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[HOME](#)

The University in the Digital Age

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Abstract

The university's value, we claim, lies in the complex relationship it creates between knowledge, communities, and credentials. Changes contemplated in either the institutional structure or technological infrastructure of the university should recognize this relationship. In particular, any change should seek to improve the ability of students to work directly with knowledge-creating communities. We offer a couple of examples of currently successful Internet-supported teaching that suggest how technology can do this. Then we explore some hypothetical institutional arrangements that might enable the university to take the fullest advantage of these emerging technological possibilities.

1 Introduction

What will the university of the digital age look like? We really ought to know by now. It's been twenty-five years since Donald Schön (1971) urged universities to start considering life "beyond the stable state." At about the same time, the futurist Alvin Toffler (1971) confidently predicted that the information age would force universities to accommodate an "accelerating pace of change," prepare for "life-long learning," and even consider "learning contracts" instead of the conventional degree. Since then, there have been a flood of reports on the future of "the university" and a deluge of technological innovations, yet beyond the replacement of the library catalog with computer terminals and the use of PCs as sophisticated typewriters, on many campuses things don't look very different. Ivy and bored students still climb the walls.

Perhaps it's just a matter of lag, as an acquaintance suggested to the hypertext guru George Landow (1993):

It took only twenty-five years for the overhead projector to make it from the bowling alley to the classroom. I'm optimistic about academic computing; I've begun to see computers in bowling alleys. (p. 161)

Yet things clearly aren't quite that simple. Universities are rife with computers. Landow himself runs his hypertext projects at the Institute for Research into Information and Technology at Brown University, former home of Ted Nelson. Schön teaches at MIT, the spiritual parent of such early hi-tech successes as Wang and DEC. Colleagues there include such irreproachable frontiersmen of the digital age as Nicholas Negroponte, Marvin Minsky, and Bill Mitchell—each of whom is more likely to give you his Home Page URL than a business card. These universities aren't waiting for the superhighway. They form its major intersections.

So the lack of apparent change in university life in the past 25 years isn't simply a matter of computational backwardness. It's probably truer to say universities are schizophrenic, a combination of high-powered computational centers and highly conventional institutional practices. Indeed, the advanced technological infrastructure of a university is itself probably as good an indicator of a certain strain of institutional conservatism as any. Those institutions that were able to accumulate the resources (financial, intellectual, social) to develop a computer-intensive infrastructure were most likely to be large, wealthy, and above all (despite Schön's pleas) profoundly stable. After all, building the Internet wasn't a job for the 7-11 franchise.

It's important to note right away, the sources of this institutional conservatism aren't found only in the easy-to-criticize administrative bureaucracies. Tenured faculty, for both good and bad reasons, tend to cling to the institutional and disciplinary sources of their own hard-won security. It took an English academic to say to one of us "We've done things this way for five-hundred years, why should we change now?" but similar currents of conservatism run through American faculty senates. Alumni and parents, too, don't always encourage change (Arenson, 1995). They've paid a lot for a chunk of tradition and often refuse to be cheated out of it. This is surely why at commencement, a ceremony more for parents than for anyone else, the campus abounds with mediaeval costumes and dead languages. And while business, which as the dominant customer for the universities' graduates has significant influence, might congratulate itself on being a force for change, Motorola and MacDonald's universities and most industrial training programs don't offer very bright alternative horizons.

Nonetheless, for all the institutional inertia, universities are changing—primarily because their "environment" is changing. The conventional 18-to-22-year-old undergraduate going through a parent's paycheck and school in four consecutive years is becoming increasingly rare and *unconventional*. Members of increasingly diverse student bodies no longer have the time, the patience, or the money to obey the universities' implicit command to assemble at conventional campuses for

conventional periods, for conventional forms of teaching. (Many of these conventions are not much younger than the costumes and customs of commencement.) People are taking up their degrees later and over longer periods, assembling them out of one course here and a few credit hours there, snatched between jobs and bank loans, when time, money, interest, and opportunity arise.

It's probably less helpful, then, to say simply that the university will change because of changing technologies than to say the emerging computational infrastructure will be crucially important in retooling the already changing university and in providing access to these students of tomorrow.

So, what might a reformed, post-millennial university that has adapted to this changing environment look like? Some suggest that it won't so much "look" as "be"-that the university of the future will be a virtual place with no need of the physical campuses that have marked a university for so long. We, however, doubt that the university will dissolve into cyberspace so easily. The idea of the virtual university, we suspect, both underestimates how universities as institutions work and overestimates what communications technologies do. Learning, at all levels, relies ultimately on personal interactions and, in particular, on a range of implicit and peripheral forms of communication that technology is still very far from being able to handle proficiently (Brown & Duguid, 1994).

Of course, communications technology will undoubtedly support and transform many of the interactions of researchers and students, teachers and learners. Moreover, its marginal cost is also much cheaper than the conventional classroom. Undoubtedly, its contribution to the university of the future will be immense. Yet the feasibility and financial viability of technological intervention are, we believe, as much issues for concern as celebration. Implemented without due understanding of the institutional character of educational forms, intervention might only further polarize an already divided system. For instance, rather than disappearing, the conventional campus with all its rich and respected resources could easily become the reserve of those who can afford it. Those who cannot would be offered the Net as their alternative. And though catalogs might claim that such an education and the degrees granted would be virtually the same, we suspect they would be materially different. The Net degree, though it might command the same letters (B.A., M.A., M.Sc., etc.), would almost certainly not command the same respect as its distant campus cousin. In consequence, despite all the claims that the Net is a means to overcome inequality, the already steeply tiered system of higher education would probably become only further divided by the unequal financial resources of its students.

An alternative approach, and one more in tune with the way people learn, is not to divide the student body between those who get the chance to go to school and those who are given only the opportunity to go on line. Rather, it may be wiser to consider ways to divide each student's career between time better spent on campus or in communities and time better spent on-line-so that all may have the opportunity to experience the best of both worlds.

To achieve a democratic expansion of the system will require, however, quite different pedagogical paradigms than delivering "education" and quite different administrative arrangements than simply establishing ever more "Open Universities." It will also require, we suggest, acknowledging the strengths and resources of the current system and using technology in support of these, not in opposition or as an alternative. So, in contrast to those who suggest that the university of the twenty-first century will not so much "look" as "be," we argue below that it may be better to think of it "looking" in many ways surprisingly similar but "being" very different, because the most profound changes may be those made in the institutional arrangements rather than the physical infrastructure that makes up what people think of as a university.

