Strategies for Using Interdisciplinary Resources Across K-16

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Abstract: Across the K-16 system of primary, secondary, and post-secondary education, the need for interdisciplinary resources is widespread. Resources are dispersed, however, across disciplinary, interdisciplinary, and professional forums, as well as the "gray" or "fugitive" literature of conference papers, teaching materials, program reports, working papers, and other unpublished work. We enlarge the conventional notion of "resources" by defining six major areas and activities that will yield a portfolio of materials and strategies for teaching, curriculum planning, and administration. They encompass (1) primary literatures, (2) professional organizations and related publications, (3) specialized literatures, (4) networking, (5) electronic database searching, and (6) professional development.

Introduction

WHETHER THEY WORK IN K-12 OR COLLEGE, most veterans of interdisciplinary teaching and curriculum development do not make full use of the available resources. Newcomers, especially, may be lost in their search for program models, sample syllabi, and answers to the most commonly asked questions. Joan Fiscella and Stacey Kimmel (1999) took an initial step toward meeting their needs in the first annotated bibliography of resources across the K-16 spectrum of primary, secondary, and post-secondary education. *Interdisciplinary Education: A Guide to Resources* goes well beyond

bibliography, establishing the groundwork for informed use of the K-12 and college literatures. Fiscella and Kimmel organized the literatures into the categories of foundations; curriculum; faculty, teacher, and team development; pedagogy and student support; and administration. In addition to providing valuable introductions to each cluster of references, the book contains essays on the nature of the literature and information seeking. It is a "must read" for anyone seeking pertinent resources.

As preparation of the Fiscella and Kimmel volume was underway, we joined other leading specialists in K-12 and college in taking a second step. *Interdisciplinary Education in K-12 and College: A Foundation for K-16 Dialogue* is the first book-length exploration of the nature of integrative and interdisciplinary education across the K-16 spectrum (Klein 2002). The authors examine topics as wide ranging as curriculum development, program management, team teaching, pedagogy and integrative process, technology in teaching, the political stakes in curriculum innovation, assessment, and the basis for a common conception of interdisciplinary education across the educational spectrum.

In this article, we extend the pioneering efforts of both books by enlarging the conventional notion of "resources" to encompass a range of activities. Using resources effectively is not simply a matter of identifying bibliographical references. It requires building a portfolio of strategies. By providing an inclusive K-12 reference in a journal read primarily at the post-secondary level, we also hope to stimulate further research and discussion across K-16. It is a timely initiative. The need to bridge K-12 and college has made K-16 a topic of wide discussion in educational circles. However, school subjects and academic disciplines dominate the discourse of K-16.

Extending dialogue across K-16 does not ignore differences. Student ages and cognitive development, institutional structures, and professional mandates vary greatly. In a rare reflection on differences in K-12 and university settings, Grossman, Wineburg, and Beers (2000) report the greatest inroads in K-12 have been in elementary and middle schools, where a "generalist ethos" has wide support and disciplinary commitments are often not strong in teaching. Curricula tend to be "predisciplinary," in contrast to a more self-conscious focus on disciplines in high school and college. Moreover, there is a "different flavor" to discussions. In elementary or middle schools, the conversation about disciplinary tools and ways of knowing and about interdisciplinarity as an intellectual problem may not be heard. Despite the rich tradition of curriculum integration, interdisciplinarity is more often conceived as a practical solution to organizational and administrative

problems of increasing motivation and creating a healthier social and psychological environment.

Nonetheless, educators across K-16 have much in common. They are responding to similar needs and interests, they utilize comparable pedagogies and models, they face similar problems, and they all underutilize existing resources. Our immediate task is to help with the latter. Three questions frame the task:

- What are interdisciplinary resources and how do they differ from disciplinary resources?
- Where are they located?
- How can they be used productively?

The inclination in traditional subjects and disciplines is to begin by looking up materials. However, identifying, locating, and utilizing interdisciplinary resources are rarely straightforward activities.

The challenge is complicated by lack of a common professional identity. Many educators do not self-identify as integrationists or interdisciplinarians. They define themselves as subject-discipline specialists—as biologists or science teachers, historians or social science teachers, English or language arts teachers. Moreover, interdisciplinarity has not been professionalized the way that most academic disciplines and school subjects have. It lacks a circular flow of students who take courses in interdisciplinary departments or programs with the expectation that some will go on to graduate work in the field and even return to specialize in it. Consequently, teachers rarely master or even encounter pertinent literatures. Furthermore, interdisciplinarity has not developed conventional patterns of professional authority or coalesced into a group with an accompanying sense of solidarity and place. As a result, many authors are unaware of each other's work, do not use common terminology, and do not consciously build on each other's work.

Newell (1998) addressed problems of fragmentation and inconsistency by identifying a professional literature at the post-secondary level. Even with greater visibility of the literature, though, many educators are not prepared for interdisciplinary teaching, administration, and curriculum development. The title of a special issue of *Library Trends*—Navigating Among the Disciplines (Palmer 1996)—suggests an appropriate metaphor. Educators must *navigate* information systems at three levels—national, regional, and local. At the national level they need to become part of the wider conversation. Good practices, disciplinary or interdisciplinary, depend on knowing

about pertinent literatures and professional forums. The second level, the regional level, is comprised of networks of like-minded educators in geographical areas. The third level is local. The national conversation and regional contacts must be situated in an individual school building or college campus, testing general understanding and support in the context of unique needs, interests, opportunities, and limits. In order to create the richest portfolio of resource strategies, whether working with a single course or a full-scale program, it will be necessary to work across six areas:

1. primary literatures,
2. professional organizations and related publications,
3. specialized literatures,
4. networking,
5. electronic database searching, and
6. professional development.

