School Improvement Research Series

Research You Can Use

Close-Up #16

Integrated Curriculum

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Introduction

> The integrated curriculum is a great gift to experienced teachers. It's like getting a new pair of lenses that make teaching a lot more exciting and help us look forward into the next century. It is helping students take control of their own learning.
>
> - M. Markus, media specialist, quoted in Shoemaker, September 1991, p. 797
>
> I'm learning more in this course, and I'm doing better than I used to do when social studies and English were taught separately.
>
> - Student, quoted in Oster 1993, p. 28

This teacher and student express an increasingly widespread enthusiasm for curriculum integration. While not necessarily a new way of looking at teaching, curriculum integration has received a great deal of attention in educational settings. Based both in research and teachers' own anecdotal records of success, educational journals are reporting many examples of teachers who link subject areas and provide meaningful learning experiences that develop skills and knowledge, while leading to an understanding of conceptual relationships.

Definitions

Integrated curriculum, interdisciplinary teaching, thematic teaching, synergistic teaching.... When attempting to define integrated curriculum, it is also necessary to look at related terms. Several definitions are offered here. As this paper is narrowed to K-12 integrated curriculum, definitions from vocational and higher education are not included, although there is a growing interest in both of those areas in the interdisciplinary, integrated curriculum. The reader interested in specifics about interdisciplinary work in those fields is invited to consult the General References at the end of this report.

A basic definition is offered by Humphreys (Humphreys, Post, and Ellis 1981) when he states, "An integrated study is one in which children broadly explore knowledge in various subjects related to

certain aspects of their environment" (p. 11). He sees links among the humanities, communication arts, natural sciences, mathematics, social studies, music, and art. Skills and knowledge are developed and applied in more than one area of study. In keeping with this thematic definition, Shoemaker defines an integrated curriculum as

> ...education that is organized in such a way that it cuts across subject-matter lines, bringing together various aspects of the curriculum into meaningful association to focus upon broad areas of study. It views learning and teaching in a holistic way and reflects the real world, which is interactive. (1989, p. 5)

Within this framework there are varied levels of integration, as illustrated by Palmer (1991, p. 59), who describes the following practices:

- Developing cross-curriculum subobjectives within a given curriculum guide
- Developing model lessons that include cross-curricular activities and assessments
- Developing enrichment or enhancement activities with a cross-curricular focus including suggestions for cross-curricular "contacts" following each objective
- Developing assessment activities that are cross-curricular in nature
- Including sample planning wheels in all curriculum guides.

Further description is provided by Glatthorn (1994, pp. 164-165).

Dressel's definition goes beyond the linking of subject areas to the creation of new models for understanding the world:

> In the integrative curriculum, the planned learning experiences not only provide the learners with a unified view of commonly held knowledge (by learning the models, systems, and structures of the culture) but also motivate and develop learners' power to perceive new relationships and thus to create new models, systems, and structures. (1958, pp. 3-25)

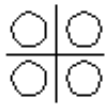
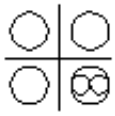
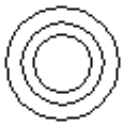
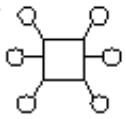
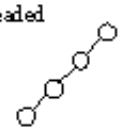
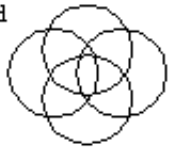
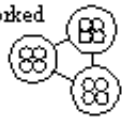
Another term that is often used synonymously with integrated curriculum is *interdisciplinary curriculum*. Interdisciplinary curriculum is defined in the *Dictionary of Education* as "a curriculum organization which cuts across subject-matter lines to focus upon comprehensive life problems or broad based areas of study that brings together the various segments of the curriculum into meaningful association" (Good 1973). The similarity between this definition and those of integrated curriculum is clear. Jacobs defines interdisciplinary as "a knowledge view and curricular approach that consciously applies methodology and language from more than one discipline to examine a central theme, issue, problem, topic, or experience" (1989, p. 8). This view is supported by Everett, who defines interdisciplinary curriculum as one that "combines several school subjects into one active project since that is how children encounter subjects in the real world-combined in one activity."

These definitions support the view that integrated curriculum is an educational approach that prepares children for lifelong learning. There is a strong belief among those who support curriculum integration that schools must look at education as a process for developing abilities required by life in the twenty-first century, rather than discrete, departmentalized subject matter. In general, all of the definitions of integrated curriculum or interdisciplinary curriculum include:

- A combination of subjects
- An emphasis on projects
- Sources that go beyond textbooks

- Relationships among concepts
- Thematic units as organizing principles
- Flexible schedules
- Flexible student groupings.

Several authors have gone beyond a single definition of curriculum integration to a continuum of integration. Fogarty has described ten levels of curricula integration (1991). The following chart summarizes some of her work. The reader who is interested in a more complete explanation is referred to Fogarty's book, *The Mindful School*.