Our own view of what the university of the next millennium may look like isn't based simply on a naive desire for a more rather than less egalitarian system of education. It's also based on our sense of what it is universities do, what roles they play in society, and why people think them worth the often huge sums of money invested in an education; most important of all, it's based on our understanding of how people learn. So, to explain our view of the university of the future, we begin by addressing questions about what it is that universities do when they "teach" and what it is that students do when they "learn." We also investigate the important role that credentials, certificates of teaching and learning, play in the system.

Our answers suggest that it is a mistake to think of the university "delivering" knowledge or students as "receiving" it. Central to higher education is the way universities provide access to communities of scholars and testimony for a student's experience among these communities. Consequently, universities should explore resources for bringing people together, not, as some interpretations of "distance education" suggest, for reinforcing their isolation. Having presented this argument, we then describe a couple of examples of the sort of technologies that are moving in this direction. Nonetheless, we continue to maintain that technology on its own cannot transform the university to meet the demands of the future. New institutional arrangements are called for.

So, in the final sections of this paper, primarily as means to provoke discussion, we offer an example of how the university might be radically reengineered. Reaching back for a historical precedent, we argue that, just as education hasn't been built around isolated individuals, so it hasn't always been built around individual campuses. Past administrative arrangements allowed flexible, small, distal communities to develop at a variety of sites, allowing scholars to congregate in dispersed, peripheral, learning groups, for which a university provided both "cover" and support. These arrangements allowed students to tap into resources beyond the campus in local sites of excellence.

In conclusion, we suggest that, supported by the powerful new communications technologies now available, such a system might best promote the democratization of learning, where the incautious use of technology might actually thwart this goal.

2 What do universities do?

So our first question is what do universities do. But before we attempt an answer, we need to express our own sense of the difficulty of talking about "universities" in general. Everyone is familiar with the story of the group of blind people inspecting an elephant. One stands by the trunk, another by a foot, another by the tail. Unable to see the whole, but only to grasp what is immediately before them, each comes up with a completely different account of what an elephant is. With colleges of higher education, it is less like the blind inspecting a single elephant than, in Geoffrey Nunberg's phrase, the blind at a menagerie. To indicate the range of this menagerie, the U.S. Department of Education reported that in 1992 there were 10,800 postsecondary institutions, of which 5,400 offered only diplomas for less than two years' work; 3,600 were regarded as accredited colleges of higher education. Of these, some 2,700 offered 4-year degrees, 797 M.A.s and 660 doctorates (NCES, 1993). Finally, other sources suggest that there are about 170 institutions designated "research universities." The menagerie has many beasts and several species.

Given the extent of the menagerie, it is tempting to focus on a small part, such as "the research university," or a particular school or discipline. But as Daniel Alpert (1985) has argued, part of the failure to change "the university" has arisen from the failure (often, as Alpert makes clear, for systemic reasons) to address "the national university system as a whole" (p. 276). What follows is an attempt to discuss that system as a system, if only at a very general level, and to raise some system-wide issues involving teaching, learning, and credentialing. So, when we use the term "university," we are using it deliberately loosely in an attempt to encompass this

"system" of higher education through accredited colleges and universities.

To consider the nature of this system, we begin by adopting a strategy from business consultants who have to evaluate huge and diversified corporations that address manifold interests. What, we want to ask, are its "core competencies"? What do its institutions do that other institutions don't? Why are individuals, families, states, and government agencies willing to pay so much for a university? What is it they want and universities offer that's worth so much?

The easiest answer, and one in line with the distinctions made in the Department of Education report we cite above, is that they give degrees.

3 Learning by degrees

Undoubtedly, people in the system don't usually like to be thought of as providing and seeking credentials. They have higher aims and higher goals. Moreover, as we will emphasize shortly, providing credentials is very far from all that universities do. Nonetheless, credentialing provides students with a tradable token in the job market. Crass though this may seem, this makes credentialing an important and complex part of what universities do. The exchange value of that token provides both a measure of a university's status and, if the exchange value is high, cover for many practices that are not themselves so easily valued. So we believe that discussion cannot get very far unless it acknowledges the central importance to universities and their students of credits and credentials, degrees and diplomas.

No doubt for some, education may indeed be an end in itself. But for the vast majority, it is an investment—a down payment on a career, social status, or, more immediately, just a job. Most people give universities the time and money they do because that's how to get a degree. And people take the degrees they do to get the jobs they want, knowing or hoping that the status and salaries of the jobs they become eligible for will fully repay the investment. For the vast majority of students, universities implicitly provide a route into the general job "draft," much as they more explicitly prepare athletes for the NBA or NFL draft. Academic aspirations and career aspirations are very tightly entwined.

Still, degrees are seen in very different ways. To some, primarily those inside the system, they are often, as we have just noted, a vulgar misrepresentation of what universities really do in detail. While to others, particularly those outside, they are valued as a succinct representation of the experience gained from a university career in general. Within the system, many rightly want to consider "how you play the game"; but

without what matters most is whether you won or lost.

These two worlds are not, however, separable. The public perception and exchange value of degrees can exert strong influence on university practice at all levels. As Peter Eisenberger, professor of physics at Princeton University, noted recently in a discussion of the research university, "Once students hear that investing years and thousands of dollars in a Ph.D. has little or no economic value or intellectual satisfaction they will start changing their plans" (Roundtable, 1995: 50). So, though it can seem a crude measure, in fact the exchange value of a degree remains a fairly sensitive indicator of the market status of a university, a degree, a discipline, and a graduate.

But we also want to suggest that degrees are actually more complex. They don't simply either helpfully represent or unhelpfully misrepresent what universities do. Rather, they provide a helpful misrepresentation—a misrepresentation that provides both universities and society with important slack in a system that should not be too taut. The degree's exchange value gives both universities and students a certain license to do what the degree permits but cannot acknowledge. It allows students to "play the game" in varieties of creative ways, on the simple condition that in the end they "win" a degree. Behind the "front" of the diploma, students and faculty can undertake activities that are socially valuable but not easily evaluated for the market. Simultaneously, it gives the job market and society as a whole more diverse and versatile candidates than they probably know to ask for.

To shift our metaphor to politics, the degree is, in legislative terms, an "omnibus package" that can draw broad public support. If this support is neglected, each of the university practices that at present comes unobtrusively "tacked" to the overall "omnibus" degree becomes vulnerable to a "line item veto."

4 Learning and lading

The degree, then, is in some ways useful for what it mis/represents. As long as it represents certain things about a degree holder with reasonable accuracy, it can creatively obscure others to advantage. But that still leaves the question of what are these "certain things?" What does a degree represent? What is its significance in this world of exchange? Where does it get its acknowledged value?

