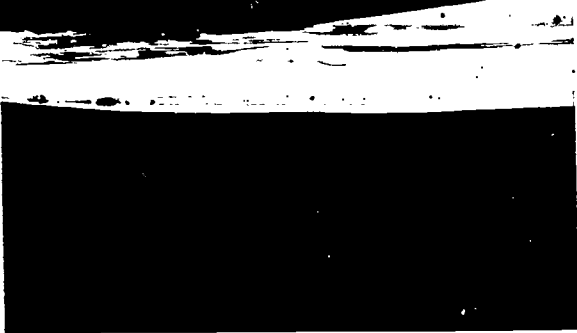Our purpose is to foster thought, encourage experimentation, and tie theory to practice.

Setting the Itinerary

for Further Explorations:

Learning Organizations

Professional teaching requires continual exploration: *What is knowledge? How do we acquire it? What sorts of social relations encourage learning?* To answer such questions a teacher must learn and apply *the knowledge* which her students are learning (e.g., ecology and psychology). Simultaneously she must grasp their *learning processes* and improve her own ability to learn in those ways (e.g., through teamwork and journal writing). Teachers who explore learning in this way will change their ideas about learning—and get excited about it.

An administration, indeed a community, that supports teachers' opportunities to change in this way will eventually face demands to reform its own ideas about learning. This concept, that learning occurs in all parts of a vibrant organization, is compatible with the systems theory of Peter Senge (1991), who sees schools as organizations that must continually acquire new perspectives and adapt accordingly. We don't want to suggest, however, that an ideal learning organization must be present (or even on the horizon) before explorations in any one part of the organization can be productive. As this publication illustrates, there are so many positive approaches to integrative curriculum, and the rationale for trying them is so sound, that a journey across even one boundary is apt to generate possibilities for crossing others.

The web on the facing page represents relationships among key facets of integrative curriculum. Learners are central to the process because, if learning is to occur, it is they who must make meaning in social interaction. To be successful, attempts to understand, practice, and support instruction must recognize this centrality of the learners' position. Because both students' and teachers' learning processes are based on the same principle of constructing meaning in interaction with others, their learning is highly interdependent.

The web emphasizes the interplay among all the parts of a curricular system. Growth in any one part stimulates growth in other parts. Effective improvements can occur in any portion of the web (curriculum, theory, and support practices), but the improvements with a lasting positive impact are the ones that affect all its components.

Integrated vs. Integrative Curriculum

"Thematic," "interdisciplinary," "multidisciplinary," "correlation," "integrated," and "integrative" appear in journal articles and sprinkle teachers' conversations (Beane, 1992). Each term has a different connotation. "Interdisciplinary," for example, suggests a repositioning of subject areas within the context of a shared theme. Ironically, in providing a clearer overall picture of the topic or issue, this repositioning blurs subject boundaries. As we encountered these terms in our exploration of curriculum innovations, we came to perceive a distinction between "integrated" and "integrative" curriculum which could guide curricular choices.

"Integrated curriculum" usually describes *content* that has been cut into separate subjects before being sewn together—like a quilt in which the patches form a unitary pattern but are still separately perceptible. The past tense—*integrated*—suggests that in order to be "integrated" a curriculum must have been *planned* in advance of the teaching and learning activities. Usually it is the *teacher* who does the planning. An example of integrated curriculum is a unit which employs perspectives and information from several disciplines to study one topic, for example, the study of a river from biological, chemical, historical, and artistic standpoints. Another kind of integrated curriculum combines two or more existing courses, such as pre-algebra and general science.

In contrast to "integrated curriculum," the term "integrative curriculum" emphasizes the process of teaching and learning in which the *student and teacher make meaning together*. Although planning plays a role in integrative education, that role is dynamic. The curriculum is being *created during the learning*, according to the student's readiness to understand phenomena and see the interplay among them. One educator expresses this planning while the learning unfolded: "It was not 'sit down and plan your strategy for the next year' because you didn't know what was going to be happening." With this flexible approach, integrative curriculum bolsters the constructive, socially interactive nature of learning. Learners forge the connections instead of merely receiving them. Rather than combining subjects, this approach proceeds from the recognition of the *unity of all subjects in experience*. In addition, it recognizes the educational benefit for students of access to many types of people and learning activities. Thus, the concept of integrative curriculum used here is a broad one, referring to integration of more than subject matter.

The point of comparing terms and concepts is not to claim the superiority of either integrated or integrative curriculum, but to stimulate discussion. The scheme on page 46 presents key contrasts between them. None of the explorations described in this publication falls neatly onto one side or the other. All, however, move *toward* a highly integrative curriculum in which more than subjects are re-united.