Primary Literatures

For interdisciplinarians, there is no such thing as business as usual. Resources are dispersed across disciplinary, interdisciplinary, and professional forums. They also float in the "gray" or "fugitive" literature of conference papers, teaching materials, program reports, working papers, and other unpublished work. "Searching for information," Kimmel advises, "is often a longer and more complex process than searching for resources in a discipline" (1999, p. 293). Like the literature, access tools, infrastructure, and technologies are under development. Moreover, especially in emergent fields, information may be more elusive, it will be aimed at diverse audiences, and it will be arrayed across multiple dissemination channels. Flexibility, creativity, and a willingness to continually assess results and modify search strategies are crucial (Kimmel 1999, p. 297). The challenge is both practical and theoretical, encountering the methodological problem of "scatter" and the epistemological problem of "knowledge organization."

Scatter refers to the dispersal of knowledge and information. Librarians and information specialists distinguish low-, medium-, and high-scatter fields in terms of width of subject area and how well underlying principles are developed and a literature is organized. High scatter is endemic to interdisciplinary subjects and topics. The practical problems created by scatter and the epistemological problem of knowledge organization meet head on in the library. By and large, Library of Congress classifications, publishers' categories, and indexes are still organized primarily in terms of subjects

and disciplines.

Interdisciplinary resources are distinct from disciplinary resources in several ways. They are generally described by a greater variety of terms. They appear in a wider, less predictable range of places, including the fugitive literature. They assume different forms, and any one theme, problem, or concept may have a variety of labels. Even when a category is readily identified, relevant literature may be dispersed across other categories. Keyword searches are a popular strategy for interdisciplinarians because they identify a wide range of sources using basic terms. Yet, major words such as "integrated" and "interdisciplinary" are used differently or interchangeably. Worse, "interdisciplinary" may not be one of the subject headings for works that in fact are integrative or interdisciplinary. The same problem arises with names of K-12 curriculum models, such as "coordinated," "connected," "linked," "fused," "unified," and "core" designs. (Of note, there are four overtly interdisciplinary Library of Congress subject headings: interdisciplinary approach in education, interdisciplinary research, interdisciplinary studies, and interdisciplinary approach to knowledge.)

Despite these obstacles, appropriate resources abound. Having a sound starter library is a crucial first step. Readers are encouraged to request a basic collection for their institutional or program libraries. What might constitute a starter library?

A Beginning Library
K-12 Literature

Beane, J. 1997. *Curriculum Integration: Designing the Core of Democratic Education*. New York: Teachers' College Press.

Beane, J. 1993. *A Middle School Curriculum: From Rhetoric to Reality* (2nd ed.). Columbus, OH: National Middle School Association.

Burns, R.C. 1995. *Dissolving the Boundaries: Planning for Curriculum Integration in Middle and Secondary Schools*. Charleston, WV: Appalachia Educational Laboratory. Accompanying *Facilitator's Guide* co-written with Beth D. Sattes.

Clark, Jr., E.T. 2002. *Designing and Implementing an Integrated Curriculum: A Student-Centered Approach* (4th Printing). Brandon, VT: Holistic Education Press.

Clarke, J., & Agne, R. (Eds.). 1997. *Interdisciplinary High School Teaching: Strategies for Integrated Learning*. Boston, MA: Allyn and Bacon.

Ellis, A., & Stuen, C. 1998. *The Interdisciplinary Curriculum*. Larchmont, NY: Eye on Education.

Fogarty, R. 1993. *Integrating the Curricula: A Collection*. Palatine, IL: IRI/ Skylight Publishing.

Integrated Curriculum. 1995. Alexandria, VA: Association for Supervision and Curriculum Development. A resource packet.

Interdisciplinary/Integrated Curriculum. n.d. ERS Info-File #128. Arlington, VA: Educational Research Services.

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

Vars, G.F. 1993. *Interdisciplinary Teaching: Why and How* (Rev. ed.). Westerville, OH: National Middle School Association.

Winebrug, S., & Grossman P. (Eds.). 2000. *Interdisciplinary Curriculum: Challenges to Implementation*. New York: Teachers' College Press.

College Literature

Davis, J.R. 1995. *Interdisciplinary Courses and Team Teaching: New Arrangements for Learning*. Phoenix, AZ: American Council on Education, Oryx.

Edwards, A.F. 1996. *Interdisciplinary Undergraduate Programs: A Directory* (2nd ed.). Acton, MA: Copley.

Haynes, C. (Ed.). 2001. *Innovations in Interdisciplinary Teaching*. Westport, CT: Oryx/Greenwood Press.

Klein, J.T. (Ed.). 2002. *Interdisciplinary Education in K-12 and College: A Foundation for K-16 Dialogue*. New York: The College Board.

Klein, J.T. 1999. *Mapping Interdisciplinary Studies.* Washington, DC: Association of American Colleges and Universities. The Academy in Transition Series.

Klein, J.T., & Doty, W. (Eds.). 1994. *Interdisciplinary Studies Today*. San Francisco: Jossey-Bass. New Directions in Teaching and Learning series.

Klein, J.T., & Newell, W.H. 1997. "Advancing Interdisciplinary Studies." In *Handbook of the Undergraduate Curriculum: A Comprehensive Guide to Purposes, Structures, Practices, and Change*, ed. Jerry Gaff & James Ratcliff, pp. 393-415. San Francisco: Jossey-Bass.