Most commonly, we suspect, degrees are taken to be a sort of intellectual bill of lading, a receipt for knowledge-on-board. Teaching, in this view, is a delivery service; universities, a loading site; and information technology increasingly looks like an intellectual fork-lift truck. Of course, no one actually says

this, but a delivery view nonetheless underlies much of what is said about universities. (It also helps explain many misguided educational and technological strategies. If it's true that the most effective technology in the classroom is still the overhead projector, this is probably not because of universities' inherent conservatism, but because they and the technology they use are seen in this fork-lift way.)

The knowledge-delivery view strikes us, however, as both wrong and misleading in a number of ways: it misunderstands how people learn, where they learn, and when they learn. In the first place, it takes students as empty vessels into which the university pours information. This is an extraordinarily passive view of how people learn, one which takes no account of the active participation involved in learning and knowing.

Anyone considering using the Internet for education should barely blink before rejecting such a passive view of learning. Net users don't sit around waiting for knowledge to be delivered. They go out actively hunting down new ideas and building new connections. They scour catalogs, Gopher and ftp sites, World Wide Web documents, MOOs, BBs and so forth, following established links and making new ones. In the process, they form elaborate and informative chains. A serious journey on the net can articulate a complex pathway, joining both nodes and links into intricate and informative narrative structures. It's not a passive process. (Nor, contrary to the associations of "surfing," is it necessarily a superficial one.)

Second, the knowledge-delivery view of the university can't account for all the things that people learn on campus outside the classroom. These can be as important to a student's career as what goes on inside. People leave college knowing not just things but knowing people and knowing not just academic facts but knowing social strategies for dealing with the world. Reliable friendships and complex social strategies can't be delivered and aren't picked up in classroom hours alone, but they can give a degree much of its exchange value.

And finally, a knowledge-delivery view radically devalues learning and knowledge creation that occurs outside the classroom and beyond the campus. Learning doesn't stop after a university career. It is, as we note below, a life-long practice. Furthermore, learning doesn't stop at the campus edge. T-shirts that proclaim "I got my degree at the University of Life" neatly ridicule the idea that the university's the only site of learning.

The degree doesn't look much like a bill of lading, then. And it isn't much treated like one either. Employers and clients, for whom most degrees are ultimately earned and with whom they are exchanged for status and income, usually look at a degree with infinitely less care. Where they would scrutinize a delivery rigorously, they rarely look beyond the central letters

(B.A., M.Sc., etc.), the name of a school, and a mumbled "major." No inventory is taken of all those classroom hours the degree mis/represents. No one outside academia really wants to examine a transcript.

Those who have received a degree don't act as though it was the delivery that was most important to them either. Alumni tend to blur on classroom information. The details of what they were taught usually fade exponentially after finals. They wouldn't easily forgive someone who asked them to take their exams a couple of years-or possibly even a couple of weeks-later.

Alumni memories do, however, provide some insight into what it is that universities actually do behind the degree. Alumni remember the groups they joined, the scholars they worked with, the teachers and students they met, the friendships they made. Such memories tend to be far stronger and far more important than the facts they were fed. We don't have to look much further than the group of Rhodes Scholars around our current president to see how college networks formed around an Oxford PPE degree can be far more important in later life than the degree's formal content.

Such networking is not simply a campus sideshow. The groups people join at university, some social, some academic, are important. There's much truth in the old saying "it's not what you know, but who you know," though that doesn't quite reflect the intricate connection between "what" and "who." It's this connection that ultimately explains why parents pay high fees for "good" schools; why students and faculty struggle so hard to find places at relatively few universities, while the vast majority of institutions often struggle to fill their places; why academics are concerned as much about where someone received their degree and with whom as about what degree was received; why outside academia diplomas are in the end significant indicators of job worthiness, though transcripts are not; and how university experience helps people find their way through life after university. For the core competency of universities is not transferring knowledge, but developing it, and that's done within intricate and robust networks and communities.

5 Universities, communities, and learning

The idea that communities are at the heart of what universities do and the experience their degrees represent may seem a heretical, wrong-headed, foolish, romantic, or simply anticlimactic answer. We want only to insist it's not a frivolous one.

A community view, we suggest, allows a more rounded view of what learning, all learning, is and how it happens. A delivery

view assumes that knowledge is made up of discrete, pre-formed units which learners ingest in smaller or greater amounts and in specialized settings until graduation or indigestion takes over. To become a physicist, such a view suggests, you need to take in a lot of formulas and absorb a lot of experimental data. But, on the one hand, knowledge is not a static, pre-formed substance; it's constantly changing and learning involves active engagement in the processes of change. And, on the other, people don't become physicists by learning formulas any more than they become football players by learning plays. In learning how to be a physicist or a football player-how to act as one, talk as one, be recognized as one-it's not the explicit statements, but the implicit practices that count.

Indeed, knowing only the explicit, mouthing the formulas or the plays, is often exactly what gives an outsider away. Insiders know more. By coming to inhabit the relevant community, they get to know not just what the standard answers are, but the real questions and why they matter. You don't pick up those things in textbooks, any more than you learn to talk like a native by studying grammar books. Anyone who has traveled in a foreign culture knows that what goes down on the street isn't what's put down in the books. Learning involves inhabiting the streets of a community's culture. The community may be made up of astrophysicists, architects, or acupuncturists-for academic disciplines are themselves just one among many types of community-but learning involves experiencing its cultural peculiarities.

The central point we want to make-a point which lies behind the various arguments we present in this essay-is that learning does not occur independent of communities. Indeed, it's exactly because students can gain credentials without ever gaining access to knowing communities that the relationship between learning and credentials is highly problematic. People can and do end up with the label but without the experience it's meant to signify. Consequently, the central thrust of any attempt to retool the education system must involve expanding access to communities not simply to credentials.

But our argument is also driven by the recognition that in our highly commodified society it is naive to believe that access on its own is enough. Those who have the label but not the experience present one problem. But those who might have the experience but not the label face another. Experience without a formal representation has very limited exchange value-as those whose only degree is from the university of life well know. The purpose of retooling must be two-pronged-it must seek to provide wider access to communities, but it must also expand ways to represent new forms of access in the markets where students need exchange value.

But before exploring these issues, we need quickly to clarify

this notion of "community." Recently the notion has been trumpeted most loudly by the "communitarian" movement. Consequently, by describing universities in terms of community, we may seem to put academic disciplines somewhere on a cozy line running between a neighborhood watch and the football-team boosters. The communities we have in mind, however, are usually less formal and often less congenial than either of these. They comprise the enduring interpersonal relations that form around shared practices. People come to share the same community by sharing the same tasks, obligations, and goals.