Name	Description	Advantages	Disadvantages
Fragmented 	Separate and distinct disciplines	Clear and discrete view of a discipline	Connections are not made clear for students; less transfer of learning
Connected 	Topics within a discipline are connected	Key concepts are connected, leading to the review, reconceptualization and assimilation of ideas within a discipline	Disciplines are not related; content focus remains within the discipline
Nested 	Social, thinking, and content skills are targeted within a subject area	Gives attention to several areas at once, leading to enriched and enhanced learning	Students may be confused and lose sight of the main concepts of the activity or lesson
Sequenced 	Similar ideas are taught in concert, although subjects are separate	Facilitates transfer of learning across content areas	Requires ongoing collaboration and flexibility, as teachers have less autonomy in sequencing curricula
Shared 	Team planning and/or teaching that involves two disciplines focuses on shared concepts, skills or attitudes	Shared instructional experiences; with two teachers on a team it is less difficult to collaborate	Requires time, flexibility, commitment and compromise
Webbed 	Thematic teaching, using a theme as a base for instruction in many disciplines	Motivating for students, helps students see connections between ideas	Theme must be carefully and thoughtfully selected to be meaningful, with relevant and rigorous content
Threaded 	Thinking skills, social skills, multiple intelligences, and study skills are "threaded" throughout the disciplines	Students learn how they are learning, facilitating future transfer of learning	Disciplines remain separate
Integrated 	Priorities that overlap multiple disciplines are examined for common skills, concepts, and attitudes.	Encourages students to see interconnectedness and interrelationships among disciplines, students are motivated as they see these connections	Requires interdepartmental teams with common planning and teaching time
Immersed 	Learner integrates by viewing all learning through the perspective of one area of interest	Integration takes place within the learner	May narrow the focus of the learner
Networked 	Learner directs the integration process through selection of a network of experts and resources	Pro-active, with learner stimulated by new information, skills or concepts	Learner can be spread too thin, efforts become ineffective

This work has been supported by others involved with the implementation of curriculum integration (Jacobs 1989; Shoemaker 1989). These differentiations may move from two teachers teaching the same topic but in their own separate classes (e.g., both English and history teachers teaching about the same period of history), to team design of thematic units, to interdisciplinary courses or thematic units, to a fully integrated curriculum, which is also referred to as synergistic teaching. Bonds, Cox, and Gantt-Bonds (1993) write:

> Synergistic teaching goes beyond the blurring of subject area lines to "a process of teaching whereby all the school subjects are related and taught in such a manner that they are almost inseparable. What is learned and applied in one area of the curriculum is related and used to reinforce, provide repetition, and expand the knowledge and skills learned in other curriculum areas. This process of synergistic teaching allows the student to quickly perceive the relationships between learning in all curriculum areas and its application throughout each of the school subjects.... Synergistic teaching does more than integrate; it presents content and skills in such a manner that nearly all learning takes on new dimensions, meaning, and relevance because a connection is discerned between skills and content that transcends curriculum lines. In a synergistic classroom, simultaneous teaching of concepts and skills without regard to curriculum areas would have a greater effect that the sum of learning skills and concepts in individual subject areas.

Background

> It is taken for granted, apparently, that in time students will see for themselves how things fit together. Unfortunately, the reality of the situation is that they tend to learn what we teach. If we teach connectedness and integration, they learn that. If we teach separation and discontinuity, that is what they learn. To suppose otherwise would be incongruous. (Humphreys 1981, p. xi).

The subject of curriculum integration has been under discussion off and on for the last half-century, with a resurgence occurring over the past decade. The "explosion" of knowledge, the increase of state mandates related to myriad issues, fragmented teaching schedules, concerns about curriculum relevancy, and a lack of connections and relationships among disciplines have all been cited as reasons for a move towards an integrated curriculum (Jacobs 1989). Almost every teacher has experienced the feeling that "there just isn't enough time to get it all in" or "the school day just isn't long enough for all that I'm supposed to do; it seems that every year there are more things added to the curriculum." This feeling of frustration is one of the motivations behind development of an integrated curriculum. Teachers see this as part of the solution to the requirements that pull teachers in different ways.

These forces in contemporary schools are reinforced by Benjamin (1989, pp. 8-16), when he cites the trends towards global interdependence and the interconnectedness of complex systems, the increase in pace and complexity of the twenty-first century, the expanding body of knowledge, and the need for workers to have the ability to draw from many fields and solve problems that involve interrelated factors.

Each of these trends is relevant to the discussion of integrated curriculum, as schools move away from teaching isolated facts toward a more constructivist view of learning, which values in-depth knowledge of subjects. This view finds its basis in the work of Piaget, Dewey, Bruner, and others who hold a holistic view of learning. Each of these theorists is concerned with children having an understanding of concepts and underlying structures. Proponents of the progressive education movement of the 1930s advocated an integrated curriculum, sometimes identified as the "core curriculum" (Vars 1987). The movement towards integrated curriculum is a move away from memorization and recitation of isolated facts and figures to more meaningful concepts and the connections between concepts. The twenty-first century requirement for a flexible use of knowledge goes beyond a superficial understanding of multiple isolated events to insights developed by learning that is connected-or *integrated*. Perkins advocates teaching for transfer and thoughtful learning when he states:

> A concern with connecting things up, with integrating ideas, within and across subject

> matters, and with elements of out-of-school life, inherently is a concern with understanding in a broader and a deeper sense. Accordingly there is a natural alliance between those making a special effort to teach for understanding and those making a special effort toward integrative education (1991, p.7).

This view supports the notion of curriculum integration as a way of making education more meaningful. Concerns about national achievement levels and high dropout rates have put the spotlight on any educational change that can lead to increased student success. In addition to the realization that curriculum integration may be an effective element in making education both manageable and relevant, there is a body of research related to *how children learn* that supports curriculum integration. Cromwell (1989) looks at how the brain processes and organizes information. The brain organizes new knowledge on the basis of previous experiences and the meaning that has developed from those experiences. The brain processes many things at the same time, and holistic experiences are recalled quickly and easily. "The human brain," writes Shoemaker, "actively seeks patterns and searches for meaning through these patterns" (p. 13).

