Institute for Academic Technology

Inaugural Reflections from an Institute

William H. Graves, James S. Noblitt, and Gerald L. Hefley

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Technology in Higher Education: Current Reflections

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The Institute for Academic Technology on the campus of the University of North Carolina at Chapel Hill is a university/industry collaboration designed to advance the educational value of affordable technologies. A broad spectrum overview of the program's goals from the director's perspective, a discipline specific faculty view of participation in the Institute's program, and the industry participant's rationale for supporting the progrom are offered.

Contents

A Personal Perspective on Instructional Computing: A New Vendor-Supported National Program

William H. Graves

The Charge

Will Rogers has provided a quote that I often use to conclude a presentation on trends and issues in instructional technologies. He said that, "You can be on the right track and still be run over." Many colleges, universities, and individual scholars have picked a particular track in instructional computing. They may or may not find solace in my view that being run over is somewhat inevitable. In the interest of understanding the speed and location of the on-coming train and the variety of ways that fellow travelers are dusting themselves off and getting back on their particular tracks to success, the Publisher and the Editor of *Academic Computing* have invited my reflections on instructional computing. (All of the articles in this first issue appeared in *Academic Computing*, October 1989 and are collected here to introduce you to the Institute and its goals and aspirations. W.H.G.) I will have an annual opportunity to offer a personal viewpoint and to solicit two accompanying articles to amplify or counterbalance my perspective. For reasons that will become clear, I asked Professor James Noblitt of Cornell University's Department of Modern Languages and Linguistics and Dr. Gerald Hefley of IBM's Academic Information Systems (ACIS) to contribute articles to this, my first report.

The Response

In agreeing to prepare an annual article on instructional computing in these pages, I acted on the two basic beliefs that:

- Affordable interactive technologies can add value to teaching and learning.
- Academe's traditional tentativeness in matters of curriculum revision and innovation argue for a national dialogue and national action on the nature/nurture issues implied by the complexity and cost of developing and employing such technologies.

The first assertion is confirmed by the growing list of EDUCOM/NCRIPTAL award winning software. The second fuels my resolve to focus less on new exemplars of educational applications — already broadly reported in these pages — than on underlying issues of infrastructure and governance that invariably and animatedly surface when instructional computing is seriously discussed in academic circles.

The Personal Context and Goal

Parts of this report are adapted from the EDUCOM book cited by the Editor in his description of my background. Indeed, the issues discussed here are exemplified by the experiences reported in the book, which is organized around the following three intertwined academic perspectives:

1) *Faculty perspectives*: The seven winners of EDUCOM/NCRIPTAL's "Best" awards for 1987 describe their experiences to lend a distinct faculty perspective to a variety of pedagogical, institutional, personal, and professional issues inherent in software development and use.

2) *Curriculum perspectives*: Recent reports have cited several problems with secondary and postsecondary basic curricula that jeopardize the quality of the nation's overall baccalaureate program. In their contributed articles, two national faculty groups representing two keystone curricula in higher education, writing programs and foreign language

programs, assess technology's current impact on their respective fields and explore its future role.

3) *Institutional perspectives*: This cross section of nine institutional case studies reveals various models for supporting instructional computing and how such support is transforming the affected academic programs.

The scope of the EDUCOM book should reassure the reader that this and subsequent annual reflections on instructional computing will draw on extensive contact with leaders in the "evolution," especially with my fellow IBM ACIS Consulting Scholars and the contributors to the EDUCOM book. My interpretation of the experiences of these leaders combines with personal experience to anchor my belief that partnerships between a vendor and higher education not only can be mutually beneficial in obvious ways, but can be conducted without compromise to academic flexibility and academic integrity. Because it was created to respond to what I believe are some of today's major issues in instructional computing, the Institute for Aacademic Technology (IAT) will be the focal point for this article.

My goal is to discuss some of the issues that impede progress in instructional computing or — as I earlier phrased it — that lead to the inevitability of being run over. My style, however, will be indirect. I will outline a rationale for creating the Institute for Academic Technology, thus identifying along the way some major issues in instructional computing while answering two questions. What is the IAT? Why did UNC-CH and IBM ACIS enter into a partnership to create it? Dr. Hefley, who is the IBM liaison to the Institute, offers an IBM perspective on the IAT in his article, "IBM and Higher Education: A Continuing Partnership." Professor Noblitt is a Fellow of the Institute on leave from Cornell to lead an IAT working group focusing on foreign language applications and, more generally, the "humanist's workstation." In his article, "Technology and Language Learning," he attempts to communicate to the general reader the issues in information technology which have a direct impact on language teaching methodology.

Why a National Approach?

Technological entrepreneurs have led the way in higher education's silicon evolution, but the efforts of these scholar/teachers, schools, granting agencies, and vendors have suffered from an overall unfocused shotgun effect expected of early grass roots activity. Too many individuals have been "run over." Too few applications

- have addressed major national educational problems,
- have attained more than local acceptance,
- have been implemented with attention to the need for common interfaces,
- are tools that can be adapted to individual instructional needs and styles, and
- are designed with a clear path for migration onto evolving hardware/software systems — upward technological mobility.

Too many promising paths have thus led to deadends for want of a critical mass of expertise, resources, and collective direction setting. To move beyond the victories and lessons of the past few years will require a national focus on faculty needs and those important educational problem areas to which technology might make its most valuable contributions. The Institute for Academic Technology was created to address these shortcomings and to provide an opportunity at the national level for faculty to influence the directions of academic technologies. Indeed, the cornerstone philosophy of the IAT is that educational needs and priorities should lead, rather than react to, the development of affordable academic technologies.

Educational Priorities

We who have served on curriculum committees, whether focused on general education or on a discipline or profession, know how difficult it is to reach consensus on educational priorities. The abstracted goals of general education are nevertheless broadly admired and accepted, as is the related proposition that language skills — some combination of spoken and written English, foreign languages, and mathematical languages — are the keystones of both general and specialized education. Several national reports have cited serious cracks in these keystones and have suggested an increased role for instructional technology as a repairing mortar — see AAC, Carnegie Foundation, and NIE references in the Resources section of this magazine. The Institute for Academic Technology intends to focus initially on these keystone areas. Through an Advisory Board comprised of a representative sample of academics and a few leaders from IBM ACIS, the IAT will evolve to address additional areas. Already, for example, there are groups at work setting agendas for other disciplines, such as astronomy.

But, what argument favors a national over a distributed approach on individual campuses? This argument is built around several issues that circumscribe the Institute for Academic Technology.