Stephen Toulmin (1972) has explored the community character of academic disciplines. He argues that through a complex of shared practices and institutional arrangements (in which the university has come to play a major part), disciplines form "communities of concept users" (p. 12). What is often thought of as "concept-acquisition," he maintains, is really a rich process of "enculturation" as newcomers become members of the community (p. 37). This enculturation, as we have argued elsewhere, involves genuine participation in the community whose concepts are to be acquired (Brown, Collins, & Duguid, 1988).

Toulmin's argument throws light specifically on academic disciplines as communities. The force of his insight into how learning occurs is significantly expanded, however, by the work of two learning researchers, Jean Lave and Etienne Wenger (1991), who argue that all learning, whether specifically "academic" or not, involves enculturation in communities. Thus, though the content may differ, the form of academic communities is at base much like the form of other communities. They are all what Lave and Wenger describe as "communities of practice."

More generally, such communities are, we think, essential and inevitable building blocks of society. Being an inevitable rather than optional form of social arrangement, they have the same credits and debits as society as a whole. They are as likely to be hierarchical as egalitarian; to be restrictive as open; to resist change as welcome it; to be internally divided as united. What connects members of a community are the practice and the concepts they share, not a warm glow of fellow feeling.

So we are not claiming, as communitarians do, that it would be useful to form communities and that universities would be a good place to form them. Rather we claim that communities, with all their strengths and shortcomings, grow inevitably and inescapably out of on-going, shared practice. For more restrictive communities, such as academic disciplines, the challenge is not to form them, but to join them. The university has, for better and for worse, become gatekeeper, controlling access to these important communities. The real test of a university is what sort of access it provides. However crude

the comparative exchange values of degrees may be, they usually indicate reasonably well not just the quality of participation of particular individuals, but also the quality of access that the university makes available.

6 How universities work despite their best intentions: Graduate and undergraduate education

Much of graduate education and research makes the attempt to bring newcomers into the disciplinary community quite clear. Practical collaboration between aspiring students and established scholars introduces the former to a discipline's theoretical and institutional characteristics. Graduate students are predominantly involved in working their way ever deeper into a community and its institutions, moving away from a toe-hold on the periphery towards increasing participation. For this, the first things they need are authentic communities and direct access. Given these, despite the occasional didactic distractions, graduate students can confront in full the characteristic demands, standards, and practices of the particular community. Graduates thus learn not only how to join a community in general, but how to move through one in particular; not only how to recognize members, but how to be recognized as one.

The reality of graduate education turns on its head the assumption that as people go into an academic field they simply become more theoretical. In many ways, they become more practical. Advanced graduate students are like apprentices being led into a profession by someone who has previously mastered its practice. The resulting mentoring relationship allows, for example, medical students to begin treating patients, law students to compose briefs, historians to undertake historical research, physics students to engage in the practice of physics rather than merely learn about it, and so on. It isn't abstract theory but concrete, community practice that's at the top of the pyramid.

Things are obviously different for undergraduates. They, after all, are prime targets of mechanisms of delivery. They prompt the question how can learning go on in the way we describe if no one is paying any attention to it-if both faculty and students think of themselves as engaged in a process of delivery? Luckily for learners (and universities), life is full of unintended consequences. Undergraduate curricula may often be designed to deliver a lot of predigested knowledge, but to do so they usually have to bring together practitioners from a lot of different, highly specialized communities. These community members, whether intentionally or unintentionally, display for students much of the reality of what life in those communities is like.

Perhaps the most important thing undergraduates gain from

this exposure is an implicit sense of how society is made up of communities of practice and how these all differ from one another. From a distance, academic disciplines appear engaged in the collective and seamless pursuit of knowledge. As students begin to engage with the discipline, as they move from exposure to experience, they begin to understand that the different communities on a campus are quite distinct, that apparently common terms have different meanings, apparently shared tools have different uses, apparently related objects have different interpretations. Learning this, however unconsciously, is a key outcome of a college career. As well as spotting the differences, undergraduates also tend to recognize the common social demands professional communities make. This is an important part of the socializing effect of universities that makes their diplomas, like high-school ones, congenial to corporations (see Eckert, 1989).

Undergraduate students don't only get to see how particular communities differ. As they work in a particular community, they start to understand both its particularities and what joining takes, how these involve language, practice, culture, and a conceptual universe, and not just mountains of facts. So by the time students have finished an undergraduate career, they have usually had sufficient experience of a variety of communities that a diploma is a safe indicator that its bearer has learned the rudiments of community joining-which is only another way of saying that he or she has begun to learn how to learn.

7 Beyond graduation: Life-long learning

In the past it has been quite easy to regard universities as essentially the focus for the sort of graduate and undergraduate education we described in the previous section. For a long time as universities have acted as gatekeepers to academic knowledge, the campus has maintained a certain isolation. "Town" and "gown" have been separate. Alumni have primarily been sources of cash for the university; universities a source of nostalgia for alumni.

Such distinctions, however, have ignored the role of communities not merely as purveyors of knowledge, but also as creators of it. "Communities of concepts" don't merely trade in concepts, they revise, and develop old ones and introduce new ones. These changes, moreover, don't occur only in the communities of the traditional "ivory tower." Knowledge is created elsewhere in society, too. Between the university and the rest of society, knowledge is constantly being changed and interchanged. The increasing dispersal of significant changes is putting pressure on the conventionally distant relations between town and gown. On the one hand, universities need to draw on resources-not merely funds of money but also funds of practical experience-that lie beyond the campus.

While on the other hand, universities need to extend their contacts beyond the campus to make sure that the knowledge they create gets out to where it can be most useful.

One way for the university to look outside itself is to consider the question of life-long learning and the notion of learning contracts. The community insight acquired during a four-year degree never, of course, sufficed for life. But in the past almost everything else a man or woman needed to know in a particular job could be picked up *in situ*. Increasingly, this is no longer feasible. As jobs transform themselves and develop in unprecedented directions, people need to reimmerse themselves in specialized communities to pick up specialized knowledge. This creates a new role for the universities-looking to education after the conventional degrees are long past, catering to the need for life-long specialized learning.

So universities need to find ways to address people beyond the conventional degree courses and to open campus communities to participation from "outsiders." In particular, universities should consider some of their unexploited assets. Whether for practical or organizational reasons, alumni and local communities don't usually have access to campus activities-classes, labs, seminars, field trips, and the like. But the use of live links, videotapes, ftp sites, World Wide Web documents, and burgeoning informational technologies should help universities to capture the otherwise transient practices on campus to make them useful in other circumstances. This needn't be thought of simply in "broadcast" terms. Hours of videotapes of classrooms have only limited use. To increase use value, universities could tailor documents (including, video, audio, or multimedia recordings) with particular audiences in mind.

