ASSESSMENT OF COMPUTER-BASED EMPLOYMENT SKILLS LEARNING SYSTEMS FOR ADULTS

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Abstract

This paper reports on a study that assessed the strengths and weaknesses of five computer-based, English-language integrated learning systems being marketed commercially in Canada for use in improving employment-related skills of adults. The systems are: Autoskill, CCC, Invest (formerly known as Jostens), Pathfinder and PLATO. The study was intended to generate data on the contexts in which the systems are used, the views of staff and learners in diverse settings about the systems and the strengths and weaknesses of each system under various conditions and with different kinds of learners. This article briefly reviews the study methodology and key findings, using those findings to raise some policy issues regarding the impact of computers on education.

Résumé

Cet article présente les résultats d'une étude visant à évaluer cinq systèmes intégrés d'apprentissage par ordinateur. Les logiciels, qui sont de langue anglaise et vendus au Canada, ont pour objet l'amélioration des habiletés liées à l'emploi chez les adultes. Les systèmes suivants furent examinés: Autoskill, CCC, Invest (précédemment connu sous le nom de Jostens), Pathfinder et PLATO. La recherche visait à produire des renseignements sur les contextes d'utilisation, à recueillir les points de vue des employés et des usagers, et à évaluer les forces et faiblesses de chaque système dans des conditions variées. L'article propose un survol de la méthodologie utilisée et des principaux résultats, suivis d'une brève discussion des enjeux politiques que soulève l'utilisation de l'informatique à des fins éducatives.

Introduction

Computers are becoming an increasingly important component, or tool, in adult education programs. New and more powerful computer-based educational systems are being introduced all the time. Several studies, primarily in the United States, have attempted to compare computer-based learning systems with conventional instruction. Watson (1994) and Thomas and Buck (1994) have reviewed the literature on these studies, and conclude that computer-based systems show outcomes as good as conventional programs. They also conclude that program differences are more important than the system used and that many of the studies are of poor quality. There is some evidence that learners' gains in mathematics are likely to be greater than their gains in language, and this tendency would be consistent with evidence that schooling has the most favorable results on skills that are less often acquired out of school (e.g., mathematics and second languages as opposed to first language). Most of the research on computer-based learning has been done in school and university settings rather than in adult education programs.

This article reports on a study that assessed the strengths and weaknesses of five computer-based, English-language integrated learning systems that are marketed commercially in Canada for use in improving employment-related skills of adults. The systems are: Autoskill, CCC, Invest (formerly known as Jostens), Pathfinder and PLATO. At the time of this study, the PALS system, used in a number of Canadian locations, was no longer being supported by a commercial company and was primarily oriented to basic literacy training, so was not included in the study. Although the differences between the systems do not allow them to be compared in a strict sense, the study was intended to generate data on the contexts in which the systems are used, the views of staff and learners in diverse settings about the systems and the particular strengths and weaknesses of each system under various conditions and with different kinds of learners. The study was intended to provide advice to those working in the field of adult education who were considering purchasing one or more of these systems and to raise some policy issues regarding the impact of computers on education.

Methodology

Research questions

Four sets of research questions were developed to guide the study:

1. Actual use. How is each system used in practice? What range of program styles and operations does each support? What roles do teachers play? What roles do learners play? What range of learners are using the system? Does use vary with different clients? Do some patterns of use appear to be more effective? How does actual use fit with each system's claims about itself?

2. Views of staff. What are the views of staff using each program? What do staff see as the strengths and weaknesses of each system? Are there some program configurations in which each system appears to work better or worse than others?

3. Views of learners. What are the views of learners/clients about each system? Do they find it helpful, user-friendly, effective in meeting their goals, etc? What features of each system are particularly helpful or not helpful?

4. Impact on learning. What achievements or gains are produced by each system? How do these vary for different kinds of sites, learners or program structures? What estimates of cost-effectiveness can be made between the programs and between these programs and conventional instruction?

Data Sources

The study used several data sources as follows:

Visits were made to 34 sites across Canada that used one or more of the systems to work with adult learners. Lists of sites were obtained from the five companies (for various reasons not all companies had a complete record of sites using their product) and the sample sites for the study were selected to provide a cross-section of

settings, taking into account important potential variables such as region, program size, program purpose and sponsoring organization. The 34 sites covered all regions of Canada, programs of very different sizes, sites with different purposes and a range of public and private sponsoring organizations. Site visits involved use of a structured protocol that included interviews with staff and learners as well as observation of the program.