Academic Complexity

There are by now many exemplars — the EDUCOM/NCRIPTAL award winning applications, for example — to buttress the claim that instructional technologies deserve our attention. But, whose attention? The individual scholar's? The discipline's or profession's? The department's? The institution's? The government's? The private foundation's? The corporate world's? The answer is, in my opinion, "All of the above." Indeed, self-interest, often in the form of institutional or economic competitiveness, provides a rationale for interest and action from across the complex spectrum of higher education's constituent participants, organizational structures, supporters, and clientele. The playing field is thus very complex and often denies a winning effort to projects that do not enjoy the involvement and support of several of the players. In an environment in which both academic computing and academic governance are "distributed," moreover, it is often difficult to locate a focal point for decision and action. Consensus and direction frequently must be forged from forces as diverse as collegial (peer) opinion, institutional leadership, and technical support philosophies and practices. Even when strategic direction emerges on a campus, the cruel hand of resource deprivation often dilutes progress. The promise of instructional technology is too great to ignore, but the "inevitability of being run over" is ever present in the requisite complexity of the academic playing field and the expense of the effort — in personal, personnel, and equipment costs.

What I have labeled academic complexity, then, argues for cooperative partnerships of the kind that EDUCOM, the national academic computing organization, should be encouraged to forge among the various constituencies so integral to progress on instructional computing. Indeed, the EDUCOM Software Initiative (ESI) is designed to be a cooperative, volunteer whole that is wiser and more strongly empowered than the sum of its parts. EDUCOM and its Software Initiative, however, remain largely inaccessible to individual scholars and academic officers who generally do not (and historically have not been encouraged to) participate in the organization and its leadership structures. A current thrust of the ESI, moreover, is to "professionalize" the role of those who support instructional computing on campuses. This thrust, very appropriate in its social and historical context, is not likely to increase faculty participation in the ESI. (The "professionalization" of computing was surely a factor in the early clamor for distributed — departmentally owned — computing resources.) For all its good work and whatever its future directions, the Software Initiative is not, in the final analysis, a source of funding for faculty initiatives. Vendors, however, have often provided such funding. It was through my work on the aforementioned book for EDUCOM (and also through the IBM ACIS Consulting Scholar Program) that I came to realize how often vendor support has built momentum that overcame various forms of academic inertia deriving from academic complexity and academic budgets. Can a partnership supported by a vendor or vendors be structured to extend to all of higher education the mutual benefits that have accrued to so many vendor-supported projects on individual campuses? Although sponsored by one vendor, IBM, and operated by one institution, UNC-CH, the Institute for Academic Technology is a partnership with all of higher education, and it was created to answer this question in the affirmative.

The IAT is an attempt to assemble and support a critical mass of academic interest and expertise in instructional computing, a difficult task for a single department, a single campus, or even a single discipline on a national scale. The Institute seeks to identify, demonstrate, and advance the value that academic technology can add to higher education's basic educational mission and to support and legitimate faculty effort in this new dimension of scholarship. Any plan to achieve these goals should address two related issues that arise in any serious discussion of the educational promise of technology: the effectiveness of instructional technology and its niche in academe's value system.

The Effectiveness of Instructional Technology

Is instructional technology effective? The qualitative nouns enthusiasm, commitment, and involvement often describe the behavior of faculty "technologists" and arguably correlate to their effectiveness as teachers. These qualities are fragile, however, and usually require structural sustenance. The effectiveness question, moreover, is often asked with quantitative connotations and global scope. Can we expect, however, to assess the effectiveness of educational technology more readily than we can assess the other "outcomes of higher education?" How do we assess the other media and materials of teaching and learning? How, for example, do we assess the effectiveness of textbooks? We usually make qualitative judgments about individual textbooks. The costs of developing and delivering textbooks, unlike the costs of developing and delivering software, are built into current educational delivery systems. The question of effectiveness thus looms financially larger for software than for texts and is made more difficult by the relative immaturity of current mechanisms for distributing software. As the marketplace for software matures, the effectiveness issue for software may equate to success in the marketplace and thus result in parity between texts and software.

For now, however, the issue of effectiveness has some of the qualities of a cart-and-horse dilemma. The base of high quality software is growing through the efforts of the EDUCOM/NCRIPTAL winners and others. But, until there is a broader base of educational software of high quality that can be shared nationally, assessing the effectiveness of instructional technologies will remain a largely unrealized but worthy goal. Until peer review of software is better understood and more widely practiced, there will be few incentives, individual or institutional, to increase the software base. Peer review, after all, is a major structural means for recognizing and rewarding meritorious achievement and is an important vehicle for assessing quality and assigning rankings in higher education. The EDUCOM/NCRIPTAL Awards Program, for example, is built around peer review.

One mission of the IAT is to create a better understanding of how to evaluate the effectiveness of technology-based curriculum materials in the peer review contexts that shape disciplinary and professional judgments and rewards.

Instructional Technology and Academic Reward Structures

A typical suggestion for advancing the revolution and not awaiting the evolution is to count software development in rank and tenure proceedings. Perhaps justified in some institutional contexts, this oversimplified approach is largely unrealistic and unjustified. The issue at hand is part of a larger issue typically posed as a question of how to reward good teaching. But, good teaching should be a baseline expectation in higher education and not a response to potential rewards beyond cost-of-living salary increases. The real issue encoded in the phrases rewarding good teaching and rewarding software development is how to encourage, recognize, and/or reward extraordinary achievement or innovation that either identifies or responds to special institutional or departmental needs not accounted for in existing reward structures. A systemic approach to the issue is to develop senior academic leadership — or at least sympathy — for innovation. Must we wait for today's graduate students, who are cutting their academic teeth with technological support, to mature into full professorship before instructional technologies find a niche in academic culture? The IAT is an opportunity to move beyond academic paralysis on this issue, and demographics reveal the timeliness of the opportunity.

According to the 1988 *Digest of Education Statistics*, approximately sixty-nine percent of the nation's tenure-track faculty is tenured, and approximately fifty percent of the tenured faculty is at the rank of Professor. There is ample opportunity, then, to nurture senior interest in the proposition that technology is affecting institutional competitiveness and the health of the disciplines and professions in two ways. It is adding value to existing courses and, in some cases, is altering the very nature of courses and curricula. That these issues are being addressed in senior ranks is evidenced by the number of scholars at the rank of Professor who have won EDUCOM/NCRIPTAL awards or participated in major projects, such as the IBM-funded Advanced Education Projects at nineteen research universities. Professional interest in and facility with technology are not, as they are often postulated to be, the sole domain of the junior faculty.