One approach might be to take advantage of a flourishing campus practice of circulating the notes of good students. These notes help a class develop a shared sense of what seems to be worth emphasis and attention in the otherwise continuous stream of information produced in class. Such a practice could be developed to add value to recordings of a class. Members of the class, as a part of their own note-taking practices, might provide real-time annotations to a recording that others will use later. An annotating system could allow a member of the class to highlight what they believe will be of particular interest to a secondary user. (If they know who that user will be and what his or her specific interests are, the class member could probably do this with some precision.) Secondary users, particularly if they are well-versed in the background, could then move rapidly from one annotated point to another as they use the recording, though they could always play intermediate sections for clarification and context if they needed. Such annotations, in effect indexing the recording for future access, might greatly increase the value of classroom recordings, which are already fairly commonly

made.

Many of the arrangements and the technologies they could use for this work will, of course, also help universities to reach the diversified conventional student body. Another strategy, one that covers both types, might be to offer "learning contracts" to incoming students. The university might contract with them to continue to maintain connections between students and the relevant academic communities after graduation in a variety of formal or informal ways (including, perhaps, the annotated recordings). In reaching out beyond the campus in ways like this the universities would not only be expanding their fee base. Simultaneously, they would be maintaining links to the sort of practical expertise they often lack. Thus arrangements like these should also help the university draw on the resources in non-university communities.

8 Technology paradigms: Distance education

We began with a descriptive account of what we think universities do. In the last section, however, as so often happens, we changed to talking about some things that universities ought to do, but don't. These primarily involve blurring the university's traditional boundaries while extending its reach across space and time. These are changes that the evolution of the university's environment is beginning to demand. And now, the emerging technological infrastructure is starting to make them possible. Information technology is particularly good at breaking down traditional boundaries and reaching across space and time. So now it's time to give a little more detail to roles technology can play.

While considering what new things a university might do, we need to keep in mind our own answer to what it is that universities already do that's valuable-their core competency of developing certain types of communities. With this in mind, our first step will be in the wrong direction: we start by saying what educational technology probably shouldn't focus on.

In the last few years, new technologies have turned universities' eager attention to "distance" teaching. Administrator's eyes gleam with the thought that distance education will allow them to reach more people across greater distances more cheaply than ever before. The attractiveness of low-cost, technologically mediated teaching is pushing some in the direction of maximum distance, minimum cost, and a virtual university. We think this is the wrong goal to pursue, for several reasons.

First, distance teaching still operates under a delivery paradigm. The concept was developed under the influence of previous generations of technologies, as the broadcast capacities of television and radio proved useful for reaching

unconventional student bodies. The Open University (OU) in England, for instance, used these technologies instead of conventional classrooms. Broadcast media allowed the OU to reach people who had little or no access to conventional universities. It didn't, however, change the underlying delivery-structure of the pedagogy. It questioned the privilege of the classroom, but it didn't question the practice. It simply used broadcast media to mediate much the same old delivery from a broadcaster at the center to recipients at the periphery (Bell & Tight, 1993).

Second, as we noted earlier, universities succeed despite themselves. It's the collection of communities they open to their students as much as their formal pedagogy that makes universities such a valuable site for learning. By attempting to push all of a student's university education onto the Net and retaining conventional pedagogy, universities simply risk making inaccessible all the valuable insights into communities that students previously gathered by default. Furthermore, students in dis-located universities will be unlikely or even unable to form the local networks that can be so important to their later life and the health and the wealth of a region. Unreflective notions of distance learning simply chase academia ever-higher up a virtual ivory tower. Technology needs to be thought about in different ways.

9 Talking the talk

It's at first difficult to see what technological paradigm follows from the community rather than delivery view of education. As each community has its own specific interests, its own ways of knowing, its own central endeavors, generalizing seems out of place. But communities are made up of people, and at the heart of all social relations and practice lies human communication of one form or another. On the basis of this assumption, we suggest that learning technology should be build around a conversational paradigm.

That declaration probably drew about as much applause as our earlier claim that communities explained the core competence of universities. Indeed, conversation can seem just about as insipid as community. It too rings with a tone of feel-good consciousness raising. But, like communities, conversations are not necessarily placid or polite. Nor do they deal solely with explicit exchanges of information between direct participants. They are complex and powerful social processes that involve silence as much as saying, knowing as much as information, and peripheral eavesdroppers as much as central interlocutors. Through first listening and slowly participating, people learn how to speak and when, what to say and to whom; they come to understand a community and practice from the inside, to recognize not only the accents, inflections, and jargon, but most of all the social significance of a practice.

Conversation is the way understanding gets around.

Saxenian's (1993) comparison of Silicon Valley and Route 128 implicitly recognizes the power of conversation. She saw that one of the differences between the two, what made one set of communities more adaptive than the other, was the presence in one and the absence in the other of a central communicative technology: local bars. The geography of Route 128 provided no central gathering point, while the more formal social structure tended to isolate employees. In Silicon Valley, by contrast, word spread and ideas were disseminated because people from different businesses relaxed together over a beer at the Wagon Wheel and talked.

More formally, pragmatic philosophy and theories of practice, on which the idea of a community of practice is based, have emphasized the importance of conversation. For both, knowledge is not some external, general object that people uncover and pass around, but a product of communal inquiries and investigations. Such claims lie behind Dewey's influential idea of "productive inquiry" (Hickman, 1990, Cook and Brown, in preparation), which essentially replaces the idea of closed, objective knowledge with an open-ended idea of knowing as inquiry. Knowing is thus always shaped by the tools of inquiry, and central among these is conversation. Conversation also underpins Wittgenstein's (1968) philosophy of "language games," Rorty's (1979) pragmatism, and Oakeshott's (1991) anti-rationalist practice theory. One way or another, all these philosophers suggest that it is through the web of language and conversation that people come to know. Stanley Fish's (1980) literary criticism similarly puts understanding at the heart of the open-ended conversation of an "interpretive community" who together reach a consensus about what's what.

10 Conversing with and conversing about

The centrality of conversation helps to explain why the Internet is such a significant phenomenon. Previous communications technologies-books, film, radio, television, telephones-have all supported distance. But they allowed primarily either monologues or one-to-one conversations. Communities, however, thrive on many-to-many conversations, which, even in the technologically rich twentieth century, have for the most part only been possible in face-to-face situations. So the campus and the workplace, which bring people together, have long been crucial sites for learning. Technology in general and the Net in particular now offer low cost ways to hold many-to-many conversations among people who are no longer in the same place.