Newell, W. (Ed.). 1998. *Interdisciplinarity: Essays from the Literature*. New York: The College Board.

Smith, B., & McCann, J. 2001. *Reinventing Ourselves: Interdisciplinary Education, Collaborative Learning, and Experimental Education in Higher Education*. Bolton, MA: Anker.

In addition, the aforementioned K-16 volumes—Fiscella and Kimmel (1999) and Klein (2002)—belong in both K-12 and college libraries.

Beyond the recency of this list, its publication history is striking. The majority of references were issued by educational presses and professional organizations, not academic presses. In K-12, professional organizations such as the Association for Supervision and Curriculum Development (ASCD) and the National Middle School Association (NMSA) have played primary roles. Allyn and Bacon, a commercial house that covers the education field, published the Clark and Agne volume (1997), as well as Nowicki and Meehan's recent *Interdisciplinary Strategies for English and Social Studies Classrooms: Toward Collaborative Middle and Secondary Teaching* (1997). Teachers' College Press specializes in publications on education and Educational Research Services (ERS) meets the research and information needs of school districts, staffs, teachers, school boards, and the public. The Appalachia Educational Laboratory (AEL) is a regional research and development laboratory for the states of Kentucky, Tennessee, Virginia, and West Virginia; it also operates as an ERIC Clearinghouse on Rural Education and Small Schools.

The college list is similar. Oryx Press published Davis's book (1995) in conjunction with the American Council on Education. Eventually it was sold to Greenwood Press, which published the Haynes volume (2002). The College Board is a non-profit educational association that sponsors ongoing collaboration of schools, colleges, universities, education systems, and organizations. Jossey-Bass, the most prolific publisher on higher education, issued the Klein and Doty volume (1994) in its New Directions in Teaching and Learning series. In 1986, the Association for Integrative Studies (AIS) established itself as a publisher in order to print the first edition of *Interdisciplinary Undergraduate Programs: A Directory*, compiled by William Newell. A decade later AIS interested Copley, which publishes customized texts for interdisciplinary and general education courses, in bringing out an updated volume compiled by Alan Edwards, Jr. (1996).

We would add that one of the most important strategies is determining a home for pertinent materials. An area of the library or a curriculum or teaching and learning office might house a dedicated collection and ideally include a computer for ongoing database searching. Separate interdisciplinary collections or shelves, though, have drawbacks. They can actually discourage people from thinking more broadly about a subject. On the other hand, some topical or focused collections do work well and, when possible, duplicated copies of key materials are well advised. Women's studies pro-

grams, for example, tend to require that a library have a large enough budget to get duplicate copies of some key works. Students can participate in the task of locating resources, in conjunction with their courses, for directed studies credit or for part-time employment as student assistants. As education in how to use the library has shifted toward a more interdisciplinary approach to information literacy, the convergence of critical-thinking and problem-solving skills with information access has magnified. An integrative approach to information gathering in the classroom underscores the fundamental tenets of integrative learning, heightening awareness of, and the ability to, synthesize insights from multiple perspectives. Indeed, one of the most powerful ways of comprehending the parameters of subject or disciplinary matter is by understanding its bibliographic structures and conventions (Searing 1996, p. 323).

Professional Organizations

Even a concept as traditional as a professional association becomes slippery when applied to interdisciplinarity. Most educators maintain membership in subject or disciplinary associations. Interdisciplinary organizations are typically a second home. In some cases, the two categories are combined. NMSA has been a primary professional voice for integrated and core curriculum. ASCD publishes many relevant books, media kits, and classroom materials. In college, interdisciplinary interests are served by a number of organizations, from the massive Professional and Organizational Development Network in Higher Education (POD) to the smaller Association of Graduate Liberal Studies Programs (AGLSP). Other groups with large memberships—such as the Society for Values in Higher Education (SVHE), the Association for General and Liberal Studies (AGLS), and the National Collegiate Honors Council (NCHC)—include interdisciplinarity as one of their objectives.

Organizations that play a direct and sustained role, however, tend to be smaller. The recent membership directory of ASCD's K-12 Interdisciplinary Curriculum and Instruction Network lists just under 200 people. AIS bills itself as the professional home for collegiate interdisciplinarians, though it has a current active membership of fewer than 400 people out of the tens of thousands of individuals engaged in interdisciplinary studies; its annual conferences seldom draw more than 150 people. Nonetheless, such groups are primary sites for information and collegial support. The National Association for Core Curriculum's *The Core Teacher*, the AIS journal *Issues in Integrative Studies*, the quarterly *AIS Newsletter*, and the electronic mailing list INTERDIS keep members posted on new publications, program models, and

conferences.

Even steady contact with primary organizations is not enough. The search for resources must widen to locate material published by other organizations with an occasional interest in interdisciplinarity. This topic has been addressed in *The Advising Quarterly*. ASCD's *Curriculum Update* and the bi-monthly publication of the National Association of Secondary School Principals, *Curriculum Report*, have issued periodic reports. In K-12, the journal *Educational Leadership* has presented special features. In college, the *Journal of General Education* (*45*[2] in 1996) and *The European Journal of Education* (*27*[3] in 1992) have also published special numbers. SVHE's *Soundings: An Interdisciplinary Journal*, exemplifies a typical pattern in college. The editorial policy invites "essays that open disciplines to each other." Interdisciplinarity is not necessarily an explicit focus, though, and the primary literature Newell identified is seldom cited. Nonetheless, articles in *Soundings* lead to a wider range of resources, especially connections in liberal education, ethics, higher education reform, and a host of particular interdisciplinary fields.