By supporting scholars from across the nation who contribute to the advancement of instructional technologies in their disciplines and professions, the IAT further legitimates participation in instructional computing. It was created on the premise that technology is here to stay and that educational leadership demands an investment in the nation's faculty that incurs the kind of nonrecoverable, short-term costs that typically cannot be borne by a single campus.

In what ways will the Institute support faculty from across the country and reach out to the national academic community? There are several dimensions to the answer. First, there is an active role for a few recognized leaders in instructional computing in several disciplines.

Disciplinary and Interdisciplinary Leadership: Leaves and Support

Disciplinary and professional societies are the traditional vehicles for attending to problems and opportunities in a particular curriculum. Scholars gather with their own kind at annual meetings but are seldom freed from institutionally constrained travel and release-time budgets to sustain a collective effort, except when participating in special, externally funded initiatives. Inserting technology into the equation introduces additional resource constraints and further complications. The IAT provides a facility and support for a few leaves of absence and various forms of short-term but sustained participation for scholars who are positioned by experience and accomplishment to shape the role of technology in their disciplines and professions.

Across-the-curriculum revisions are usually rationalized around lofty interdisciplinary goals but often amount to little more than a modest redistribution of feudal turf on a particular campus. Yet, one of the distinguishing features of the silicon evolution in higher education is its interdisciplinary nature. Conferences and workshops often highlight computing across the curriculum, and attendees frequently describe such gatherings as refreshing and extremely valuable, in part, because of their interdisciplinary nature. The IAT is structured to encourage daily, not just occasional, cross fertilization in selected disciplines.

At any time, at least two disciplines are represented, and one on-leave chair from each discipline is on site at the IAT. Each disciplinary chair coordinates a working group of colleagues from within or near the discipline. Some in the group visit the IAT only on the occasion of special working sessions. Others are on-site on leaves supported by their institutions or external agencies. Still others are in funded summer positions. When on-site leadership is not feasible, the IAT seeks and coordinates other ways to support disciplinary groups working on problems in instructional computing judged to be of high priority by its Advisory Board.

What are the disciplinary groups actually doing and how are they working together in an interdisciplinary mode?

A Focus on Academic Tools

Those hardware/software applications that impose no pedagogical assumptions and that can be broadly adapted to different problems and different styles of teaching and learning are often called academic tools. Some tools. such as word processors. are clearly general and interdisciplinary. Other tools appear to be interdisciplinary but may have less obvious import in some areas than others. Hypermedia tools exhibit no disciplinary biases but presently appear to have greater application. for example, in foreign languages than in mathematical sciences. The IAT's disciplinary working groups review general tools from their disciplinary perspectives and share and discuss their findings with the goal of identifying an integrated set of tools that will be useful on almost any faculty desk.

Each disciplinary group also identifies special disciplinary tools and. where appropriate, writes specifications for tools that are needed by the discipline but that are either unavailable or available only in weak implementations. The goal is to assemble a collection of tools that will be broadly useful in the discipline and that can serve as a basis for others to explore in their own ways the promise of instructional technologies. Although its focus is on instructional technology. the IAT does not attempt to distinguish too finely between research tools and teaching tools. One of the major themes of instructional computing. after all, is that affordable interactive technologies can bring the practice of a discipline or profession into the classroom.

The IAT has a technical staff to support its various disciplinary faculty groups. Support functions include developing prototypes of tools from specifications supplied by the groups. If the prototypes meet faculty expectations. the IAT promotes their development to commercial standards by interested commercial or academic developers outside the IAT.

How can the lofty goal of building national consensus around a set of integrated general and disciplinary tools be achieved in a one-vendor environment? What about those who own or prefer other vendors' systems?

The Institute's Hardware/ Software Platforms

The concept of the IAT grew out of a conversation with Professor Noblitt over two years ago and matured with advice from the Consulting Scholars and some of the contributors to the aforementioned EDUCOM book. At the 1988 EDUCOM Conference in Washington, the idea of a national consortium was described at a roundtable discussion open to all vendors. IBM ACIS subsequently responded, and the IAT was born. The idea of a multivendor consortium, clearly an idea fraught with practical difficulties, gave way to a more practical one-vendor environment for the complex challenge that shaped the IAT's charter. A better understanding of the Institute's technological base, however, will reveal a potential that exceeds even the ambitious goal of building national consensus around integrated sets of general and discipline-specific tools supported by IBM systems.

The IAT focuses on IBM's affordable strategic platforms in the process of identifying valuable academic tools and creating specifications for new ones, all in response to educational priorities and the need for integration — common interfaces, data exchange, etc. At the moment, this broad mandate draws attention to DOS with Windows, OS/2 with Presentation Manager, and AIX with Motif or, perhaps, NeXT Step. These systems depend on Microsoft, on the Open Software Foundation, and on NeXT. As such, they are not closed IBM systems, and when implemented on Intel's 80386 architecture, potentially provide a seamless environment with a variety of affordable entry points for specific academic needs. (Affordable is a relative but still meaningful word in the academy). The Institute is a focal point for advice from academics to IBM (and others) about the directions in which these strategic platforms and the academic tools that support them should be developed. Several scenarios will suggest the value and openness of this approach.

Specific Examples of the Institute's Work

Without suggesting that higher education would or should adopt a common word processor, it is reasonable and valuable to identify sophisticated document-preparation software that supports all three environments cited above. A freshman could then use, on an entry-level platform, the same tools that support faculty work on a more powerful platform. When supplemented with additional tools for preparing compound documents, the basic tools that support freshman composition could support engineering majors' projects, and seamless file exchange technologies could ensure that a student's project portfolio is an electronic whole not subject to the varied technological requirements of different departments and courses. In light of the potential technological linkages between Windows, Presentation Manager, and Motif, and their strategic importance to IBM, Microsoft, and other companies, these ideas may be more than academic fancy. By raising such issues with a national academic voice, the IAT hopes to contribute to a new coherence in campus computing environments. The coherence inherent in common interfaces and data exchange, moreover, favors a tools approach to instructional computing and should contribute to the IAT's ability to forge national consensus around selected tools — general and discipline specific. These factors, in turn, should address a major issue in instructional computing: the general reluctance of one scholar to use instructional materials developed by another.