The value of the Net doesn't simply lie in the way it allows groups of people to talk with one another. It also comes from

the way that, unlike telephones or video links, the Net can provide common objects for participants to observe, manipulate, and discuss. It's not, then, simply a medium for conversation, nor is it just a delivery mechanism. It combines both, providing a medium for conversation and for circulating digital objects. Furthermore, it also allows participants to turn the ongoing conversation itself into another object of conversation for further reflection. Usually, educational technology tries to do one or another of these things. Ideally, it should combine all three. Some technologies do.

E-mail E-mail, usenets, bulletin boards, and listserve mail lists get their usefulness from the way they transmit transient comments and allow them to be captured to make up an archive. Of course, not all comments are illuminating, but an archive is helpful in showing both dead ends and possible developments. Participants see for themselves the ebb and flow of exchange and its history.

Lists and their narrative archives are particularly useful for people not directly joining in, list "lurkers" as they are sometimes known. The experience of lurking, particularly if it comes with the right to join, can be quite rewarding. Like a good conversation or a lively radio talk show, list exchanges can be enjoyed as much by those who don't contribute as by those who do. For those who don't, there's a lot to be learned merely from eavesdropping. On many lists, the only evidence of the many lurkers haunting the virtual space comes when someone threatens to take an interesting conversation off list. Then people suddenly materialize to protest, writing to say how much they've learned from merely lurking.

CoNote Nonetheless, everyone who's hung out on a list knows that for every good conversation that gets going, there are a dozen false starts. And for every useful contribution, there can be a dozen uninformed and highly opinionated ones that derail everyone. Often, the conversational wheels merely spin or community conversations with potential get side-tracked by outsiders who haven't grasped the context. This is particularly true when the participants are not well versed in the topic. Dan Huttenlocher, a professor in Cornell's Computer Science Department, tried to create a useful closed list for informal undergraduate class discussions, but he was disappointed to find how little it helped. "Particularly for undergraduates," he notes,

A list makes conversation easy, but focus difficult. Students don't need the opportunity to talk. What they need is something to talk about.

Conversely, when he put problem sets on a class ftp server, Huttenlocher found this gave students a great deal to talk about, but no means for simultaneous conversation.

To help focus conversation, Huttenlocher with Jim Davis of the Xerox Design Research Institute at Cornell, designed "CoNote," a Mosaic-based tool that in essence combines the server and the discussion group. CoNote allows students looking at problem sets on a Web document both to post and to read questions and comments attached to particular points in the document. With CoNote, students could raise and discuss tricky issues, learn from others, discover they weren't the only one stuck, and generally enter into lively debates about issues important to the class. By capturing the transient and attaching it to the particular point at issue, CoNote allowed students themselves to add context to the original document, thereby helping other readers. The system was an instant success, proving much more useful and used than either the list or the ftp site alone.

LatinMOO Nowhere on the Net has conversation become as lively as in MUDs and MOOs. MUDs (Multi-User Dungeons) were designed so that several players on computers connected by modems could play the game "Dungeons and Dragons" together. MOOs remove the game goals and turn the "virtual space" into a manipulable set of "rooms" with programmable "objects." By allowing rooms to be built, modified, and given their own character, MOOs have given an important, "ownable" sense of place in the void of cyberspace-providing a place rather than merely a space for people to congregate. This makes MOOs significantly different from forums and chat lines. In consequence, MOOs have become the clubs and coffee-houses, pubs and cafés of the Internet. Now you can go to an on-line Wagon Wheel to see what's up. In these on-line programming environments, communal knowledge spreads like wildfire.

University teaching took eagerly to MOOs. Many have simply been used on one campus, but one of the great attractions of MOOs is that they allow people on several campuses to get together for discussions. Especially for courses that have difficulty finding enough live bodies on one campus, the MOO offers an interesting prototype for distance learning. One particular instance is James O'Donnell's courses on Boethius, run in the fall of 1994 for credit from the graduate school at the University of Pennsylvania. Graduate mediaeval Latinists are few and usually far between, but LatinMOO allowed students from the United States and Asia to form a reasonable graduate-seminar quorum. (The course on Boethius spanned some 9 time zones.)

The structure of the course and the use of the MOO reached far beyond simple "delivery." LatinMOO was much more than a chat line. It was designed as a "complex" with a quadrangle, several classrooms, a common room in which only Latin could be used and a virtual Coke machine around which people would gather to chat. O'Donnell opened the MOO classroom to students enrolled in the class, while he made other parts of

the MOO available for Latin students from his regular courses (including a "live" class on Boethius) to get together more informally. To widen the conversation, O'Donnell combined other Net facilities with the MOO creatively. He made the central text available to all at a Web site with links to a commentary and other resources. And he started a Boethius e-mail list that included all in the MOO seminar and the live class, but which essentially created space for virtual "auditors." This opened discussion to students and academics from around the world, while maintaining a separation between levels of participation. The e-mail exchanges were themselves archived on the Web.

These are examples of learning technologies (though not all designed for educational uses) that succeed, we think, because implicitly they honor community and conversational paradigms. As such, they begin to show the sort of technologies universities need to support their core competencies.

They may suggest the way to go, but they also raise certain challenges. In the short term, they offer means for universities to expand their mission while maintaining their current arrangements. But in the long run, as we suggest in the remainder of this essay, they may create a need for more radical rearrangements-rearrangements that allow "open" rather than just "distance" learning. Open learning seems to us a much more valuable goal, but it will put much greater pressure on universities to change.

11 Transformations and rearrangements

The sort of learning that goes on the Net outside classrooms (whether real or virtual) with no-one in charge but the learner is closer to what has been called "open learning" (which the Open University never quite achieved) than it is to "distance teaching" (Hodgson, Mann, & Snell, 1987). Open-learning advocates seek to bring down barriers that prevent learners from taking charge of their own learning as much as possible. These barriers are not simply physical or technological, but also social and institutional (Boot & Hodgson, 1987, Bell & Tight, 1993, Coffey, 1977).

So unlike distance teaching, the promotion of open learning cannot be taken as primarily a technological issue. Institutions will have to cede significant amounts of control if learners are actively to take charge of their own learning. Or perhaps it is truer to say, that as students use the Net to take increasing control over their learning, universities will have to recognize and accommodate themselves to changes this will provoke in their conventional gatekeeping roles.

But if the Net questions universities' conventional control over

access, it makes problems for learner's too-problems of access and problems of representation. In the matter of access, if learning involves legitimate participation in communities, the Net often provides only an illusion (though often a very powerful illusion) of participation while actually keeping people at a safe distance. As anyone who has sent e-mail to the White House, Congress, or even a newspaper knows, the Net can often be used to give the impression of access while refusing the actual experience. So the Net may, for instance, allow students to tap into community objects, but not into the community itself. They may find access to a text, but not to the communities that give that text significance. Where Fish (1980) was once challenged by the question "is there a text in this class?" the Net raises the challenge "is there a class with this text?"