Guidelines

Risk-taking is inherent in any exploration. In the case of integrative curriculum, those who have gone before can't pave the way for those who wish to embark on their own adventures. But close attention to explorers' accounts does
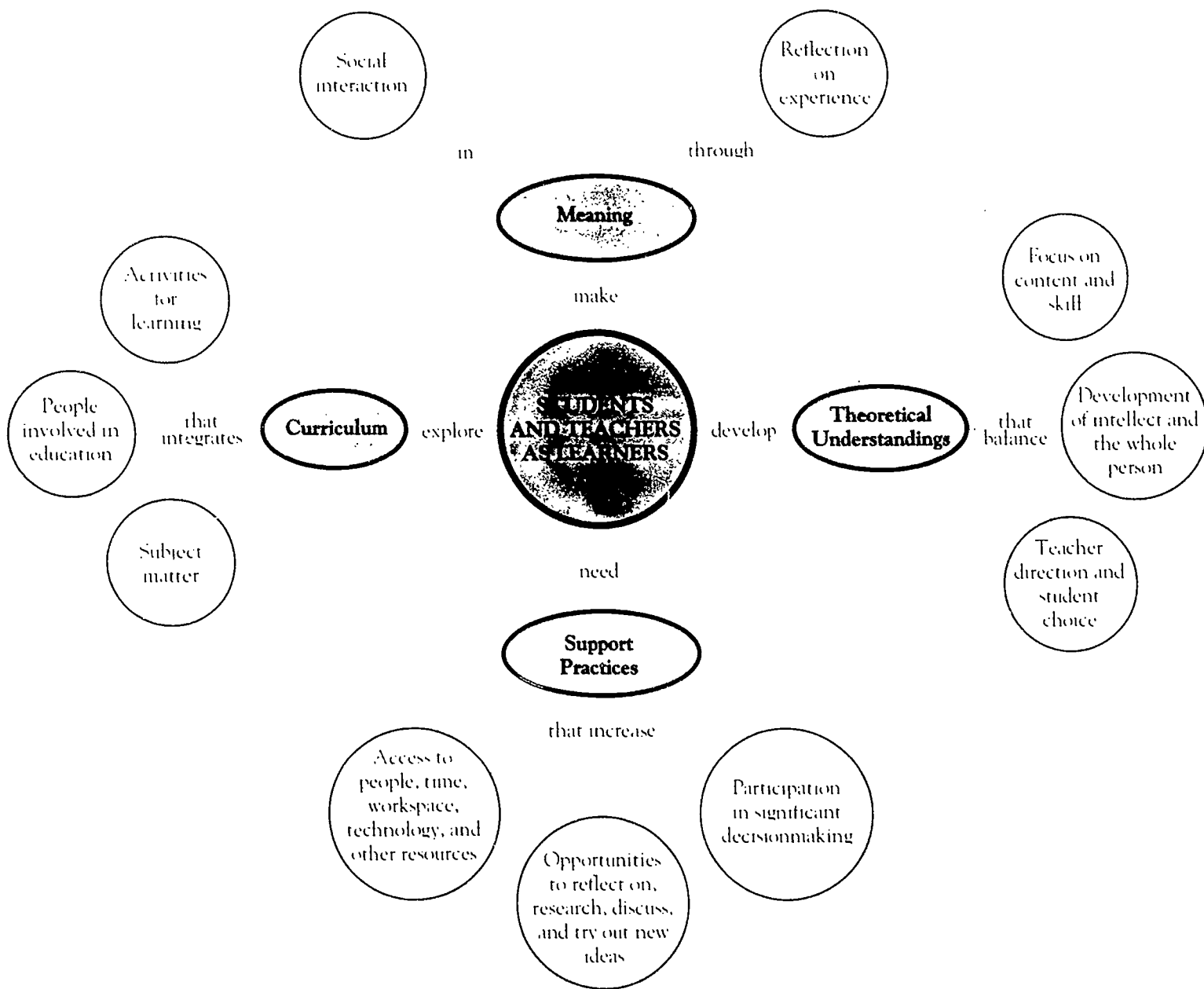
Exploring Integrative Curriculum in a Learning Organization. *The web starts from the centrality of students and teachers as learners making meaning. It depicts connections among curriculum, understandings, and support practices which emanate from this central interaction.*

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yield two broad guidelines for the journey into integrative curriculum:

• Integrate the curriculum from any (or all) of a variety of entry points—theoretical understanding, curricular practice, and support strategy. Since curriculum is a process of planning and learning within a system, it is possible to make progress by starting in any one of these areas. Education practices, the ideas underlying them, school clients, and community are interlinked so closely that change in a single part of the system affects the whole.

• Set education goals and itineraries (i.e., methods of implementation) that fit the school and community. Successful innovation depends on astute observation of the context (times, places, people, and purposes) in which it occurs. Since the purpose of integrative change is to *bring together previously separate elements of education*, knowing how these elements operate in the situation at hand is especially important. One of the greatest challenges and joys of integrative teaching is the need to pay close heed to the environment in order to chart the next steps.

Integrated Curriculum

• The *teacher* as key to the learning process.

• *Planning occurs before* teaching/learning activities.

• *Content* is emphasized.

• *Separate subjects* are the starting point.

• *Subjects* are learned together.
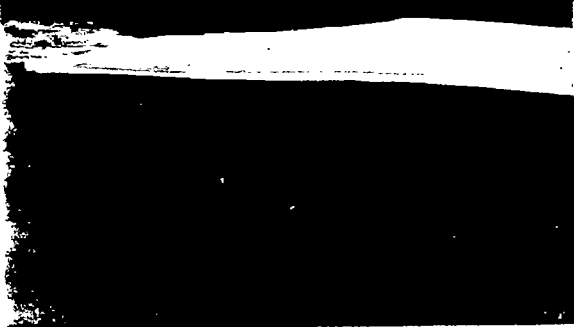
Integrative Curriculum

• The *students' and teachers' negotiation* is the center of learning.

• Decisions about curriculum are made *during* teaching/learning activities.

• *Process* is emphasized.

• *Seamless experience* is the starting point.

• Inquiry leads to the incorporation of multiple *subjects, people, and kinds of activities*, inside school and out.

TONY KNEIDEK

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Many of our integrative examples rely on constant interaction among teachers and between teacher and students to determine the amount and type of structure needed from the teacher and the degree of independent inquiry necessary.

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