OWL International's *Guide* was recently cited in an article in these pages as a useful hypermedia tool (Louie and Rubeck, 1989), and it underlies one of the 1989 EDUCOM/-NCRIPTAL awards given to Havholm and Stewart of the College of Wooster. It is both a Windows (DOS) application and a Macintosh application, and the IAT has made available to OWL a report outlining the strengths and weaknesses of the

Windows version of *Guide* and noting some revisions that would make it more useful in higher education. This kind of input to vendors of products that are useful in higher education serves us all.

The character sets of foreign language and science classrooms are not satisfactorily supported by today's affordable technologies. By working directly with IBM, the IAT can hope to influence the future development of IBM and Microsoft systems to provide direct support at the system level for important academic needs, such as easy access to foreign language and mathematical character sets. Published reports on these kinds of issues, moreover, will be open and available to all and, typically, will represent academic needs in vendor-independent terms.

Foreign language learning is one disciplinary emphasis at the IAT, and Professor Noblitt is working with other foreign language scholars to create a strategic agenda for language learning in a new technological environment. Planning sessions and subsequent symposia will bring together these scholars and ACIS personnel to identify foreign language projects across the country and to create a library of related software and information, to include that available through the EDUCOM Software Initiative and through IBM sponsored programs such as ISAAC, WiscWare, TASL. (See Hefley article on p. 29.) This disciplinary working group will examine problems in foreign language learning and feasible solutions that draw on a range of current technologies, to include new interactive audio and video technologies. They will work with their counterparts in mathematics to identify common interests, educational needs, and directions in standardization of interfaces, networking features, multimedia opportunities, and issues that are differentiated by the different institutional missions that prevail across the nation's community colleges, colleges, and universities.

These examples suggest the ways that the IAT, though supported by one vendor, can broadly contribute to the continuing development of affordable computing environments to meet higher education's general needs, as well as the requirements of particular academic niches — the humanist's workstation or the mathematical scientist's workstation, for example. They portray a "think tank" with an applied orientation that seeks to leverage the complex academic, technological, and economic forces that only in consort can advance the potential of technology to add significant value to a higher education.

How will those who are not participating in the IAT's research and development programs learn about the results of these programs?

Dissemination

If one thrust of the IAT is to build a broad consensus around a general set of academic tools and specialized disciplinary tool sets supported on strategic IBM hardware/software platforms, then surely a complementary and equally important goal is to serve as a national focal point for information about these tools and their use. As the Institute's disciplinary groups discover thoughtful applications of existing academic tools and develop specifications for new tools, they will report these in writing and in other ways, possibly to include video tapes and satellite broadcasts. With an on-site networked classroom with approximately thirty PS/2 Intel 80386 machines and high quality color projection, the Institute will also offer a variety of workshops to disseminate its work. The classroom itself will be developed as an experimental site for studying the ways in which affordable technologies can be adapted to classroom use in a variety of campus contexts. What features of classroom technologies will encourage faculty use? How can networks facilitate the in-class use of technology? What are the environmental features of a "model" classroom for the coming decade? These are the kinds of questions that the IAT will address.

Conclusion

The University of North Carolina at Chapel Hill and IBM designed the Institute for Academic Technology to advance the educational value of affordable technologies. Our hope and intention is that the Institute will serve as a national vehicle for:

- securing a more proactive role for educational priorities in shaping the use and development of affordable academic technologies.
- gathering academic opinion in arriving at these priorities.
- supporting a representative cross section of faculty leadership on the use and development of integrated academic tools to add value to education.
- legitimating faculty work on these issues.
- disseminating information about exemplary applications supported by IBM's strategic and broadly affordable technologies.

Readers who have persisted this far may wish to receive announcements and materials from the Institute for Academic Technology and may also wish to contribute to the national dialogue on the issues and opportunities that gave birth to the Institute. Please let us hear from you on BITNET at IAT@UNC. and remember to include your postal and BITNET addresses if you want to be on the Institute's mailing list.

Technology and Language Learning

James S. Noblitt

The Meaning Of Technology

Although we generally think of technology in the sense of "high technology," the concept is actually much broader in its original meaning. My dictionary offers, among others, the following definition:

> **technology** *n.* [Gk *techne* art, craft, skill] the totality of the means employed to provide objects necessary for human sustenance and comfort.

The Institute for Academic Technology, by facilitating an exchange of expertise between specialists in language and computing, can have a role in defining the humanistic use of modern technology.

Historians point out that new technology is introduced with the aim of increasing productivity in some established form of human labor. After an initial "scaling up" phase, during which old tasks are simply done better with new tools, the vision of what can be accomplished with those tools undergoes a transformation. A culture experiences a "convergence" of activities around technology as new applications are conceived. In this way, an increase in productivity is the precursor to an increase in creativity.

Information technology offers a particularly well-documented case in point. The printing press was initially conceived of as a way to reduce the labor of manuscript copying, but the printed book eventually transformed the entire scope of education, chiefly through the process of democratization of knowledge. (Boorstin, 1983)

We are currently witnessing a strong shift toward the use of personal computers for word processing. Those who have experienced composing at the electronic keyboard report they are unwilling to return to the typewriter, and this may be taken as evidence of a shift in the perception of how writing is best done. It is likely, moreover, that the scaling up process for word processing will lead to a convergence with electronic communication links, databases, and information processing. (Noblitt, 1988)

The technological environment, by offering methods for both the creation and transmission of knowledge, has always played an important role in shaping the educational curriculum. One may already foresee that information technology is sure to play a role in the way we conceive of teaching languages. Microcomputing, in particular, offers an unprecedented means for access to authentic samples of other cultures, integrating sound, symbol, and image in ways that appeal to a broad range of learners. No particular component is new, but the convergence of elements enhances the visualization of authentic linguistic interaction. More importantly, the new technology provides learning environments which permit creative interaction with primary language material. The promise is real and genuinely exciting, but one may wonder what (if any) instructional use will be made of the new tools.

High Tech Concerns

Many scholars are concerned about the educational implications of the new technology. Are the ever-expanding objectives of foreign language study making unrealistic demands on the educational establishment? Since high technology is expensive, one may expect economic factors to play an important role in determining the utilization of computer-aided, multimedia language learning methods. Will technology be available only to those agencies that have access to federal funds? This consideration alone could determine whether foreign language learning for professional purposes will be governed by the public or private sector.

Value judgments about the worth of technology quickly center on what is meant by the "human sustenance" mentioned in the definition at the beginning of this essay. Ortega y Gasset's pessimism about the worth of technology as an end in itself was clearly expressed when he wrote, in 1951, his seminal essay, "The Myth of Man Beyond Technology." (The translation below is by Patrick Dust.)