The net of relevant resources must also include disciplinary and professional organizations serving particular fields. In researching such groups, Nelson Bingham found that the majority of interdisciplinary organizations tend to focus on a particular topical area: a subset of people (e.g., women, ethnic groups), a specific area of application (technology, child development), or a content area (environment, religion, systems research) (1994, p. 90). Their specialized literatures and materials comprise a vital tier of resources.

Specialized Literatures

Educators across K-16 confront the "duality of the interdisciplinary search task" (Bartolo & Smith 1993, p. 347). They need to find information in other disciplines but often lack knowledge of them. Time and attitude are critical factors. Venturing away from an area of expertise changes professional roles and relationships, shifting self-identify from expert to learner. Human resources are as important as material resources. Colleagues with expertise in a particular discipline are valuable sources of materials and advice, as guest lecturers in classes and for joint research activities. Students can and should be involved in the process, not only in selecting topics and ferreting out resources, but also in designing and evaluating programs. Their assistance becomes part of the learning process as well.

Relevant resources may be hard to identify because each discipline

defines a topic in ways that exhibit its distinctive concepts, theories, methods, and language. Both teachers and students need to put on the lenses of other subjects or disciplines in order to understand their characteristic worldviews. Interdisciplinarity is suffused with a sensibility of context. The most fruitful resources not only shed light on a particular theme or problem, they exhibit the common perspectives, assumptions, premises, and values of a specialist audience. Asking *what* is said and *why* aids in reconstructing an image of who formulates the characteristic questions, statements, and inquiries of a discipline. Comparisons of perspectives and kernels of insight facilitate a more comprehensive perspective and a larger nugget of insight. The level of sophistication will vary by age group, but even in primary school, teachers may engage students in thinking about how a particular person—an artist or a scientist, a historian or a biologist—envisions a topic.

A good strategy is also a long-term strategy. Remaining alert to the conferences and publications of specialized groups will continue to yield information on new developments and resources. In K-12, articles on interdisciplinary curriculum have appeared in *The English Journal*, *Language Arts*, *The Science Teacher*, and other field-specific publications. In college, *Teaching History*, *Chemical Education,* and other discipline-specific journals publish course and program descriptions as well as discussions of historical and theoretical developments. Specialized journals also occasionally devote issues and sections to interdisciplinary interests in their immediate areas. In defining an interdisciplinary literature, Newell (1998) drew on scholarship in journals as varied as *German Quarterly*, *Political Psychology*, *Social Science Journal, Sociology of Health and Illness*, *American Music Teacher,* and *Art Bulletin*. However, relying on journals is not enough. Organizational newsletters are important sources of updated information. A survey of women's studies literature showed surprising reliance on the newsletters of women's organizations as sources of information. Yet action-oriented publications are rarely found in school and college libraries (Searing 1992).

The importance of ERIC cannot be overstated. ERIC (Educational Resources Information Center) is a cornucopia of information on content areas and models of integrating curriculum in K-12 and college. It captures information that might otherwise remain invisible. ERIC is comprised of two indexes and abstracts: *Resources in Education* (RIE) and *Current Index to Journals in Education* (CIJE). Available separately in print, the two are combined in the electronic ERIC database that is available without fees at *www.eric.ed.gov*. RIE indexes and abstracts unpublished literature such as conference proceedings and presentations, reports, curriculum models, and

course syllabi. CIJE indexes and abstracts journal articles. AskERIC is an Internet-based, question-answer service for teachers, administrators, library personnel, and the public. It may be accessed through the prior URL or www.askeric.org (Kimmel 1999, p. 298).

One of the most important allied literatures focuses on innovative pedagogies. Although the discussion is widely dispersed, several recent books directly define the link to interdisciplinarity. Clarke and Agne's (1997) *Interdisciplinary High School Teaching* examines the role of inquiry-based learning, writing, thinking, computer processing, problem-based learning, and constructivist and experiential learning. *Interdisciplinary General Education: Questioning Across the Lines* (Seabury 1999), which reflects on the experience of the University of Hartford's All-University Curriculum, explores the role of problem-based and experiential learning, collaborative teaching, and teaching diversity, values, and critical thinking. The AIS-sponsored volume *Innovations in Interdisciplinary Teaching* (Haynes 2002) explores the link in colleges between collaborative learning and learning communities, feminist pedagogy and multicultural pedagogy, team teaching, writing-intensive teaching, inquiry-based and performance-based teaching and learning, as well as advising, assessment, technology, lifelong learning, and study abroad.

Linkages with specialized literatures also underscore the importance of the third area—networking.

Networking

In offering advice on networking, Bingham stressed the importance of creating multiple networks composed of individuals, programs, and organizations (1994). Other educators are often the best way of learning about materials for teaching particular themes and problems, as well as particular knowledge fields and integrative pedagogies. Asking direct questions about resources not only expedites access, it alerts other groups and individuals to the extent of shared interests. Those who seek usually have something to offer. A good networking plan also operates across global, regional, and local levels. At the global level, attending national conferences and subscribing to publications of key groups assures that one remains up to date and lessens the sense of isolation that many individuals experience. Organizational electronic mailing lists and bulletin boards are available in all subjects, disciplines, and interdisciplinary fields. The Directory of Scholarly and Professional E-conferences (*http://www.n2h2.com/KOVACS/*) and H-NET (http://www.hnet.msu.edu/lists) are excellent places to locate electronic mailing lists. In addition, current models of interdisciplinary courses and programs can be

identified by using key directories and compilations (e.g., Edwards 1996, Davis 1995, Clark & Agne 1997), checking the Web sites of key organizations (e.g., AIS, Coalition of Essential Schools), and following the advice on database searching cited below.