This research is supported by Caine and Caine (1991) when they connect neuro-psychology and educational methodologies and state that the search for meaning and patterns is a basic process in the human brain. In fact, the brain may resist learning fragmented facts that are presented in isolation. Learning is believed to occur faster and more thoroughly when it is presented in meaningful contexts, with an experiential component. Of course, every brain-every student-is unique. While the search for patterns and context may be universal, every learner will have his/her own learning style. To meet these diverse needs means providing choices for students.

Put to use in the classroom, the brain research points toward interdisciplinary learning, thematic teaching, experiential education, and teaching that is responsive to student learning styles. These finding are summarized by Shoemaker (1991, pp. 793-797).

The current movement toward an integrated curriculum, then, has its basis in learning theorists who advocate a constructivist view of learning. There is a body of brain research that supports the notion that learning is best accomplished when information is presented in meaningful, connected patterns. This includes interdisciplinary studies that link multiple curricular areas. There are many examples in the literature of such efforts by K-12 teachers, as well as those teachers involved in vocational education and higher education.

Another rationale for curriculum integration finds its basis in the commonsense wisdom of teachers, who are coping with an increased body of knowledge, large classes, and many mandates related to everything from drug awareness to AIDS to bus safety. When all of these requirements are added to the traditional body of knowledge for which teachers feel responsible, integration is seen as one way to meet both the needs of the students and the requirements of the state. The integration of curricular areas and concepts allows teachers to assist students as they prepare for the next century.

Finally, the movement toward a global economy and international connections, as well as the rapid changes in technology, are pushing education toward integration. The ability to make connections, to solve problems by looking at multiple perspectives, and to incorporate information from different fields, will be an essential ingredient for success in the future.

> An enduring argument for integration is that it represents a way to avoid the fragmented and irrelevant acquisition of isolated facts, transforming knowledge into personally useful tools for learning new information (Lipson, et al. 1993, p. 252).

Nature of the Research Literature

The research related to curriculum integration is centered around three major categories, which overlap to some extent. The largest body of reports are descriptions of thematic units or other types of integrated curricula that the authors have actually used in their classrooms, or that an observer has documented. Most of these resources are listed in the General References section of this report. Most of these articles are grade specific and integrate two or three content areas. Some include actual lesson plans, while others are more descriptive. Some also include the teachers' perceptions of the effect of the integrated curriculum. Others include comparisons, either a comparison of two classes taught differently the same year or two classes taught in consecutive years.

The sources listed in the Key References section of this report fall into several categories. Fifty-three documents were reviewed for this report, many of which consider multiple aspects of curriculum integration. An initial look at the literature included eight resources that offer definitions of curriculum integration or interdisciplinary curriculum. These references include many variations on the term, including those that look at integration on a continuum. Definitions came from this writers' own observations, as well as from conversations with teachers and curriculum developers.

Three resources consider the issue of curriculum integration from a historical perspective, looking at the core curriculum movement and other educational innovations. This perspective tends to look at the middle or junior high school as a place where innovations were designed to meet the many needs of the young adolescent. Beyond a historical look at curriculum integration, eight articles discuss why this is an important part of education. These articles include those that cite brain research and its relation to learning, as well as those articles that describe current and future educational and societal conditions that require an integrated perspective.

Thirteen articles describe in part or whole the impact of an integrated curriculum on achievement and attitude. These articles span the grades, from primary through high school. Teachers' attitudes and perceptions are also considered in these references. The other area of research of great interest to teachers is the literature on how to establish an integrated curriculum. Ten resources present information about ways in which curriculum integration has effectively been put into practice.

Many resources describe examples from classrooms in which the curriculum has been integrated. Thirteen examples from elementary school were considered, along with eleven from middle or high school. These examples include those that looked at the curriculum as a whole and those that focused on specific areas, such as writing.

While not reviewed for this report, the reader may want to pursue the literature on curricular integration in vocational education and higher education. For that reason four references are included about vocational education and two are included that relate specifically to higher education.

Many of the articles are written by classroom teachers or by researchers who have spent time in a specific classroom. For this reason, there are a multitude of examples included in these references. While most are not spelled out in detail, they serve as a snapshot of what goes on in the classroom on a daily basis.

Research Findings

Research findings on the topic of curriculum integration fall into three majors divisions. There are a minority of research reports documenting comparison studies that were designed to determine the

effectiveness of an integrated curriculum on content learning and attitude. There are also a large number of reports on how to implement an integrated curriculum successfully. These reports are frequently written by teachers or researchers who have been involved in programs they believe to be successful at enhancing learning. The largest body of information about curriculum integration describes teachers' experiences in the form of descriptions of thematic units they have taught or collaborations with other teachers. It is the conviction of these writers that an integrated curriculum meets the needs of their students, although they have not conducted a specific study to document this. The General References section of this paper includes citations of examples from elementary, secondary, and vocational school, as well as higher education.

Even those research reports that document the effect of an integrated curriculum, when compared with a more traditional, subject-bound curriculum, have involved small numbers of students. It is very difficult to determine all of the variables that come into play when looking at student achievement. For these reasons, the findings emerging from these studies should be regarded as provisional rather than definite conclusions based on research. It is necessary to keep in mind that a multitude of factors come into play when one considers the success or failure of a program, a class, a school year or a unit. Despite these difficulties, the data reported support the implementation of an integrated curriculum in both elementary and secondary schools.