> To be an engineer and nothing but an engineer...means to be potentially everything and actually nothing. Just because of its promise of unlimited possibilities, technology is an empty form like the most formalistic logic and is unable to determine the content of life. That is why our time, being the most intensely technical, is also the emptiest in all human history.

As Dust puts it, in his analysis of Ortega's philosophy, the value of technology is ultimately determined by the use made of it:

> Technology, it is clear, enables man to transcend nature, but it does not produce a transcendence beyond man himself. Rather, it emerges as the appropriate vehicle for the full realization of man *qua* man, that is, as pure possibility immersed in reality.

John Naisbitt, in his book, *Megatrends* (1982), predicted that information technology would have the effect of enhancing contact between individuals in the postindustrial society. He called this effect "high tech, high touch." This prediction ran counter to the intuitions of many humanists, like Ortega, whose experience of technology had been based on certain of the dehumanizing aspects of the industrial revolution. The "personal" computer likewise appeared to represent a high tech intrusion into the domain of humanistic concerns. On what basis should computing "penetrate the curriculum?"

The idea that technology per se can provide solutions for educational problems has met with justifiable skepticism. Every cure has the inevitable unforeseen side-effects. For example, the technology that offers solutions for processing a glut of information is also the channel through which information is produced and delivered in the first place. The culture has begun to experience a sense of being overwhelmed by information. The problem is that this golden age of scientific discovery is producing new information at a rate that strains our capacity to process it, let alone comprehend it. The *Scientific American* (July, 1989) reports that the National Space Science Data Center has processed some six trillion bytes of data since the Pioneer space probe. (That's about twice as many bytes of data as contained in the nineteen million books of the Library of Congress.) If the Earth Observing System is launched in the mid 1990s, we will receive several trillion bytes of data every few days!

The volume of unprocessed information now available in electronic form has already profoundly changed the operation of university libraries, and a change in attitude toward what the novice scholar must learn is underway. The Dante project at Dartmouth College, for example, offers electronic information processing to assist scholars in simply locating topics of interest in an immense volume of secondary sources. I have read that it takes 200,000 pages to print just the authors and titles of articles worldwide pertaining to chemistry in the past decade. Shall we tell our graduate students to master the secondary literature of the field? By what new epistemology shall we know the meaning of the word "educated?"

There are, understandably, ample expressions of concern about our ability to cope with the educational implications of an information-based society. (A recent book suggests that you suffer from "information anxiety" if you find yourself nodding in agreement to statements about which you know nothing!) Innovations in information technology are taking place at such a rapid pace that traditional humanists are having difficulty adjusting to the conceptual demands of data processing, information processing, knowledge processing, and the like. They wonder, with T.S. Eliot,

> Where is the wisdom we have lost in knowledge?
> Where is the knowledge we have lost in information?

Almost the exact sentiments are reflected in a recent essay by Meg Greenfield entitled "Misled by the 'Facts'," (*Newsweek*, June 26, 1989) She is concerned that we have little basic understanding of foreign cultures with which to interpret the news reports from abroad.

> For it is one of the ironies of the current well-documented information explosion with all its instantaneous transmission of news and data around the globe and right into your car radio that we get the impression that we know more than we do...We are misled by our own information, knowing much more than we understand.

She registers a complaint that should give educators pause:

> Our heads are stuffed full of snippets of lore that give us the false impression that we know something when we don't or when what we do know is only the most superficial skimming of the pond.

The same concern was foreseen by Alvin Tofler in *The Third Wave* (1981). The popular media have adjusted length of exposure to a decreasing attention span on the part of the viewing public, delivering information in brief, unconnected, commercial messages. Tofler calls this kind of informed state "blip culture." It is discomforting to imagine that our general education curricula could devolve to a similar fragmented state.

Intellectuals have been particularly troubled by the commercial scaling up phase of media technology for entertainment purposes and have seen little evidence of a convergence with instructional needs. Educational controls available in the classroom and library are lacking for the media, which remain associated primarily with conditioning rather than enlightening the viewer. Tony Schwartz, who devised the anti-Goldwater campaign for Johnson and thereby introduced a new and effective form of political advertising, is quoted in the *Harvard Magazine* (May/June, 1989) as saying "Education is the slowest form of learning." Does this mean that educators must compete with the media to be effective?

The Medium is the Method

Some perspective on the question may be gained by examining the role of technology (broadly defined) in the evolution of language learning methodologies. As will be clear from what follows, I draw basically on writers like Havelock, McCluhan, Ong, and others of the so-called "Toronto School." As Oswyn Murray puts it, "There, a new theory was born, the theory of the primacy of communication in the structuring of human cultures and the human mind." Murray points out how the theory had evolved by the 1960s to show in what way changes in modes of communication — speech, writing, printing, telecommunications — were markers of cultural progress.

It should be noted that there may be considerable lag between technological innovation and its acceptance as a legitimate tool for learning and research. New instructional technology is embraced only if it is perceived as supporting institutionally recognized educational objectives. The process of technological integration therefore tends to be incremental. New methods do not replace old ones, any more so than literacy replaces orality. Changes in method simply modify the balance of importance assigned to a particular component of training.

The analysis offered here argues that methods of language teaching and learning have always been determined by communication technology. The interesting question is why only selected devices of the communications world have been integrated into our educational curriculum. Lectures, blackboards, and books are firmly established; tape recorders, television, and films are marginal; telephones and radio have little instructional significance. What underlying educational objectives are communicated by the medium used? Since methodologies are highly dependent on the means by which language information is presented to the student, we may say (to paraphrase McLuhan) "The medium is the method."

The progression of method, communicative emphasis, and institutional innovation may be schematized as follows:

The Oral Medium

The oral world of the individual language learner has always been served by some form of direct method. It remains the only effective means of instruction in first language learning, providing the child with a meaningful context for associating a life's experience with linguistic material. When successfully implemented, direct methods combine sound, symbol, and image with thinking, doing, and feeling. The major institutional technology developed to support this kind of instruction has been the classroom, designed to provide an extension of the primary oral world through mentoring. The method is labor-intensive and relatively slow, since results are governed by the developmental characteristics of the language learner, but it is unsurpassed for effectiveness in producing authentic results for those who are motivated to be integrated into a particular society.

The Literate Medium

The literate world of language learning has produced a number of methods known generically as grammar-translation. The key technology was, naturally, writing. The printed word permitted scholars to be increasingly analytic in their approach to language. The codex book, in particular, offered the possibility of indexing and cross-referencing of information. Systematic lexicography, a relatively late development, provided dictionaries and contributed to the analytic techniques which led to modern descriptive grammars.