Furthermore, though Net groups-newsgroups, mail lists, MOO fraternities, and so on-are, we believe, profoundly useful means to support and develop existing communities, they are not so good at helping them to form. Huttenlocher argues there is important synergy between his live classes and the exchanges on CoNote, that CoNote alone couldn't provide. "The Net isn't a good place to form communities," he claims, "though it's a very good place to keep them going."

Rheingold's (1994) notion of "virtual communities" as well as O'Donnell's experience in LatinMOO at first seem to challenge Huttenlocher's claim. But both are special cases. The WELL, where Rheingold's community formed on line, brought together a group of like-minded people from a fairly homogenous social background and geographical region. They seem to have managed to meet off line almost as frequently as on. Certainly, their on-line behavior reflected norms formed off line and shared by most participants. The Net works well to bring like-minded people together like this, but not to make people like minded. Follow a list joined by people from radically different communities and the difficulties are often quite apparent. For instance, it's often not the notorious "flame" that's a barrier to cohesiveness but the difficulty of recognizing (as writer or reader) what is inflammatory. What's brisk and to the point to an American or amiably assertive to an Italian can be quite offensive to British or Japanese contributors, with their distinct and culturally specific notions of politeness, deference, and self-deprecation. Similarly, members of different disciplines often fail to understand each other's interests. What's important to a historian, for instance, is often irrelevant to economists, making list discussions of economic history quite volatile encounters.

In O'Donnell's class (in which one of the current authors took part), too, on-line participation was appreciably tempered by common off-line experiences. In particular, the participants were graduate students, which by our own analysis, makes them quite distinct from Huttenlocher's class. Graduate

students have already been heavily socialized into the patterns of university and graduate work and behavior, whereas undergraduate classes are actively engaged in this difficult socializing process. Unlike Huttenlocher, O'Donnell didn't have to instill too many social conventions beyond those of MUDding itself. The niceties and the idiosyncrasies of scholarly behavior were already there.

This takes us back to our original argument. A good deal of what an undergraduate diploma signifies and of the exchange value it gains comes from the way education socializes students, making them unreflectively familiar with diverse communities and helping them learn how to learn. Experience on the Net, we suspect, doesn't do this quite so easily.

Even if the Net did provide full access, it still presents learners with another problem. Net autodidacts, who have taken full advantage of the Net's open-learning potential, lack a recognized way to represent their experience-and, as we argued earlier, it's the representation of experience (not the content) that has exchange value. Employers who have proved generally reluctant to accept credentials from the "university of life" are unlikely to behave very differently with open learning on the Net.

We believe that the university's oversight and credentialing function will still be needed in the digital age, and so will the learner's need for access to communities of scholars. What the digital age is likely to change, as we suggest in the following sections, is the relationship between these two.

12 A historical, distributed model

If we ignore, as some prefer, the way credentials provide both constraints on and resources for the higher education system—a valuable form of misrepresentation as we have called them—then it's possible to see the march towards distance learning as a fairly direct march to progress. With the development of various technologies, it can be claimed, students have slowly been able to take advantage of each new form of distance learning: the correspondence course, the broadcast-media course, and now Net courses. The future, as electronic university proponents assume, is simply to continue this progressive trend and move towards an "Electronic World-Wide University" (Rossman, 1989).

From our standpoint, this view of the future has three disturbing flaws. First, as we have argued, providing students with direct and legitimate access to face-to-face communities has been a central and important role of the university. Electronic universities, primarily seeking to "deliver" knowledge to individuals over a distance, would not do this. Moreover, the idea of a worldwide university focuses on

knowledge as universal and ignores its particularity and locality.

Second, the idea of a virtual university leaves unresolved the close relation between pedagogy, credentialing, and control and the subtle misrepresentation involved in the getting and granting of degrees.

And third, the history to date of this progressive march, this story of a steady loosening of an age-old university grip on knowledge and access, though appealing, simply isn't true. We have already discussed the first two points. The third, which we discuss in this section, suggests alternative possibilities for organizing post-secondary education, and these alternatives, in turn, help us address in the following section some of the problems our discussion of the first two points raised.

The sort of highly centralized university control that "Open" learning seeks to break down is not, in England at least, an ancient arrangement, but a rather recent one. In the past, universities played less of a monolithic gatekeeping role. The professions, for instance, relied much more on professional apprenticeship. In these areas as elsewhere, university dominion has been increasingly extended, its control continuously centralized rather than diffused.

Formerly, several universities oversaw much looser, more highly devolved arrangements. Students from Scotland to Singapore, for example, took courses and external degrees from the University of London, many without ever leaving home (Bell & Tight, 1993). Nor, importantly, were these simply correspondence courses—early forms of distance teaching. The external degree allowed students and teachers to form or join relatively autonomous groups thousands of miles from the degree-granting university. In the nineteenth century, for example, high quality high schools opened their facilities to students, particularly women, beyond conventional high-school leaving age, enabling local scholars to provide university-level courses in places without a university.

In this devolved system of higher education, pedagogy and control were widely distributed, involving both local and distal scholars and communities. From a distance, the university acted primarily as an administrative body, providing oversight, materials, and credentialing. This arrangement meant that students were neither dislocated from local networks nor yet trapped by the limitations of local resources. They could gain access to established credentials without losing their connections and access to local communities. They could, in fact, draw on the strengths of both the metropolis and the periphery. Moreover, this form of arrangement significantly opened educational opportunities for rural woman, the poor, and Third World residents who lacked access to universities.

For various reasons, the use of external degrees has diminished (though the University of London still administers some). Moreover, much of the "open" potential of the external system has given way to distance teaching, which paradoxically only continues the trend of centralization, replacing local resources with metropolitan ones. So the twentieth century has not provided a linear story-either of progress or of doom. Certainly learners have wrested some control from the university, but in other areas the university has increased its control. The single (and increasingly large) campus as the sole source-of faculty, disciplines, and colleagues-for matriculating students has been the result of a twentieth-century trend of concentration that has probably been as significant as the opposing triumphs of dispersal.

Any rethinking of the university as a resource for open learning, it seems to us, needs to steer a path between the university's centralizing tendencies, on the one hand, and the optimistic faith that technologically mediated distance education will necessarily and inevitably over come this. More than a technological fix is called for. In the following section, we suggest ways to think about restructuring the university to meet these goals.

13 Breaking down the monolith

To take advantage of the technologies of the future without losing sight of the resources of the past, a successful university should, we believe, aim for three things:

- (a) to enable students to engage in open learning, exploration, and knowledge creation
- (b) simultaneously, to provide the resources to help them work in both distal and local communities, and
- (c) to offer them the means to earn exchangeable, equivalent credentials for work done in class, on-line, or through hands-on experience.