Surveys of learners were conducted at most of the 34 sites visited. 615 learners completed a custom-designed survey form asking about their experiences with the computer system(s).

All known Canadian sites using any of the five systems were surveyed by mail using a questionnaire specifically designed for this purpose, and 139 sites provided usable replies, for a response rate of 62%.

The principal investigator interviewed Canadian representatives of each of the five systems.

Other relevant Canadian studies were reviewed, including Crowley (n.d.); Sylvestre and Lewis (1993); Thomas and Buck (1994), and Wilson (1992). On the whole, Canadian research on computer-based learning for adults is weak, even though the systems are used quite widely.

Readers should keep in mind that the findings reported here are based on actual use of the five systems in 1994, and may not be reflective of all their capacities. Furthermore, the systems are upgraded regularly and significantly, so the evaluation does not predict how the systems might look or operate in the future.

Key Findings

The Importance of Context:

Each system is best understood within the dynamics of its own history, a changing marketplace and rapidly changing technology. The systems will likely be very different in a few years than they are today. Each has a different history, a different corporate structure and presence in Canada. Each started out with a particular purpose that has shaped its approach. At the same time, all five companies are altering their product steadily in the face of changing market conditions and in a desire to expand sales.

Three of the five systems—CCC, Invest and PLATO—are U.S. products being sold in Canada. Only PLATO has actually established a Canadian corporate presence with Canadian staff, although its research and development continues to be done in the United States. Invest is sold through a series of Canadian business partners, and CCC is marketed through Columbia Learning Systems of Calgary. The two Canadian systems, Autoskill and Pathfinder, are different from each other and from the U.S. systems. Neither was intended to be a commercial venture, but their original success led to a commercial approach. Autoskill was developed and has been run by two researchers and is now a limited company. Pathfinder is a private

company that grew out of the original development of the system within the non-profit training organization YES Canada.

Each system has tried to establish its own identity and distinguishing features. PLATO, for example, began as a tool for adult learning in non-institutional settings. It has a very wide range of content, including a strong focus on higher level skills (e.g., calculus, advanced science). CCC was largely developed for use in schools to supplement the work of teachers and thus has strong ties to what might be considered a standard school curriculum. Invest was developed as an adult work education system and has placed great stress on job skills. Pathfinder was begun to provide a computer-managed learning component to an existing youth retraining program focusing on GED (General Educational Development) preparation. GED is intended to approximate the skills and knowledge of high school graduation. Autoskill grew out of research on reading and learning problems of school-age children and had originally a remedial focus. Differences in origins and purposes continue to be reflected in the basic design of each system.

This being said, the differences between the systems should not be overemphasized. Each has developed in ways that make it more similar to the others in an effort to capture additional and changing markets. All five systems allow other kinds of software to be integrated with them. The site survey data showed many sites using other software such as typing tutors, word-processing and spreadsheet programs, as well as other educational programs (e.g., reading activities). This use of multiple vehicles for learning is increasing and is likely to continue to increase rapidly. All systems allow an increasing degree of customization, such as adding local materials or creating unique paths through the material. The companies indicate, however, that most sites do not use the customization capacities of the system, probably due to lack of skill and time.

Moreover, because the field of computer-based learning is highly competitive and the technology is changing rapidly, a positive development by one system will soon be emulated by the others. All the companies have research and development programs, and some of these, especially in the U.S.-based systems, are very large. Each system puts out new releases regularly in an attempt to correct problems and add additional features. Users can often see significant differences between parts of the system that have been newly upgraded and parts that are a year or two older. The rapid pace of change means that any listing of particular features or problems is very likely to be outdated within a few months.

Key Finding #1:

The five systems may be categorized into three groups. Autoskill is intended to build skills in reading and mathematics but is not designed to cover school curriculum. Pathfinder is a computer-managed learning system that can be adapted fairly readily to many different kinds of learning. CCC, Invest and PLATO are computer-assisted instruction systems that provide coverage of many subject areas and levels with instruction largely on the computer.