Clarke and Agne's *Interdisciplinary High School Teaching* (1997) exemplifies the regional level. They drew on a network of schools and individuals across New England. State and area service centers, government education offices, archives, and other information services are good sources for contacts and even pertinent materials. The Wisconsin Department of Public Instruction, for instance, developed a general framework for teaching patterns of thinking in interdisciplinary high-school curricula, focusing questions that guide student planning and help in monitoring progress. Local and regional libraries and archives are useful as well. A Diversity Librarian at the University of Michigan, for example, was charged with developing and managing interdisciplinary collections in minority studies, sexual orientation studies, and multicultural studies. Comparable positions have been created around the country in women's studies and in environmental resources. Broad subject clusterings of specialized holdings, evidenced by the trend toward merging separate science collections into a general science information service, further support interdisciplinary needs (Searing 1996, p. 317, p. 322).

The local level is equally important. Every geographical area has historical, scientific, and cultural resources that can be tapped. In a health-oriented unit or course, to illustrate, a teacher or a core staff can draw on school staff such as the school nurse, parents, and community members, including physicians and public health workers. For a college course on global issues, members of the economics and political science departments, as well as local political and industrial leaders, can be asked for advice and even guest lectures. Environment- and history-based courses across K-16 often build on local community problems and draw on local human and material resources. In college, regional studies, such as Appalachian or Adirondacks programs, have incorporated field-based experiential learning.

The most local level is the same school building or campus. Across K-16, educators are often unaware of what the person in the next room or building is doing. Lack of awareness results in duplication of curriculum and loss of integrative opportunities. Heidi Hayes Jacobs's (1997) model of curriculum mapping provides an internal, bottom-up way of identifying what is actually happening in a curriculum and possibilities for joint planning and teaching. In one school, curriculum mapping led to a collaborative ninth-grade unit on Japan among an English teacher, a social studies teacher, and

an art teacher (pp. 21-22). College faculty are also unaware of potential connections. One planning group—designing an interdisciplinary, general education curriculum—worried about how to involve the agriculture school, which was located on the periphery of both the physical campus and the general education effort. When queried, the planning group commented that one of the projected themes was hunger. Once the relationship between the topic of hunger and the presence of faculty in agriculture was perceived, a separation became a connection.

Electronic Database Searching[1]

Of necessity any portfolio of research strategies today includes online resources. A search of WebQuests (*http://webquest.sdsu.edu/*) using the keyword "interdisciplinary" will yield a wealth of curriculum resources in K-12. Another good site is ThinkQuests (*http://www.thinkquest.org*). Key sites for college include the National Learning Communities Project Web site (*http://learningcommons.evergreen.edu*) and the AIS Web site (*http://www.muohio.edu/ais/*). Numerous scholarly and professional discussion groups also cover a wide range of disciplinary and interdisciplinary topics. Some are open to anyone, but others restrict access to members of the sponsoring group. A number of services gather and evaluate information Web sites. For instance, Argus Clearinghouse (http://www.clearinghouse.net/) and Scout Report (http://scout.wisc.edu/report/sr/current) identify electronic mailing lists, as does the humanities- and social science-based H-NET (http://www2.h-net.msu.edu/lists).

The Scholarly Societies Project of the University of Waterloo Electronic Library is a clearinghouse with links to interdisciplinary interests and individual Web sites. It connects to over a thousand professional associations (http://www.lib.uwaterloo.ca/society/overview.html). In addition, the Web site of Anthony Judge (laetusinpraesens.org/links/webkon.php) offers a compilation of Web sites on integrative knowledge and, in the realm of sustainability, SAGUFNET/The Swiss Academic Society of Environmental Research and Ecology provides bibliography and information services, a discussion forum, and links to other sites (http://www.transdisciplinarity.ch).

The challenge of locating knowledge and information is compounded in interdisciplinary projects by the problem of "scatter." Pertinent sources are dispersed across multiple disciplines, professions, and interdisciplinary fields. Consequently, interdisciplinary searching requires going beyond the usual search for books and periodicals. Many online disciplinary, multidisciplinary, or topic-oriented databases are only available in their

complete form through subscription, but they may well be available in the local academic library. That is always the first place to check.

Other useful resources include specialized databases and multidisciplinary print and online indexes and abstracting services. The Wilson Indexes cover 200-400 selected journals in disciplinary clusters (e.g., General Science, Applied Science and Technology, Social Sciences Index, Humanities, Art, Business, Education). Print and online encyclopedias, dictionaries, and handbooks also provide entry into fields that may be new to a scholar. As always, consulting with librarians will also yield pertinent resources in special collections, archives, and specialized libraries.

The Institute for Scientific Information (ISI) merits special mention. Their products cover the most frequently cited journal titles. The Current Contents® database makes available tables of contents for journals in arts and humanities, social sciences, and sciences. The citation indexes (Arts and Humanities Citation Index™, Social Science Citation Index™, Science Citation Index™) help in tracing how a seminal article has been used in more recent articles, tracking forward in time.

Another dimension of the challenge of scatter is identifying synonyms or alternative terminology appropriate to particular databases outside one's field. As Stacey Kimmel (1999) suggests, because new interdisciplinary terms and topics may run ahead of existing subject headings, the first step may be to "retrofit" them or, if matches can't be found, to engage in free-text searching. Carefully constructed "keyword" searches will produce a wider overview of resources. The issue of terminology arises particularly in what is sometimes called "federated searching."