To achieve this goal, the monolithic university needs to become a good deal more flexible than it is today. There are various ways this might be done. Here we suggest one in what, we must state immediately, is much more a thought experiment than a rigorously thought-out model.

The University of London system for external degrees suggests that there are really four parts to the standard university. These are a degree granting body, academic staff, campus facilities, and students.

In recent years, as we have suggested, these have increasingly come to be thought of as a single unit. Historical

precedent and contemporary technology, however, argue there's no inherent reason to keep these tied tightly together. Take them apart again, and the system of higher education might become much more flexible. In a distributed system, these four parts of the university might evolve as follows:

The *degree-granting function* might be taken up by degree-granting bodies (DGBs). A DGB would receive its own degree-granting credentials from exactly those bodies that assess universities now. They would fight over students and faculty, just as universities do now. They could take on as many or as few students and faculty as they thought viable, becoming smaller than a liberal arts college or larger than an entire state system. They could set degree requirements and core courses as they saw fit. Depending on the outcome of these options, their degrees would gain recognition, reputation, status, and exchange value much as now. But DGBs would be essentially administrative bodies, owning little beyond their administrative competency and a building to house their (administrative) staff. Without the need for the massive capital investment that a university requires today, DGBs would be much more flexible than their predecessor, able to evolve to meet the needs of students, faculty, and the labour draft.

Faculty, in this scheme of things, could then become independent contractors. Like doctors who contract to HMOs, they would have to find DGBs to sanction their teaching, and like doctors, they might find more than one to do this. DGB recognition would allow students who study with a particular scholar to gain credit for work done towards a degree from the DGB. Scholars could contract individually or in teams. But unlike today, they wouldn't have to assemble in one place. There is no reason for all the faculty of a DGB, nor even all the members of a team, to be in the same place. Some could be on the East Coast, some on the West Coast, and some overseas. They might teach students from several DGBs on-line or in person, through tutorials, lectures, or seminars, or any combination.

Fees could vary depending on the type of teaching offered—a lecture, a tutorial, a research seminar, a lab, or in-work training for graduate, undergraduate, or extension students. DGBs might pay a *per capita* fee to reward a teacher's ability to attract high-quality students to the DGB. Or, like eighteenth-century academics (including Adam Smith and his Edinburgh colleagues), scholars might collect a fee directly from the students they attract. If the DGB pays for matriculating students, auditors might pay teachers directly, offering an incentive to ensure that the structure and content of a course were not shaped by degree and exam requirements alone.

Research might be administered by a DGB, or staffed and funded separately. For both teaching and research, faculty

could find their own facilities. For some these would be extensive, involving labs and expensive equipment. For others it might only be a library or a classroom. Others running small tutorial groups or on-line classes might need no facilities beyond an Internet link.

Facilities, then, might look very much like the campus of today yet be quite independent of either the DGB or the faculty. A particular facility would compete for faculty and students in the region by the quality of its facilities. Both faculty and students using a particular facility might come from several DGBs. The facility itself would become a regional magnet for staff and students. Thus it would be in the region's interest to maintain a high standard of facilities. Faculty and students wouldn't have to travel to their DGB, but they might travel to be close to superior facilities. On the other hand, they wouldn't be locked in to one set of facilities. In well-endowed areas some faculty and many students might use more than one facility. DGBs, faculty, and students might not use campus facilities at all, though, given the needs for socialization, most DGBs and many faculty might insist that as part of their degree candidates spend a set amount of time on campus in groups rather than on line individually.

Student choices grow dramatically if the university is broken up. Their central choice would involve finding a suitable DGB. Perhaps they would choose one that insists on conventional campus life. Perhaps one that made no campus demands. Perhaps one that included certain faculty. Perhaps one that had faculty in the various regions they expected to live in over the next few years: northern Scotland, Singapore, or San Francisco. They might choose one whose degree in an area of interest is known to have a particularly high exchange value; or one that was prepared to validate certain kinds of in-work experience. But students wouldn't be committed to working with the faculty of a single campus or a single region, and in particular, they might be able to work with local communities of excellence whose credentials under present arrangements are not accepted by universities.

In particular, a distributed system might allow much greater flexibility for local sites of professional excellence—research labs, hospitals, architects' offices, law firms, engineering offices, and the like—to offer mentoring programs that give students practical experience and course credits simultaneously. Regions that lacked conventional academic facilities might start to attract students through the quality of mentors in their conventional work force. Students in forestry, agriculture, mining, conservation, or ocean science would, for instance, be able to go and work with experts in their field in the field, however far this might be from conventional academic centers.

Essentially, a student's university career would not be through

a particular place, time, or preselected body of academics, but, rather like their current explorations of the Net, through a network of their own making, yet endorsed by the DGB and its faculty. A student could stay home or travel, mix on-line and off-line education, work in classes or with mentors, and take their own time.

Funding of universities wouldn't change much. DGBs would take tuition fees, while arrangements for faculty and facility *per capita* payments could be negotiated in a variety of ways, as we have suggested. Subject to accreditation, private institutions could set up their own DGBs; states could set up their own. Some DGBs might try to be exclusive, others inclusive. Each would over time develop its particular reputation, attracting faculty and students through the exchange value of their degrees. Groups concerned about education in their field might try to establish themselves as DGBs-the MLA, Computer Scientists for Social Responsibility, or "Academics to bring back Western Civ.," who might not all be dead, white, or male. As we suggested earlier, degrees that reflected too much concentration, that represented too accurately the work involved, might well fall in value compared to those that mis/represented greater diversity. For in the end, the goal of a devolved system would be the flexibility to enable students to avoid sacrificing breadth to depth or vice versa, graduating students as capable of change as the world they encounter.

14 Conclusion

This sketch is intended more as an intuition pump than as an accurate picture of the future. Yet for all its limits, we hope it will make the general point that the radical changes occurring in a university's environment, from the reconstitution of its student body to the reengineering of its technological infrastructure, will require quite different institutional arrangements than those found today. Distance learning, where much current interest lies, is, we believe, too deeply enmeshed within current arrangements to produce sufficiently radical change. More far-reaching alternatives will be needed to take advantage of the resources new technologies offer. Without different institutional arrangements, we fear that not only will these technologies be underexploited, but they may well reinforce the current limitations of our higher educational system.

Whether the university of the future will look anything like the picture we've drawn we can't tell, but we're confident it will look more like our hybrid, combining the local and the distant, the real and the virtual, open learning and conventional diplomas, the strengths of the old and the resources of the new, than it will look like the aging system of today or the ethereal system some envisage for tomorrow.

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