Autoskill. Autoskill is a tool for developing skills in reading, writing and mathematics, rather than an employment preparation program. Unlike the other systems, its focus is on skill development rather than curriculum coverage in a way analogous to typing program: A non-typist would certainly benefit from such a program, a typist with some skill might well benefit from parts of it and even a skilled typist might be able to make use of it to improve particular capacities. Autoskill does not address employment skills beyond its role in developing language and mathematics skills, although the reading program may use content related directly to work, and Autoskill could certainly be part of a broader employment preparation program. It is comparatively inexpensive and appears to be effective for its purposes, but since it has a different objective than the other systems, it is not really an alternative to them. In Canada, Autoskill is primarily used in schools and in adult literacy settings including ESL programs and in prisons.

Pathfinder Learning Systems. Pathfinder is a "computer-managed learning" (CML) system. It allows the creation of individualized programs of study. The Pathfinder System refers learners to appropriate resources based on their responses to tests on the computer and keeps track of learners' objectives and progress. However, the actual learning material is usually found in print materials such as text and reference books. Thus learners at Pathfinder sites spend most of their time working away from the computer terminals, in contrast to "computer-assisted instruction" (CAI) systems, in which the course content is wholly or largely on the computer.

Pathfinder's structure offers a great deal of flexibility. A wide range of reference materials and learning activities can be connected to the system, including audio-visual materials, trade books and customized materials designed at a particular site. This means that Pathfinder can be adapted more easily than CAI systems to new applications. An important aspect of this flexibility is that Pathfinder can be used as a route to credentials such as high school diplomas more easily than can a CAI system.

Flexibility is a positive feature of Pathfinder, but accompanying that flexibility is a quality issue. CAI systems tend to be self-contained and thus control the quality of all the material within the system, but the Pathfinder system does not control the quality of the resource materials that are tied to it. If the resource materials to which learners are directed—which may be customized at each site—are of inferior quality, then the learning experience will be equally limited. Pathfinder sites are heavily concentrated in British Columbia, with another group in the Maritimes and small numbers of other sites throughout the rest of Canada. Pathfinder sites reported a stronger focus on academic credentials and certificates as a main outcome. However these sites also reported just as much emphasis on other goals such as academic skills, workplace skills and self-esteem. Survey data indicated that Pathfinder sites had the highest portion of learners out of school 10 years or more.

CCC, Invest and PLATO. CCC, Invest and PLATO are full computer-assisted instruction (CAI) systems. Each provides a wide range of content on the computer

covering areas such as reading, writing, mathematics, science, social studies, life skills and work skills. Much of the content is based on a generic school curriculum. Most of the learners' time is spent working with the computer, which provides testing, placement and learning activities. All three systems make extensive and increasing use of graphics and integrate sound, CD-ROM and other peripherals.

Although the three systems have some differences in approach and emphasis, it was found that for purposes of upgrading employment skills the differences among them were relatively unimportant. The three differ in the range of content they address, in the way learners move through the content and in the relative emphasis given to different learning elements, but none of these differences is nearly as significant as the variations among sites in the way each of the systems is used, as described later in Key Finding #3.

All three systems are based in the United States, with essentially all research and development also taking place there. Each of the three systems tends to be most commonly used in particular parts of Canada. This distribution is largely a function of where each system has sales staff, but is also partly related to places where there is sponsorship for adult employment preparation programs. Each system can be found in sites with diverse sponsors, though PLATO has a greater presence in for-profit sites. All three systems sites reported improved academic skills as their most important goal, with increased self-esteem second and academic credentials and workplace skills either third or fourth. The survey did not show systematic differences in the size of sites by computer system being used.

An important point to note is that 9 of the 23 CCC sites and 8 of the 51 PLATO sites reported dealing primarily with Aboriginal learners, and almost half the CCC learners in the learner survey reported having a first language other than English or French. CCC sites were also most likely to have more female learners and to have more young learners. Invest was more likely to be found in retraining programs for particular industries; it has been fairly widely used in the Maritimes in the fishery worker retraining efforts. PLATO had very broad coverage of client groups. The learner survey showed a wide range of learners using each of the systems. There were various differences in learners' backgrounds and reasons for enrolling in their program, but none that appear significant in understanding the survey results or evaluating the systems.

Key Finding #2:

Staff and learners are very positive about working with the systems.

Data from the site visits, site surveys and learner surveys indicate that 1) overall ratings of all of the systems were very positive and 2) differences among the systems were small. No system ranked consistently higher or lower than the others. Moreover, even where a system's overall rating was very high, some sites gave it much lower ratings. In short, these results do not provide any evidence that one system is seen by sites as either particularly good or particularly weak.