Libraries eventually provided an alternative to the classroom and introduced learning beyond the boundaries of the oral world. Book technology additionally has, since the Renaissance, provided an economically viable medium for creativity that is not likely to be matched by other forms of recording human thought. Literacy has become an educational ideal and remains the criterion skill for democratization of learning, even though reading skills are mastered only with a considerable increase in instructional effort and resources. The study of literature has become nearly synonymous with a humanistic education.

The Secondary Oral Medium

The wartime objectives of practical (chiefly oral) language learning eventually led to the so-called audio-lingual method. The method and its derivatives attempted to restore study of the spoken word to primary emphasis in the classroom, through a curriculum designed for direct interaction with other cultures. A new domain for study, the language laboratory, was introduced to exploit in particular the technology for recorded speech.

The secondary oral world of language learning is much more recent and less well understood for its significance in language learning. (Ong, 1982) It came about through techniques for recording and broadcasting sound which originated during the industrial revolution. Language learning through the mass media did not result in a widely accepted methodology, chiefly because no academically recognized research was initially associated with it. It was rather the ability to record and analyze speech scientifically that created a research agenda for linguists and anthropologists.

Postwar educational objectives produced two cultures for language teaching and learning. Academic instruction, based on print technology, tended to emphasize the goals of general education and humanistic learning represented in literature. Governmental agencies, such as Foreign Service Institute, Defense Language Institute, and the like, tended to emphasize skills for professional language training and made more use of high technology. (Lambert, 1984)

The Computer-aided Medium

The computer-aided, multimedia world of information exchange has made available much richer databases of sound, symbol, and (in particular) image for the language learner. More importantly, the computer has permitted interaction with the material through adaptive testing, simulations, tutorials, and information processing tools. This technology, combined with the "postindustrial" objective of international economic competition, has stimulated further development of interactive methodologies, already in vogue for conversational and audio-visual language learning techniques.

It is too soon to identify the educational domain of application for the new methodology, although some language "labs" are being called "learning centers" when multimedia devices are installed. Classrooms, libraries, and learning centers are all likely candidates; but microcomputing offers the possibility of extending the learning environment to one's personal domain in much the same way as the portable tape recorder seriously diminished the need for public listening stations for language tapes. It is likely to be the case that computer-aided, multimedia methods will allow the student to operate in a spectrum of interconnected domains, which may be loosely referred to as networks.

Colleges and universities are now stressing study abroad as an extension of the language learning environment. This coincides with a move toward "internationalization" of the curriculum, which attempts to join the ideals of general and professional language education. The computer-aided, multimedia approach to language learning is seen by many as an important component in the expanded educational objective. The new technology presents, however, serious institutional problems in governance, curriculum design, materials preparation, assessment, and funding.

A Role for Humanists

Many educators see a role for humanists in fashioning appropriate tools for the intelligent utilization of information technology. Relational databases in general — and hypertext presentation devices in particular — magnify by many orders of magnitude the amount and sequencing of information available to the student or researcher. When query-driven, information technology can provide a dazzling learning resource. Learners, led by a need to know, organize factual material according to the way it will be used. (The "case history" approach, used in business, law, and medicine, illustrates a kind of query-driven learning.) However, when large databases are simply browse-driven, the learner may be left with "blips" of loose associations, unable to create structured hierarchies of information. It is one thing to empower the individual with powerful concepts and techniques for self-directed inquiry. It is quite something else to be set adrift in a high tech sea of information.

The heart of the matter lies in how we think of general education. If we wish to prepare our children to participate economically and intellectually in a high tech world. they need to be educated — not just trained — in how the modern world works. Specialized knowledge in a number of fields is likely to change rapidly. at a pace unimagined even during the Renaissance or the Industrial Revolution. when our school curricula were devised. General education should provide the basic understanding through which specialized or professional knowledge is achieved. The current so-called Information Revolution offers a wonderful opportunity to put our students in contact with the primary observed data of foreign languages and cultures. It is essential. however. that the approach be query-driven. not just browse-driven. This will require the participation of humanists whose commitment to research and teaching are enhanced by an understanding of what technology can and cannot do.

Microcomputing appears to offer a bridge between the specialized and professional level of inquiry of the researcher and the general interest level of the student. The databases of interest for research can also be used for instructional purposes. For example. if we have created a language database of primary and secondary resources for a line of research. we can make it available for our students' use. All that is needed is a software utility — a "tool for learning" — that will guide access in a rational way. Scholar and student may then interact in a creative way with primary observed data rather than pedagogically "canned" material. In theory. at least. the process described should create a meaningful relationship between general and specialized knowledge. More importantly. the scholar should not feel a tension between teaching and research.

A Need for Joint Effort

In spite of the promise of high technology. one must assess realistically the likelihood of its realization in the educational establishment. The private sector is convinced that an important market exists for microcomputing in education, but it is having difficulty in dealing directly with institutions of higher learning. The academy is generally discipline-governed and not in sympathy with market-driven concerns. This means that the best minds do not as a rule address problems unless they are on the leading edge of an existing research paradigm. It is generally difficult for the private and public sectors to pool resources, as the for-profit and not-for-profit points of view create mutual distrust.

On the other hand, there is ample evidence of immense concern in all sectors for the underlying problems of general education. Business needs knowledgeable and trainable graduates from educational institutions; educators need assistance from business in tooling up for information technology. A recent article by David Gelernter in the *Scientific American* (August, 1989), "The Metamorphosis of Information Management," states that software has become "the preeminent medium for building new and visionary structures." This is so because "information refineries" are needed to convert facts into knowledge. The problem is that we have no equivalent of what he terms a "Department of Public Software Works" in the public or private sector:

"Few organizations have the time and money, and fewer the expertise to [build sophisticated software for information management]. Most of the projects undertaken so far are at universities or other research institutions that lack the resources to turn their prototypes into finished, widely used systems."

Gelernter's concern is shared by many educators. The design and implementation of technology that is significant for human sustenance will require cooperation between higher education and industry, and there are few models of how this can be achieved. Institutions that provide both technical assistance and an environment for creative thinking can do much to encourage those who are willing to work on educational applications. Neither industry nor the academy can address the problems effectively alone. The Institute for Academic Technology will provide the needed interface between the worlds of education and computing. It would be particularly gratifying to see language education as one of the first beneficiaries of applied information technology.