Federated searching is the use of an interface that allows simultaneous integrated access to or searching of a variety of databases. It may be used across databases provided by one vendor or a software that will search across databases from different producers or vendors. Federated searching allows efficient grouping of databases useful for interdisciplinary or multidisciplinary topics. To reiterate, the terminology of an interdisciplinary topic may vary across fields, and search strategies in federated searching must take that factor into account. (One source of information on federated searching is a PowerPoint presentation by Cheri Duncan of James Madison University [www.viva.lib.va.us/viva/tech/cat/link/Federated%20Searching.ppt].)

Alert services can also be set up for subscription databases through vendors, such as OVID, that will run a search each time the selected database is updated. The alert provides a list of citations corresponding to the search

without having to run it at regular intervals. This service is particularly help-ful with databases that provide tables of contents of scholarly journals, such as Project Muse.

Finally, numerous useful sources of information are freely posted on the Internet by individuals, associations, or institutions that can be identi-fied by using search engines such as Google™. Beaucoup! (www.beaucoup.com) lists search engines, Web page indices, and directo-ries. Authors of rich Web sites write contextual information, list bibliographic information for seminal books or journal articles, and annotate links to re-lated Web sites. Such sites are capable of integrating a variety of resources and communicating the interdisciplinarity of topics. For instance, the Voice of the Shuttle (vos.ucsb.edu/) covers the humanities. Begun as a series of static pages, it has been reorganized as an extensive open-ended database that continues to grow.

Professional Development

While studying interdisciplinary teaching in Brazilian schools, Ivani Fazenda (1995) discovered an indiscriminate proliferation of practices. In Brazil, as in the United States and Europe, the number of educational projects with the word "integration" and "interdisciplinary" in their titles has increased dra-matically. Yet many usages arise from intuition or trendiness: "In the name of interdisciplinarity, established routines are condemned and abandoned, and slogans, nicknames, and working hypotheses are created which many times are improvised and ill-considered" (p. 7). Heidi Hayes Jacobs concurs: "I can't tell you how many times," she laments, "I've been in a school and seen good intentions gone astray" (cited in "Curriculum Integration" 1995, p. 76). Klein and Newell expressed similar concerns about college (1997, p. 408).

In K-12, the topic of revisioning teacher education has generated wide debate. Recommendations include limiting the number of education courses, requiring more time in field settings, creating new routes to teacher certification that bypass post-secondary education, establishing state-level training programs for teachers and administrators, placing greater emphasis on staff development, restructuring schools as "learning organizations," and providing more information about new practices. Newer middle-level certi-fication programs call for at least modest depth in more than one field, and study in additional areas, at the same time, undergraduate education is being rethought to cultivate liberal learning and integrative capacity in all fields (Hawley 1993; Vars 1993, p. 17). Across K-16, moreover, a generation of

teachers is appearing in classrooms with interdisciplinary experience themselves, as students. However, the majority of teachers still learn on the job. They also tend to retain an identity with their original disciplines and a sobering reality in the midst of major change in the teaching core of the United States; they do not necessarily have adequate knowledge of their own disciplines, let alone the complexity of interdisciplinary teaching and learning.

Professional development forums should be part of any strategy. To help middle-school teachers learn about interdisciplinary instruction, the Department of Education in Colorado started an Interdisciplinary Core Academy where teams can work on developing units (Willis 1992). ASCD has identified other professional development opportunities for K-12 teachers in related teaching areas and at institutes on integrating curriculum. College teachers, in turn, are served by a number of groups. The annual Asheville Institute on General Education, co-sponsored by the Association of American Colleges and Universities (AAC&U), includes some attention to interdisciplinarity, and the AAC&U Network for Academic Renewal once hosted a conference on interdisciplinary studies in collaboration with AIS. The Association of Graduate Liberal Studies Programs has offered workshops, prior to their annual conferences, on setting up Master of Arts in Liberal Studies programs. On occasion, workshops at annual meetings of AAC&U and the AAHE have addressed interdisciplinary issues. The Institute in Integrative Studies at Miami University is a faculty development program that trains college teachers in curriculum development and pedagogy. A group of the institute's participants joined in authoring a special issue of the *Journal of General Education* (*45*[2], 1996). The issue features theoretical reflections on their work and a pragmatic "Guide to Interdisciplinary Syllabus Preparation." The guide was developed by David Flaten, revised by participants in subsequent institutes and by AIS members, and published in Newell (1998, pp. 97-99).[2]

An example that extended across K-16 illustrates the rich variety of outcomes that can emerge from a summer institute (Tchudi & Lafer 1993). Thirty teachers who participated in a two-week institute, The Truckee River Community Project, went back to school themselves. The institute focused on language arts by reading texts, writing journals, workshops conducted by Nevada writers, and culminating projects. The overall theme, "Water in the West," guided the activities, combined with a Nevada Humanities Council program or a midsummer *chautauqua*. The activities included taking field trips on the river, visiting the Lahontan Reservoir in order to learn about the region, and preparing teaching materials for fall classes. A striking variety of

projects resulted:

- teachers from an elementary school developed a month's worth of activities related to the river, then expanded it to a year-long theme study of communities for the entire school;
- a middle-school media specialist and a senior high English teacher compiled a Nevada-water-desert bibliography for young readers;
- a middle-school teacher helped students map out a bicycle tour that retraces the passage of pioneers throughout the region;
- a teacher in a new interdisciplinary high school linked the water theme to a larger team focus on communities and survival;
- a literacy teacher at a Job Corps center incorporated Nevada interdisciplinary materials into her program;
- a college instructor based a writing course on Nevada issues and the theme of water.