Staff at the sites visited commented positively on the systems' motivating effects on learners, on the ability the systems' abilities to individualize programs, on the degree to which record keeping was automated and on the ease of use for themselves and learners. There were one or two places where reservations were expressed about the traditional nature of the content or about the possible isolation of learners, but these were exceptions overwhelmed by positive comments. It is worth mentioning that staff are not necessarily aware of all the features or capacities of their system.

Learners, while very positive, were not uncritical of the systems. 36% of the respondents said the system they used had problems or weaknesses, with CCC respondents least likely (26%) to say so. However, respondents varied widely in the problems they identified. Lack of sufficient Canadian content was the only system-related problem identified by more than 11% of those commenting. Invest and CCC use material and examples that are primarily American, and in the social studies module this was seen as a particular problem by Canadian sites. Learners also reported many positive outcomes from their participation in the programs, including "reaching goals", developing self-esteem, developing job skills and feeling up to date. Acquiring academic credentials was the most important outcome reported by learners.

The study found no consistent evidence from site visits or surveys that indicated particular systems are best suited to particular kinds of learners in employment skill development programs. Some of the systems (Pathfinder, PLATO) do not deal with basic literacy skills, but most employment skills programs also presume at least a basic level of literacy. Most programs reported less success with younger clients (ages 18-24). Because most sites have multiple goals and serve a range of clients, and because there is variability among sites, it is not possible to conclude that a given system is the best option for, say, worker retraining, or disabled clients or any other specific group.

Key Finding #3

The variability among sites using any particular system is of more significance than the variability between the computer systems. In particular, the quality of staff is a critical factor in program success.

One cannot overemphasize the differences among sites, whatever computer system they were using. The sites visited and the sites responding to the survey varied greatly in almost every aspect: number of staff, number of learners, sponsorship, age of the program, number of computers, time spent on computers, length of program and program objectives. Some sites operate 16-week structured programs, while others last a year or more and are open-ended. Some are full-time and quite regimented, others part-time and unstructured. Some look very much like a traditional school in approach, while others were very dynamic adult education environments. Some are sponsored by school systems, staffed by teachers and located in schools; others are sponsored by for-profit companies, staffed by personnel without formal qualifications and located in downtown commercial buildings. The degree of control learners have over their work varies greatly from site to site, as

does the degree of informality between staff and learners. In some sites attendance is carefully monitored and excessive absence can mean expulsion; in other settings attendance is optional. Physical settings vary from extremely basic (and uncomfortable) to very comfortable.

Program staffing is particularly critical. It was clear from the site visits that the skills, commitment and approach to learning of the staff had more impact on learners than any other variable, including the computers themselves. While this study did not set out to look at issues of staffing, the site visits indicated that staff-to-learner ratios, qualifications of staff, salaries, initial and ongoing training and staff attitudes toward learners and toward computer-based learning all varied significantly from site to site. All the systems providers recognize that the value of their system will be enhanced or diminished depending on the staff at a given site.

Key Finding #4:

Sites do not have sufficient information on the learning and other outcomes of their programs.

The researcher had expected that a reasonable number of sites would make use of the data-gathering features of their systems, and that data would be available to the study in order to make comparisons in areas of cost-effectiveness with conventional education programs. In fact, very few of the sites visited kept data that would allow calculation of academic gains of learners related to time in program. Almost half the sites visited (14 of 34) kept no achievement data on exit. Others had exit data but no entry data, or had data but did not compile it, or relied on provincial exams or post-program placement rates. About a quarter of the sites appeared to have good data on post-program activities of clients, though few of these extended the data beyond six months or a year. The site survey data showed a similar pattern.

There were several reasons for the very limited use of achievement data. First, the sites themselves typically saw no use for entry and exit test data. They focus on the progress of individual learners, not on overall or average achievement gains. The computer systems keep track of each student's progress in relation to program objectives, and this information is always readily available to the staff and learners. Scores on achievement tests were of no particular use to learners continuing with further studies or in gaining employment. The match between standard achievement tests (such as the Canadian Adult Achievement Test) and the measurement standards used by each of the computer systems is unknown, so it is certainly possible that two sets of achievement data would have proved confusing to sites. Most sites focused mainly on specific outcomes that seemed appropriate to their clients, such as high-school credits, provincial adult education exams, or entry requirements for community college programs. A few sites did keep data on program outcomes, tracking learners for six months or a year after they left the program.