EFFECT ON CONTENT KNOWLEDGE

Research reviewed for this report indicates no detrimental effects on learning when students are involved in an integrated curriculum. The areas of integration included: 1) art, mathematics, and reading; 2) writing across the curriculum; 3) history, science, and mathematics; 4) history and literature; 5) integrated humanities; 6) health and reading; 7) areas of mathematics; 8) social studies, health, and the arts; 9) physical education, the arts, health, and literature; and 10) science, social studies, health, and the arts (Aschbacher 1991; Edgerton 1990; Greene 1991; MacIver 1990; Shoemaker 1991; Vars 1965; Vye 1990; Williams 1991).

Vars (1965) summarized five major research studies and reported that in middle school programs that adhered to block time and core programs-both forerunners of the current integrated curriculum discussion-there was no loss of learning of subject matter and that, overall, students in the integrated programs did as well or better than students in separate-subject programs. The fact that teachers who plan and teach together have the same expectations across subject areas is a factor in the overall performance of the students.

The Humanitas program, an interdisciplinary, thematic, team-based approach to high school humanities in Los Angeles (Aschbacher 1991) has been compared to 16 other schools which are more traditional in their approach. Performance-based assessments; surveys of teachers, students, and administrators; classroom observations; teacher and student interviews; analysis of assignments and examinations; analysis of portfolios; records of student attendance; records of discipline incidents; and records of college-oriented behavior and standardized tests were all considered in this research, making it one of the most thorough explorations of curriculum integration.

The findings show that the Humanitas program has a statistically significant effect on writing and content knowledge, even after students have been enrolled for only one year. The largest gains were shown in conceptual understanding. The control groups of students made no gains in conceptual understanding during the same timeframe.

Students in the Humanitas program stay in school longer, work harder (by objective measures and their own report), and like school better. The expectations are higher in this interdisciplinary program, and

the students are involved in more complex discussions that require them to make connections between content areas and the real world. These same expectations hold true for the students' written work, as students may be asked to write an essay that includes a discussion of the beliefs of more than one culture and the way those beliefs are influenced by cultural factors and values. The students are to include perspectives from art history, literature, and social institutions and make links to their own lives.

While the evaluation of the Humanitas project involved large numbers of students and a control group, there are also many smaller-scale studies reporting positive achievement outcomes for students who participate in an integrated curriculum. Levitan (1991) reports that a change from a literature-based language arts program to a science-literature-based program for sixth graders resulted in achievement increases for the majority of the students. Similar results are reported by Willett (1992) in a study of 87 fifth graders. Integrating the study of math with art resulted in higher posttest scores than those students who were taught mathematical concepts in isolation by the regular classroom teacher. "The data indicate that the integration of art activities into mathematics and reading can enhance the learning of specific concepts" (Levitan, 1991, p. 12). Similar results were reported by Friend (1984) in a study of mathematics and science integration with seventh grade students.

These findings seem very logical when one considers the work of Schmidt (1983), who found that in integrated language arts classrooms the amount of time spent in art and literature is more than double the amount of time spent on these subjects in classrooms where integration is not a priority.

EFFECT ON ATTITUDE

There is a small body of research related to the impact of an integrated curriculum on student attitudes. MacIver (1990) found that integrated program students developed team spirit and improved their attitudes and work habits. This was attributed, in part, to the fact that teachers met in teams and were able to quickly recognize and deal with a student's problem. Vars (1965) also reports that motivation for learning is increased when students work on "real" problems-a common element in integrated programs. When students are actively involved in planning their learning and in making choices, they are more motivated, reducing behavior problems. Jacobs (1989) also reports that an integrated curriculum is associated with better student self-direction, higher attendance, higher levels of homework completion, and better attitudes toward school. Students are engaged in their learning as they make connections across disciplines and with the world outside the classroom.

Students are not the only ones who respond favorably to the learning experiences that are part of an integrated curriculum. In a study of an integrated mathematics curriculum, Edgerton (1990) found that after one year 83 percent of the teachers involved preferred to continue with the integrated program rather than return to the traditional curriculum. MacIver (1990) found that teachers appreciate the social support of working together and feel that they are able to teach more effectively when they integrate across subjects and courses. They discover new interests and teaching techniques that revitalize their teaching.

When teachers who participated in the Mid-California Science Improvement Program were interviewed by an independent evaluator, the findings indicated a dramatic increase in science instruction time and comfort with science teaching. The teachers involved in this program taught year-long themes, with a blend of science, language arts, social studies, mathematics, and fine arts. Improvements were noted in student attitudes, teacher attitudes, and student achievement. These findings were consistent for both gifted and "educationally disadvantaged" students (Greene 1991).

RESEARCH ON IMPLEMENTATION

The research findings related to implementation have several common elements. One factor that comes through loud and clear is that *curriculum integration takes time*. Common planning time is needed to allow teachers to select themes, explore resources, discuss student learning styles and needs, and coordinate teaching schedules. Broad strands, such as community, change, or systems have been found to be effective thematic organizers (Shoemaker 1991). Based on an extensive review of the literature and discussions with teachers, Shoemaker lists the following as essential components of an integrated curriculum:

- **Core skills and processes.** These include basic skills, such as reading and mathematics, as well as social skills and problem solving.
- **Curriculum strands and themes.** These are the organizing principles around which the curriculum is built. They are broad-e.g., Human Societies-and integrate content from multiple areas.
- **Major themes.** Each curriculum strand is further divided into major themes, e.g., Environments or Diversity.
- **Questions.** Questions are used to further define major themes and focus activities.
- **Unit development.** From the major theme and the questions, knowledge, and skills related to the concepts, teachers plan activities that will lead to the development of knowledge and skills which will answer the questions. Teachers also collect resources and develop actual lesson plans and assessment strategies.
- **Evaluation.** Through an assessment of student progress the unit is evaluated.