The teachers from Brown Elementary School in Reno, who developed a month-long series of activities, were later commissioned by the Nevada State Council of Teachers of English and the Nevada Humanities Committee to revise their material for publication, resulting in *Teaching Nevada: An Interdisciplinary Approach* (cited in Tchudi & Lafer 1993).

The Truckee River Institute illustrates an added lesson. It was financed by the Nevada Humanities Council and the Pacific Telesis Foundation. Local, state, and federal agencies, as well as private agencies, should all be considered when seeking support. The Fund for the Improvement of Post-Secondary Education (FIPSE) has been foremost among federal programs for college educators. The series Lessons Learned from FIPSE Projects examined recently completed projects for evidence of "What Worked, What Didn't, and Why." Some programs are ongoing, others occasional. In 1993, the National Endowment for the Humanities (NEH) joined with the National Science Foundation (NSF) and FIPSE in funding an Asheville Institute on Interdisciplinary General Education that targeted improving connections between science and humanities. In 1995, NEH funded a summer workshop on interdisciplinary teaching offered by AGLSP. The annual Lilly [Foundation] Teaching Conferences are also devoted to promoting innovations. When contacting organizations that have issued calls for interdisciplinary proposals, inquiring about past initiatives may lead to further information, ideas, and contacts. Dissemination plans in grant reports are also good sources of additional information. Just as the librarian or information specialist should be

consulted early, the staff member of a school, district, or campus who monitors funding programs should be involved from the start as well.

Across K-16, team teaching continues to be a vital forum for professional development as well as curriculum building. One of the reasons middle schools have been a continuing site of team teaching is that their faculty are adult cooperative learners who have a sense of community and feel part of the school decision-making process (Jacobs in Brandt 1991, p. 86). Informal alliances can also be powerful. At the University of North Carolina, Asheville, faculty members formed "teaching circles" to talk about effective teaching in Asheville's humanities-based interdisciplinary general education program. While college teaching has never been served by the ongoing system of in-service and teacher development typical of K-12, the need for teacher development has given rise to campus teaching and learning centers, which, in turn, have brought wider attention to professional development for college teachers. Interdisciplinarity is a common topic on the agendas of such centers.

The earlier advice about networking provides a final means of ongoing professional development for both individuals and groups. Any curriculum must evolve from the participants. Yet, time spent formulating questions and answers that are already addressed in the literatures is time lost. Model syllabi, sample units and lessons, and activity kits are valid starting points. ASCD and ERIC, to reiterate, are abundant sources of classroom materials. AGLSP has produced packets of information on graduate liberal studies programs and syllabi that may be used or adapted in undergraduate contexts. Networking with peer institutions and parallel programs is an added way of finding curriculum models, sample syllabi, texts, and pedagogical strategies.

Conclusion: Toward a "Critical Colleagueship"

Ultimately all interdisciplinarians, whether in K-12 or in college, need to develop a "critical colleagueship." Although he was not talking about interdisciplinarity—rather the challenge educators face in working with subject-area standards—Brian Lord's (1994) concept of "critical colleagueship" is rooted in a common challenge. All educators must learn to work with new structures and knowledges. The traditional teacher-training model, however, is inadequate for this challenge. The traditional model reflects a view of teaching and learning that is at odds with many reform initiatives. The toolbox of renovations is small, and conceptualization of the teaching profession centers on a reductive set of behaviors, skills, and items of knowledge to be

applied in classrooms. Teaching, however, is an "uncertain craft," defined by complex relationships and fluid situations that create mismatches between teacher preparation and student needs. Critical colleagueship is a form of professional development that fosters self-reflection, collegial dialogue, and ongoing critique. Through greater reflectiveness and sustained learning, teachers are able to think more deeply and to experiment more thoroughly with novel ways of teaching.

The shared intellectual values of teaching and learning that Lord defined for subject-matter areas are also crucial in interdisciplinary contexts: being open to new ideas, being willing to reject weak practices and flimsy reasons, accepting responsibility for acquiring and using relevant information, being willing to seek out the best ideas and the best knowledge, relying on organized and deliberative investigation instead of learning by accident, and assuming collective responsibility for creating a professional record of research and experimentation. Critical colleagueship, Lord suggests, is in many respects a local activity. Small groups of teachers form "communities of interest" that cut across all of their activities. However, "collective generativity" is also required. The broad community of resources, human and material, must inform local judgments and practices. There is no magic bullet, but a robust portfolio of resource strategies that draws on local, regional, and global levels, is a substantial investment in doing the job well.

Biographical note: Julie Thompson Klein is Professor of Humanities in the Interdisciplinary Studies Program at Wayne State University, a former president of the Association for Integrative Studies, and has served as editor of *Issues in Integrative Studies*. She consults widely, both nationally and internationally, on interdisciplinary research and education. Her books include *Interdisciplinarity: History, Theory and Practice* (1990) and *Crossing Boundaries: Knowledge, Disciplinarities, and Interdisciplinarities* (1996); the co-edited volumes *Interdisciplinary Studies Today* (1994) and *Transdisciplinarity: Joint Problem Solving Among Science, Technology and Society* (2000-2001); and the AACU monograph, *Mapping Interdisciplinary Studies Today* (1999).

William Newell was founding president of AIS in 1979 and has served since 1983—first, as secretary-treasurer and newsletter editor and then as executive director. He compiled *Interdisciplinary Undergraduate Programs: A Directory for AIS* in 1986, and edited the AIS-sponsored anthology, *Interdisciplinarity: Essays from the Literature*, in 1998. He has published over twenty-five articles and chapters on interdisciplinary studies; guest edited two journals; and served over seventy times as consultant or external evaluator to colleges and universities in the United States, Canada, and New Zealand. He directs the Institute in Integrative Studies and, in his spare time, is a professor in the School of Interdisciplinary Studies at Miami University.