IBM and Higher Education: A Continuing Partnership

Gerald L. Hefley

The Institute for Academic Technology (IAT) is a logical extension of the developing partnership between IBM and the academic community. But is that partnership itself logical? What do the partners hope to gain from it. and from each other? Bill Graves and Jim Noblitt address those questions from their own perspectives elsewhere in this issue; I'd like to offer IBM's viewpoint.

IBM's Philosophy

On the simplest level, we at IBM are investing in our next generation of employees. Like any high-technology firm. we rely on a well-educated work force, men and women capable of understanding and developing advanced systems. We believe that the use of computers in the classroom, even in nontechnical courses, will improve the learning process and open new instructional avenues. The students who come out of these new classrooms will be vital to the future of IBM.

On a different level, we are also investing in the future of our industry. Many of the most important advances in computing, from programming languages to communication protocols, have come out of university research; we expect there will be more. While this work certainly would continue without corporate support, it would be handicapped, just as our efforts would be slowed if we had no access to university achievements. The IBM/higher education partnership permits campus-based and industry-based research to complement and nourish each other.

Finally, there has been a great deal of discussion lately about the ability of the United States — and U.S. businesses — to keep pace in an increasingly competitive world. Some observers believe the United States is losing global stature, and they trace the cause to what they perceive as failures in the nation's educational system. While we don't agree with all the doom and gloom, we do believe that an investment in education is a wise investment, especially as competition for global leadership intensifies.

Recent Efforts

These are not new opinions at IBM: our commitment to education is long-standing, involving not just money and equipment but people as well. In 1982, this commitment resulted in the development of a new organization within IBM: Academic Information Systems (ACIS).

ACIS' primary mission is to understand the needs of the academic community and work to meet those needs. We focus on several areas:

- improving the quality of instruction.
- enhancing student productivity with affordable, simple-to-use computers.
- providing tools to improve the effectiveness of research.
- enhancing access to the ever-growing body of knowledge with advanced library systems.
- providing more effective solutions for campus administrators, and
- linking the campus with improved communication approaches.

For our purpose in this article, I will focus on ACIS' efforts to help faculty improve the quality of instruction using technology. A couple of questions pop to mind when addressing the use of technology in instruction. Does the introduction of technology indeed improve the quality of instruction? If technology does help, then what has ACIS done so far in this area? Once instructional software is developed, how are the results made known to other faculty? How can the software be distributed and made available to faculty and institutions? How does the Institute follow as a logical extension of these efforts?

We are convinced that the use of computers in the classroom can make a significant difference in the educational process. Take, for example, the work being done by Dr. Loretta Jones, a member of our Consulting Scholar Program, and Dr. Stanley Smith, both of the University of Illinois at Urbana-Champaign. They are coauthors of *Exploring Chemistry*, a series of interactive video lessons that can be used either to supplement or replace traditional laboratory instruction. Studies have shown that students with low placement scores (Jones, 1987) and engineering majors (Smith, Jones, and Waugh, 1986) both achieved higher quiz and lab report scores using the interactive lessons. As an added benefit, these lessons are cost- and time-efficient when compared to laboratory classes.

We also know that interest in instructional computing is growing rapidly. ACIS has sponsored an Academic Computing Conference each year since 1984. The first year there were 250 attendees. This past June more than 1,000 educators came to the conference in Anaheim. An attendee at these conferences would have observed that the quality of instructional software has improved dramatically over the last few years. The software is better designed, more robust, and easier to use. The educational goals addressed by instructional software and the methods to realize them have also changed. There has been a shift from simple drill-and-practice to more complex simulation and multimedia efforts in order to develop in the student a deeper understanding of the subject area. Technology has become a tool for learning in its own right.

The technology in the hands of inspired faculty has provided new ways to visualize concepts and data, and new methods of analysis and ways to organize ideas. The technology has provided students with the means to solve real problems using real data. It has enabled students to investigate the real world rather than a limited textbook example. This leads to deeper insights into and increased understanding of the nature of the subject matter.

This evolution in the use of technology did not just happen. Creative faculty have known for some time about the potential of the technology, and vendors have developed programs to assist and enable faculty to realize this potential.

ACIS began its first major support effort, the Advanced Education Projects, in 1984. This five-year program involved nineteen universities and resulted in nearly 3,500 individual projects offering ways to improve the educational process by using powerful and affordable workstations. More recently, we've sponsored the Community College Competition for Excellence, coordinated by both the League for Innovation in the Community College and the American Association of Community and Junior Colleges, AACJC. We are currently involved in a joint project with the Sloan Foundation for members of the Foundation's New Liberal Arts Program. The project is designed to enhance the current capability of each selected college to make educationally effective use of the computer in undergraduate liberal arts courses. A total of twenty colleges and universities are involved. These efforts by IBM have provided the means for faculty to develop instructional computing to the level of sophistication it has achieved to date. Many of the innovative uses of technology in the learning process demonstrated at the recent Anaheim conference began development in these types of programs.

Research results are disseminated through informal networks of scholars and ultimately through professional, peer reviewed journals. How are results in the use of technology in instruction disseminated? After all, a great idea is of no value to someone who hasn't heard about it. ACIS sponsors a number of other programs designed to spread the word about the instructional ideas coming our of Advanced Education Projects, or being developed by the Consulting Scholars and other ACIS-supported projects. Our hope is that these programs — including ISAAC, Wise-Ware, TASL, and Community College Instructional Technology Transfer Centers — will help spark debate and further development by exposing ideas to critical review.

ISAAC, the Information System for Advanced Academic Computing, is an electronic bulletin board accessible without charge to anyone in the academic community. ISAAC began as a way of soreading information about Advanced Education Projects, but it has grown considerably. It now contains at least four major databases and numerous discipline or technology specific discussion groups. There are several modes of access to ISAAC, including BITNET, INTERNET, ARPANET, and modem (via a toll-free 800 number). ISAAC is funded by IBM and operated by the University of Washington for the benefit of the entire academic community. Faculty can dialog on the mission, goals, and activities of the Institute through the facilities provided by ISAAC.

The University of Wisconsin and IBM have established an instructional software distribution facility called Wisc-Ware. Wisc-Ware contains hundreds of software packages developed by faculty for use in instruction and research. The software is available to colleges and universities for a small fee.

The Academic Software Library, TASL, is a distribution channel set up by several academic societies to distribute peer-reviewed software. This is an important step in ensuring that software developers are held to the same strict standards as other scholars. Although IBM sponsors TASL, each member society has set its own policies and procedures for peer review. The societies that make up dTASL are:

- The American Institute of Physics in cooperation with the American Physical Society and The American Association of Physics Teachers.
- The American Society for Engineering Education.
- The Center for Applied Linguistics in cooperation with The Linguistic Society of America and Teachers of English to Speakers of Other Languages.
- The Modern Language Association, and
- The American Political Science Association.