When considering Shoemaker's essential components, teachers give broad definitions to her terms. For example, major themes may be drawn from existing structures within a school, such as works of literature or cross-subject areas.

Successful efforts toward integration tend to include the above elements or a variation. Palmer (1991) suggests that teachers and curriculum supervisors work together to identify common goals, objectives, skills, and themes. From these lists, the teachers work together to find appropriate connections to content areas. For example, research skills may be a part of science, math, music, language arts, and social studies. From this discussion, teachers devise plans for teaching. Any plan takes time, empowered teachers, flexible schedules, and teams whose members are able to work together (Brandt 1991).

Just as curriculum integration changes the way instruction looks, it may also lead to a change in assessment strategies. As students are involved in "real" tasks, teachers find that they need to design performance assessments that give a true picture of student understanding of concepts.

When beginning an implementation plan, Jacobs's experience has led her to identify four steps that are integral to success (1991, p. 27). They are:

1. Conduct action research to learn about current resources and best practices.
2. Develop a proposal for integration.
3. Implement and monitor the pilot program, with continual assessment of students and the program.
4. Adopt a program and continue to assess.

SUMMARY OF RESEARCH FINDINGS

The findings support the positive effects of curriculum integration. Lipson (1993) summarizes the following findings:

- Integrated curriculum helps students apply skills.
- An integrated knowledge base leads to faster retrieval of information.
- Multiple perspectives lead to a more integrated knowledge base.
- Integrated curriculum encourages depth and breadth in learning.
- Integrated curriculum promotes positive attitudes in students.
- Integrated curriculum provides for more quality time for curriculum exploration.

Recommendations

Factors that need to be considered in an integrated curriculum are (Gehrke 1991; Jacobs 1989; Lipson 1993; MacIver 1990):

- Common definitions of terms (such as theme, strand, or outcome)
- Available resources
- Flexibility in scheduling
- Support services
- Subjects and concepts that will be integrated
- Links between integration and broader outcomes
- Curricular scope and sequence
- How evaluation will occur
- Parent and community support
- Themes that promote the transfer of learning and connections
- Team planning time that is used to exchange information about content, students, special areas of teacher expertise, and teaching methods.

When teachers select themes, it is important that they avoid themes of convenience that have no meaningful, larger concepts. While an individual teacher may or may not have expertise in each content area, members of teacher teams are able to work together to find connections that cut across single content areas (Lipson 1993). Themes that promote the linking of concepts and lead to deeper understanding are more effective. A theme is more than a series of activities; it is a way to facilitate student learning and understanding of conceptual connections. Activities that are arbitrarily connected are not helpful (Brophy and Alleman 1991). Thus, an integrated curriculum is a means, not the end result. Poorly designed units do not achieve this end of deeper understanding and thorough learning.

Each of these elements needs to be considered as teachers look at curriculum integration. It is necessary for each school to determine the best procedure to meet the needs of the particular student body. A secondary school may face different constraints than an elementary school. Rather than move from a traditional, subject-specific curriculum to an integrated curriculum in one sudden sweep, schools find more success when they make gradual changes, making sure that everyone involved feels a sense of ownership of and commitment to the changes.

Some areas may lend themselves more naturally to integration, such as math and science or language arts and social studies. However, as reported above, there have been very successful efforts in nontraditional alliances, e.g., art and math. As teachers are more and more involved in integration, they find that they see connections that they had not seen initially. As teachers see these connections and develop learning experiences and assessments built around the connections, students also understand them. This understanding leads to more successful learning.

Areas for Further Research

An integrated curriculum may not address a logical sequence within a discipline such as mathematics. Further research into the effect of this will be needed if teachers are to look at the role of sequence in curriculum selection decisions. It may be that sequence decisions currently held are more a product of textbooks than actual necessity for understanding. When the curriculum is based on broad concepts linked in thematic units, students may acquire knowledge in very different ways, making the traditional sequence less meaningful. This is an area that has not been fully explored in the research on integrated curriculum.

Another implication, cited by Humphreys (1981), revolves around assessment of student learning. If themes are guided, in part, by student and teacher interest, there will be less consistency of experience than many teachers currently strive for. This may impact performance on standardized tests and require alternative methods of assessing student understanding of essential concepts.

Teachers who are not provided with adequate inservice or time to thoughtfully develop an integrated curriculum may go to an unstructured, "a little of everything" approach (Jacobs 1989), rather than a truly integrated approach to learning. This does not facilitate the kinds of understanding and achievement that integrated programs discussed in this report have documented. Best practices for initial and ongoing inservice training need to be explored more fully.

A related issue is the extent to which preservice teachers are prepared to teach in settings that are committed to curriculum integration.

A final word of caution is for the teacher who feels that this must be an all-or-nothing scenario. There may well be instances in which curriculum integration is not the most appropriate way to go. A careful examination of successfully integrated programs may suggest the extent to which integration can or should be implemented.

Key References

Aschbacher, P.
"Humanitas: A Thematic Curriculum." *Educational Leadership* 49/2 (1991): 16-19.