Notes

1. All URL addresses were verified on 15 and 16 June 2003.
2. For information on the Institute in Integrative Studies at Miami University, contact Director William Newell at *newellwh@muohio.edu*.

References

Bartolo, L.M., & Smith, T.F. (1993). Interdisciplinary work and the information search process: A comparison of manual and online searching. *College and Research Libraries*, *54*(4), 344-53.

Bingham, N. (1994). Organizational networking: Taking the next step. In J.T. Klein & W. Doty (Eds.), *Interdisciplinary studies today* (pp. 85-91). San Francisco: Jossey-Bass. New Directions in Teaching and Learning series.

Brandt, R. (1991, October). On interdisciplinary curriculum: A conversation with Heidi Hayes Jacobs. *Educational Leadership*, 24-26 (Available in the 1995 *Integrated Curriculum* [pp. 85-87] from the Association for Supervision and Curriculum Development, Alexandria, Virginia. An ASCD Select packet).

Clarke, J.H., & Agne, R.M. (1997). *Interdisciplinary high school teaching: Strategies for integrated learning*. Boston: Allyn and Bacon.

"Curriculum Integration." (1995). *ASCD Update*, *32*(1), 1-2 (Available in the 1995 *Integrated Curriculum* [pp. 75-76] from the Association for Supervision and Curriculum Development, Alexandria, Virginia. An ASCD Select packet).

Davis, J.R. (1995). *Interdisciplinary courses and team teaching: new arrangements for learning*. Phoenix, AZ: American Council on Education, Oryx.

Edwards, A.F. (1996). *Interdisciplinary undergraduate programs: A directory* (2nd ed.). Acton, MA: Copley.

Fazenda, I.C.A. (1995). Critical-historical review of interdisciplinary studies in Brazil. *Association for Integrative Studies Newsletter*, *17*(1), 1, 2-9.

Fiscella, J., & Kimmel, S. (1999). *Interdisciplinary education: A guide to resources*. New York: The College Board.

Grossman, P., Wineburg, S., & Beers, S. (2000). Introduction: When theory meets

practice in the world of school. In S. Wineburg & P. Grossman (Eds.), *Interdisciplinary curriculum: Challenges to implementation* (pp. 1-16). New York: Teachers' College Press.

Hawley, W.D. (1993). New goals and changed roles: Re-visioning teacher education. *Educational Record*, *74*(3), 27-31.

Haynes, C. (Ed.). (2002). *Innovations in interdisciplinary teaching*. Westport, CT: Greenwood Press.

Jacobs, H.H. (1997). *Mapping the big picture: Integrating curriculum and assessment K-12*. Alexandria, VA: Association for Supervision and Curriculum Development.

Kimmel, S. (1999). Interdisciplinary information searching: Moving beyond discipline-based resources. In J. Fiscella & S. Kimmel, *Interdisciplinary education: A guide to resources* (pp. 293-309). New York: The College Board.

Klein, J.T. (Ed.). (2002). *Interdisciplinary education in K-12 and college: A foundation for K-16 dialogue*. New York: The College Board.

Klein, J.T., & Doty, W. (Eds.). 1994. *Interdisciplinary studies today*. San Francisco: Jossey Bass. New Directions in Teaching and Learning series.

Klein, J.T., & Newell, W.H. (1997). Advancing interdisciplinary studies. In J. Gaff & J. Ratcliff (Eds.), *Handbook of the undergraduate curriculum: A comprehensive guide to purposes, structures, practices, and change* (pp. 393-415). San Francisco: Jossey-Bass.

Lord, B. (1994). Teacher's professional development: critical colleagueship and the role of professional communities. In N. Cobb (Ed.), *The future of education: Perspectives on national standards in America* (pp. 175-204). New York: The College Board.

Newell, W. (Ed.). (1998). *Interdisciplinarity: Essays from the literature*. New York: The College Board.

Nowicki, J.K., & Meehan, K.F. (1997). *Interdisciplinary strategies for English and social studies classrooms: Toward collaborative middle and secondary teaching*. Boston: Allyn and Bacon.

Palmer, C. (Ed.). (1996). Navigating among the disciplines: The library and interdisciplinary inquiry [Special issue]. *Library Trends*, *45*(2), 129-366.

Seabury, M. (Ed.). (1999). *Interdisciplinary general education: Questioning across the lines*. New York: The College Board.

Searing, S. (1992). How libraries cope with interdisciplinarity: The case of women's studies. *Issues in Integrative Studies*, *10*, 7-25.

———. (1996). Meeting the information needs of interdisciplinary scholars: Issues for administrators of large university libraries. In *Library Trends*, *45*(2), 315-42.

Tchudi, S., & Lafer, S. (1993). How dry is the desert? Nurturing interdisciplinary learning. *Educational Leadership*, *49*(2), 76-79.

Vars, G.F. (1993). *Interdisciplinary teaching: Why and how* (Rev. ed.). Westerville, OH: National Middle School Association.

Willis, S. (1992, November). "Interdisciplinary learning: Movement to link the disci-
    plines gains momentum." *Curriculum Update*, 1-8. (Available in the 1995
    Integrated Curriculum [pp. 77-84] from the Association for Supervision
    and Curriculum Development, Alexandria, Virginia. An ASCD Select
    packet).