IBM has established seven Community College Instructional Technology Transfer Centers, including one in Canada. These centers conduct workshops, evaluate software, and share information about instructional software with other community colleges.

These ACIS programs, partly designed to seed development and dissemination of instructional software, have resulted in a great deal of activity and some very creative, insightful solutions to educational problems. The results obtained to date have been marvelous, so we believe that with the proper support, they can be even better. Discipline oriented development and dissemination have reached a stage in which more cooperative efforts will now be able to leap to new levels of achievement. To bring this activity into sharper focus and provide a multidiscipline environment in which creative ideas can be built upon, expounded, and expanded, IBM has funded the Institute for Academic Technology. The Institute will also help in the dissemination of these results by providing a single focal point, a clearing house if you like, for the use of technology in instruction.

The hope is that the Institute will be able to bring together at a single location, the best of all the instructional computing development, provide a focal point for brewing these ideas together, and, thereby, provide the springboard to boost development to even greater heights. The availability of affordable multimedia technology provides the opportunity for this boost to accelerate the development and acceptance of technology in the learning process.

The Institute

The Institute for Academic Technology, then, is the logical continuation of ACIS' mission. Where prior efforts tended to be discipline specific, it will be the role of the Institute to provide both a means and a place for scholars from different fields to meet, to share their knowledge, and to define their own solutions to their instructional computing needs.

What I hope is apparent from my description of ACIS' mission and the programs we've developed so far is our respect for the scholar's viewpoint. Faculty understand the educational process, and they are the only ones who can effectively integrate technology into that process. It is the role of the Institute, and IBM's support of the Institute, to support faculty in pursuit of this goal. In a very real sense, we will be the graduate students at the Institute, assisting and learning as the faculty push the limits of the latest instructional technologies.

We expect that the technologies explored at the Institute will redefine the terms powerful and affordable as they apply to instructional computing. Reliable, high-speed local area and wide area networks will create new ways for sharing information and instructional materials. Advanced technologies, involving integration of sound, video, and user interfaces, will give faculty a new palette of methods and media for creating learning environments. I fully expect that faculty will discover entirely new directions for microcomputers, and we'll do our best to follow.

The Institute will also serve as a clearinghouse for this new technology: a place where scholars not directly involved in developing new methods can come to consult with their peers, to explore how the computer can improve instruction. They'll find here the tools they need to exploit the new methods. One of the first priorities of the Institute will be to make the tools already available — and there are many — better known, even as work begins on the next generation of instructional technology.

From IBM's perspective, the Institute will not replace our other initiatives in higher education but will provide a focal point for them, and IBM will continue to develop standalone projects as well as others that feed into the Institute's work. The recently announced Audio-Visual Proposal Competition for faculty application development serves as an indicator of this. IBM will not select the winning proposals; all submittals will be subjected to peer review coordinated by the Institute, and that process will decide the outcome of the competition.

Conclusion

In short, the Institute for Academic Technology will be run by faculty, for faculty. It will package tools that have been judged useful and prepare quality examples of how these tools can be used in instructional settings. Members of the academic community will come to join in seminars and workshops where they will learn more about these tools and formulate the requirements for further developments. IBM will be there to support, to listen, and to respond.

It is my firm belief that this partnership, joining as it does the process of peer review and technological development, will change the nature of classroom instruction. Separately we can only recognize problems; together we can solve them. This mutual concern, this drive for solutions, is the basis for the Institute.

About the Authors

William H. Graves received his Ph.D in Mathematics from the University of Indiana. He is Professor of Mathematics at The University of North Carolina at Chapel Hill (UNC-CH). For two terms (six years), he was the first Associate Dean for General Education, a position created in the college of Arts and Sciences during a university-wide curriculum reform movement in the last 1970s and early 1980. In this position he was responsible for the General Education Curriculum.

His initiatives on behalf of general education included partnership efforts with the public schools of North Carolina and with IBM. He successfully sought support from IBM's Academic Information Systems to launch what became a five-year, technology-based faculty/curriculum development experiment. Approximately fifty UNC-CH faculty members experimented with instructional computing as a means to add value to their teaching and their students' education. This work earned them national attention as interest in instructional computing burgeoned, and many campuses extended speaking invitations to Graves. This experience contributed to the creation of the IBM Consulting Scholars Program in 1987, and Graves was invited to be a Consulting Scholar. He has been a campus or conference speaker and observer on more than 150 occasions.

Graves is now Special Assistant to the Provost with a variety of shifting responsibilities, presently including the coordination of academic information technologies campus wide. He recently led a movement to create a national center to advance instructional computing. In June of 1989, IBM announced its support for the Institute for Academic Technology to be located at UNC-CH. Dr. Graves is the Institute's Director.

James S. Noblitt received a M.A. degree in French literature at the University of Virginia and was a Fulbright Scholar at the Sorbonne in Paris. He then received a Ph.D in French linguistics at Harvard and spent two years at the Center for Applied Linguistics working on programmed instruction in French.

Professor Noblitt joined the faculty of the Department of Modern Languages and Linguistics at Cornell University in 1967 where he heads the French language program and gives courses in medieval French and applied linguistics. He is the author of an introductory text for college French, Nouveau Point de Vue, and co-author of Systême-D, a program for writing assistance in French. The software offers the student a word processor combined with a bilingual dictionary, a concise reference grammar, examples of usage, and full expansion of verb forms. Systême-D won the 1988 EDUCOM/NCRIPTAL award for "Best Foreign Language Software."

Professor Noblitt joined Professor Graves as an IBM Consulting Scholar in 1987 and has travelled to over fifty educational institutions during the past two years to exchange information on the role of computing in research and teaching, particularly in the humanities. He is on leave from Cornell as Fellow at the Institute for Academic Technology, The University of North Carolina at Chapel Hill. There he will focus on the role of technology in foreign language teaching and learning.

Gerald L. Hefley received his BA in Mathematics from the University of South Florida in 1963 and joined IBM the same year. In 1968, he took a leave from IBM to earn a Master of Engineering in 1970 and PhD in Operations Research in 1971, both from the University of Florida. He was on the faculty at the University of Iowa from 1971 until returning to IBM in 1973.

After a number of headquarters assignments with IBM in White Plains, he became the IBM project manager for Project Ezra, the Advanced Education Project at Cornell University. He is currently the IBM resident program manager at the Institute for Academic Technology.

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