A description of the Humanitas program, an interdisciplinary secondary-level program. The goals of the program are twofold-professional growth for the teachers and enriched humanities for the students. Impacts on students and teachers are described, and insights from students are included.

Benjamin, S.
"An Ideascope for Education: What Futurists Recommend." *Educational Leadership* 47/1 (1989): 8-16.

An article considering future trends and needs in education.

Bonds, C.; Cox, C., III; and Gantt-Bonds, L.
"Curriculum Wholeness through Synergistic Teaching." The Clearing House 66/4 (1993): 252-254.

An article presenting a definition and description of "synergistic teaching" in an integrated

curriculum. The authors contend that this method of teaching is more effective than separate-subject teaching.

Brandt, R.
"On Interdisciplinary Curriculum: A Conversation with Heidi Hayes Jacobs." *Educational Leadership* 49/2 (1991): 24-26.

An interview with Heidi Hayes Jacobs, a professor at Teachers College, Columbia University. Topics include the meaning of interdisciplinary curriculum, the impact of national standards, and factors in implementation.

Brophy, J., and Alleman, J.
"A Caveat: Curriculum Integration Isn't Always a Good Idea." *Educational Leadership* 49/2 (1991): 66.

An article stressing the importance of considering educational goals in designing an interdisciplinary curriculum.

Caine, R., and Caine, G.
Making Connections: Teaching and the Human Brain. Alexandria, VA: Association for Supervision and Curriculum Development, 1991.

A book integrating findings from neuro-psychology with educational methodologies. Specific education recommendations are given regarding interdisciplinary studies, thematic teaching, integration of the arts, and alternate forms of assessment and grading practices.

Cromwell, S.
"A New Way of Thinking: The Challenge of the Future." *Educational Leadership* 49/1 (1989): 60-64.

A discussion of challenges and issues related to future trends in education.

Dressel, P.
"The Meaning and Significance of Integration." In *The Integration of Educational Experiences*, 57th Yearbook of the National Society for the Study of Education, edited by Nelson B. Henry. Chicago: University of Chicago Press, 1958, 3-25.

A review of the meaning and elements of integrated curricula during the 1950s. The importance of this movement is discussed.

Edgerton, R.
Survey Feedback from Secondary School Teachers that are Finishing their First Year Teaching from an Integrated Mathematics Curriculum. Washington, DC, 1990. (ED 328 419)

A report summarizing the results of a survey of secondary mathematics teachers who were involved in an integrated mathematics curriculum for one year. A majority of the teachers-83 percent-wanted to continue with the integrated curriculum. A copy of the survey is included.

Fogarty, R.
The Mindful School: How to Integrate the Curricula. Palatine, IL: Skylight Publishing, Inc., 1991.

A book describing ten ways to integrate a curriculum with pros, cons, and examples for each model. Worksheets for teachers interested in exploring a particular model are included at the end of each chapter.

Friend, H.
The Effect of Science and Mathematics Integration on Selected Seventh Grade Students: Attitudes Toward and Achievement in Science. New York: New York City Board of Education, 1984.

A report on a study to determine the effect of an integrated mathematics/science seventh grade physics unit on students' attitudes toward and achievement in science. Groups of students using the integrated curriculum achieved better than similar students using the nonintegrated curriculum.

Gehrke, N.
"Explorations of Teachers' Development of Integrative Curriculums." *Journal of Curriculum Supervision* 6/2 (1991): 107-112.

An article reporting the findings from a study of integrated curriculum development in six schools. Findings include the need for teachers to have time to work together and the fact that coaching plays a role in teachers' development of integrated curriculum. Definitions are also provided.

Good, C. (Ed.).
Dictionary of Education, Third Edition. New York: McGraw Hill, 1973.

A reference for definitions and explanations of educational terms.

Greene, L.
"Science-Centered Curriculum in Elementary School." *Educational Leadership* 49/2 (1991): 48-51.

A description of the interdisciplinary curriculum in an elementary school in the Salinas City School District. Examples from the curriculum, teacher training related to the curriculum, early evaluation results, and impressions from participants are included.

Humphreys, A.; Post, T.; and Ellis, A.
Interdisciplinary Methods: A Thematic Approach. Santa Monica, CA: Goodyear Publishing Company, 1981.

A book exploring the how and why of thematic teaching. It includes many examples of interdisciplinary themes that encourage students to discover, explore, and experiment. Links are made among the humanities, communication, arts, natural sciences, mathematics, and social sciences.

Jacobs, H. H.
Interdisciplinary Curriculum: Design and Implementation. Alexandria, VA: Association for Supervision and Curriculum Development, 1989.

A survey of relevant information on interdisciplinary teaching from various perspectives. Both design and implementation are discussed, along with a rationale for interdisciplinary teaching.

Levitan, C.
"The Effects of Enriching Science by Changing Language Arts from a Literature Base to a Science Literature Base on Below Average 6th Grade Readers." *Journal of High School Science Research* 2/2 (1991): 20-25.

A report of the effects upon the attitude and achievement of a group of below-average sixth graders generated by enriching the language arts curriculum from a literature base to a science base. While attitude stayed constant, achievement increased for 12 of 17 students.

Lipson, M.; Valencia, S.; Wixson, K.; and Peters, C.
"Integration and Thematic Teaching: Integration to Improve Teaching and Learning." *Language Arts* 70/4 (1993): 252-264.

A thematic approach to teaching is presented as a way to replace fragmented teaching with integrated contexts. A carefully selected theme provides for coherence and serves as a focus for activities and teaching material.

MacIver, D.
"Meeting the Need of Young Adolescents: Advisory Groups, Interdisciplinary Teaching Teams, and School Transition Programs." *Phi Delta Kappan* 71/6 (1990): 458-465.

A review of three elements found to be successful in middle schools: advisory groups, interdisciplinary teaching teams, and school transition programs. The data are taken from the John Hopkins University Center for Research on Elementary and Middle Schools (CREMS).

Markus, M., media specialist. Quoted in Shoemaker, B.
"Education 2000 Integrated Curriculum." *Phi Delta Kappan* 72/10 (1991): 797.

A description of the Education 2000 Integrated Curriculum task force work in the Eugene, Oregon Public Schools. Includes an overview of brain research supporting curriculum integration and a description of the major themes and concepts in the Eugene curriculum. Each strand is illustrated with a list of themes and concepts. The implementation process is described.

Meckler, T.
Reading Improvement Using the Health Curriculum. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, April 1992. (ED 254 836)

Report on the results of a traditional health curriculum vs. a health curriculum with a reading/language arts format. The subjects, 389 junior high students, were placed in one of the two groups. Those in the experimental group made greater gains in reading and language arts than the control group.

Oster, L.
"Sub-Saharan Africa: An Interdisciplinary Curriculum Unit." *English Journal* 82/4 (1993): 24-28.

A description of an interdisciplinary curriculum that combines English, Studio Art, and Global Studies. Using the framework of "power," students study Sub-Saharan Africa. Examples of work done in English, art and global social studies are included, together with evaluations by the teacher and suggestions for others implementing such a unit were

included.

Palmer, J.
"Planning Wheels Turn Curriculum Around." *Educational Leadership* 49/2 (1991): 57-60.

A description of the system used in Howard County, Maryland Public Schools to create interdisciplinary curricula. Examples of planning wheels for "Smoke Free 2000" and "Consumerism" are included.

Pappas, C.
"Focus on Research: Collaborating with Teachers Developing Integrated Language Arts Programs in Urban Schools." *Language Arts* 70/4 (1993): 297-303.

Power and authority issues between elementary teachers and university researchers, as well as between elementary teachers and their students, were explored in the context of the development of an integrated language arts program.

Perkins, D. N.
"Educating for Insight." *Educational Leadership* 49/2 (1991): 4-8.

Perkins discusses the need for teachers to promote thoughtful, insightful learning in their classrooms. The use of "mental models," "coaching," and "teaching for transfer" are suggested as effective ways to move toward more insightful learning.

Schmidt, W.
Curriculum Integration: Its Use in Language Arts Instruction. Research Series Number 140. East Lansing, MI: Institute for Research on Teaching, 1983. (ED 241 942)

Report of a study that examined the amount and kinds of language arts curriculum integration in elementary classrooms, contextual factors associated with the integration, and the relationship between the teachers' thinking about integration of the curriculum and the amount of integration in their classrooms.

Shoemaker, B.
"Integrative Education: A Curriculum for the Twenty-First Century." *Oregon School Study Council* 33/2 (1989).

This document discussed meanings of integration; why there is a need for integrated curricula; models of integrated curricula; what the Eugene, Oregon integrated curriculum project is; contrasts between an integrated and a subject-centered curriculum; and support for an integrated curriculum.

Vars, G.
A Bibliography of Research on the Effectiveness of Block-Time Programs. Ithica, NY: Junior High School Project, Cornell University, 1965.

A review of research related to block-time and core programs in middle and junior high schools.

Vars, G.
Interdisciplinary Teaching in the Middle Grades: Why and How. Columbus, OH: National Middle School Association, 1987.

A description of interdisciplinary curriculum from the middle school vantage point, including specific information about why this approach is appropriate for this age group and how it might be organized.

Vye, N.

The Effects of Anchored Instruction for Teaching Social Studies: Enhancing Comprehension of Setting Information. Paper presented at the Annual Meeting of the American Educational Research Association, Boston, MA, April 1990. (ED 317 984)

A paper describing a three-year experiment designed to enhance literacy and social studies skills in fifth graders. Positive results were replicated across teachers and in multiple settings. "At-risk" and "average" students benefited from the integrated experience.

Willett, L.

The Efficacy of Using the Visual Arts to Teach Math and Reading Concepts. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, April 1992. (ED 348 171)

A paper documenting the effect of the use of art lessons to enhance the comprehension of specific mathematics concepts in fifth grade students. Pre- and post-tests were given to 87 fifth graders. Sample lessons plans are included.

Williams, D.

A Naturalistic Study of Unified Studies: A Holistic High School Program. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL, April 1991. (ED 333 552)

An ethnographic study of an integrated university/high school partnership. Observations, interviews, and document analysis indicated that both teachers and students learned from the program's focus on real experiences.

General References

Vocational Education Examples

Briers, G.

Identification of Math and Science Concepts, Skills, and Experiences Provided in Vocational Agriculture in Texas. Texas A & M University: Department of Agricultural Education, September 1986. (ED 281 035)

This article includes matrices of science and math essential elements. Also describes a project which included reviewing the state Basic Curriculum Guide for Production Agriculture and developing a table of opportunities for students in vocational agriculture to develop concepts and skills in mathematics and science. The authors also describe workshops for teachers which ensured the implementation of the skills matrix.

The Integration of General and Technical and Vocational Education, Trends and Issues in Technical and Vocational Education.

Paris, France: United Nations Educational, Scientific, and Cultural Organization, 1986. (ED 274 802)

This book contains eight case studies that describe the state of vocational, technical, and general education in eight Unesco countries and their progress toward the integration of the three types of education. The final chapter of the book presents the conclusions derived from analysis of the case studies.

Ladewig, B.
"The Effective Integration of Basic Competencies into an Applied Discipline." *Journal of Vocational Education Research* 12/1 (1987): 11-19.

A group of 399 students in a home economics course integrating basic competencies and employing computer assisted instruction showed significantly greater gains in basic competencies than a control group of 611 students in a similar course.

Martinez, R.
"Sparking Interest in Academics: Welding Class Helps Students Improve English, Math Grades." *The Vocational Education Journal* 67/8 (1992): 34-37.

Report of a high school program which incorporated math and English within vocational courses. The findings showed that the majority of the students' academic and welding performances improved or were maintained.

Higher Education Examples

Goldbort, R.
"Literature, Science, and Liberal Education: Toward Integrative Studies." *Teaching English in the Two-Year College* 18/2 (1991): 121-125.

Illustrates how science fiction can encourage students to reflect on the interaction of science, humanities, and literature. Suggests thematic teaching approaches based on writings dealing with ethics, biological determinism, and science.

Watkins, B.
"In Non-traditional, Interdisciplinary Study at Columbia College, Artists Get a Chance to Broaden Their Horizons, Hone Creativity." *The Chronicle of Higher Education* 37/3 (1990): 17.

A report on a program at Columbia College that allows art students to participate in interdisciplinary studies. Projected outcomes are included.

Elementary Examples

Alaska's Forests . . . More Than Just Trees.
Fairbanks, AK: Alaska State Department of Fish and Game, 1987. (ED 340 564)

This unit emphasizes forest wildlife, ecology, and conservation and includes a teacher's guide with information, interdisciplinary activities, games, and related materials. The thematic approach integrates science, language arts, social studies, mathematics and art.

Berlin, D., and White, A.
"Report from the NSF/SSMA Wingspread Conference: A Network for Integrated Science and Mathematics Teaching and Learning." *School Science and Mathematics* 92/6 (1992): 340-343.

Report of a National Science Foundation/School Science and Mathematics Association conference. The conference developed a rationale for integrated teaching and learning of science and mathematics, defined guidelines for the implementation of integrated teaching, and identified high-priority research topics related to the concept of integration.

Bilbe, R.
"Primary Place: Teaching with Themes." *Instructor* 102/2 (1992): 84-85.

Presents guidelines for developing thematic units for primary students. The article includes ideas, activities, and experiences for a color unit and for maintaining thematic teaching throughout the year.

Britton, J.
Writing and Reading in the Classroom. Technical Report Number 8. Berkeley, CA: Center for the Study of Writing, August 1987. (ED 287 169)

A report describing several teaching methods designed to integrate the teaching of reading and writing at the elementary and secondary levels.

Brophy, J.
Mary Lake: A Case Study of Fifth Grade Social Studies (American History) Teaching. Elementary Subjects Center Series Number 26. East Lansing, MI: Michigan State University Institute for Research on Teaching, December 1990. (ED 334 111)

A case study of a month-long unit in a fifth grade class that involved the integration of history and language arts and an emphasis on writing and cooperative learning.

Drake, J., and Drake, F.
"Using Children's Literature to Teach about the American Revolution." *Social Studies and the Young Learner* 3/2 (1990): 6-8.

Reports on a third-fourth grade class, finding that students responded enthusiastically to the study of history through literature.

Klein, R., and Prendergast, C.
"Courage and Survival." *Instructor* 101/2 (1991): 14.

Presents suggestions for developing a thematic teaching unit to help students overcome fear by learning about the courage of survivors in literature.

Malecki, C.
"Teaching Whole Science in a Departmentalized Elementary Setting." *Childhood Education* 66/4 (1990): 232-237.

A description of an integrated science program in one elementary school.

Mansfield, B.
"Students' Perceptions of an Integrated Unit: A Case Study." *Social Studies* 80/4 (1989): 135-140.

A description of a case study of fifth and sixth graders involved in an integrated unit.

Spiegel, D.
"Materials for Integrating Science and Social Studies with the Language Arts." *The Reading Teacher* 44/2 (1990): 162-166.

An article describing instructional resources helpful for elementary teachers to use when teaching interdisciplinary science/social studies/language arts.

Secondary Examples

Goldbort, R.
"Science in Literature: Materials for a Thematic Teaching Approach." *English Journal* 80/3 (1991): 69-73.

This article outlines units that create opportunities for students to bring together literature and science.

Needham, N.
"Radical Restructuring: Changing School Culture." *NEA Today* 11/8 (1993): 15.

A description of a high school's implementation of a four-period block to replace a traditional seven-period day.

Waites, B.
"Targets in the Twilight Zone." *Times Educational Supplement* 40/6 (1993): 31.

This article describes "The Search for the Lost Village," an interdisciplinary experience that focuses on physical, human, and environmental geography.

Westerberg, J., and Whiting, J.
"Popcorn: An Explosive Mixture of General Mathematics and General Science." *Mathematics Teacher* 85/4 (1992): 306-309.

An example of a unit integrating science and mathematics.

This publication is based on work sponsored wholly, or in part, by the Office of Educational Research and Improvement (OERI), U.S. Department of Education, under Contract Number RP91002001. The content of this publication does not necessarily reflect the views of OERI, the Department, or any other agency of the U.S. Government.

May 1994