In education generally it has been very difficult to demonstrate through research that any single program variable has strong and consistent effects on student outcomes; there are simply too many complexities to the educational process. The same is true for employment preparation programs, perhaps to an even greater extent. As noted earlier, several studies, primarily in the United States and primarily in schools and universities, have attempted to compare computer-based learning systems with conventional instruction (see Watson, 1994; Thomas & Buck,

1994). The general consensus of the research is that computer-based systems show outcomes as good as conventional programs, but that differences among programs are more important than the system used, and that many of the studies are of poor quality. To learn more about the long-term impacts of computer-based learning, however, it will be necessary to have much better outcome data than exist in most of the sites involved in this study. Sponsors of these programs should build evaluation requirements into their funding and should commission evaluation studies early so that evaluators can help programs collect better data.

Key Finding #5

Taking into account the distinct differences noted in Key Finding #1, each of the five systems can be a useful vehicle for adult learning.

The data gathered for this study provide no grounds for recommending a general preference for any one of the five systems. Each appears capable of playing a useful role in academic upgrading and employment preparation programs. The choice of system for any program site will depend on several considerations:

Purpose and match with program. Any site considering using a computer-based system should invest some time and effort into exploring which system best meets its program objectives. This means more than simply looking briefly at each system. It may mean a careful comparison of systems in terms of their actual curriculum. Each program has its advantages under particular circumstances. Given the size of the investment, a site should reasonably devote several staff weeks to choosing the most appropriate program for its purposes. Many sites are not currently doing this kind of assessment before choosing a system. In our study we found that reasons for choosing a particular system included its availability under a provincial site license, a good local sales person, word of mouth and use by other sites in the same area.

Cost. There is no single, fixed cost for any of the systems. Cost depends on the configuration chosen by a particular site. All the companies provide a range of options that affect the total price, and increasingly the companies are allowing purchasers to choose the particular parts of the system they wish to buy. There was some room to bargain over costs with the companies. Several sites reported they were able through negotiation to get a better price than initially quoted or to get more for the quoted price.

Local support. Cost of the computer system is small compared to the ongoing costs in staff time for learning to use it effectively. Once a site has invested in a system, it has every reason to want to stay with that system. It takes many weeks for staff to become highly skilled at using a particular system and learning about all its features.

Links among sites using the same system are currently weak in most cases. It may make good sense for a site to select a system that is being used in other nearby locations, since this provides opportunities for pooling knowledge, for help with problems, for shared training and even for sharing services to learners. The

fragmented nature of adult education in Canada currently works against such sharing.

For potential purchasers, these findings are both disappointing and helpful. They are disappointing in that they do not provide an unambiguous basis for choosing a system, but they are helpful in that users can be reassured that they are unlikely to make a huge error by buying the wrong system, but can focus their efforts instead on how their computer system is used and supported.

General Considerations in Computer-Based Learning

Four important policy issues arise from the study. These concern the role of Canadian companies in this field, the fragmented nature of the adult education enterprise in Canada, sponsorship of programs and links to work or further education, and the challenge computer-based learning systems pose to many aspects of education.

Canadian content

Of the five computer-based employment systems studied, three are from the U.S. and two are Canadian. The three CAI systems are American. The Canadian organizations are much smaller than their U.S. competitors. For example, Pathfinder Learning Systems had in 1993 a total annual revenue of about $5 million, while CCC spends much more than that each year just on research and development. Given these imbalances, it is likely that the U.S. systems will develop more rapidly and command increasing market share in Canada. This means that highly desirable skills and jobs will be located in the U.S., not in Canada. All the research and development for CCC, Jostens and PLATO is carried out in the U.S., while Pathfinder and Autoskill both export Canadian knowledge and skills to other countries. In the race for high value-added jobs in Canada, computer-based learning seems a potentially important area.

There would seem to be many possible developments in this field in which Canadian companies might be involved. The changes in technology make it increasingly possible to target training to particular industries or sectors. It may be especially valuable for Canadian companies to develop training materials in fields in which Canada has a large economic stake, such as natural resources or energy.

The issue is not only economic, though. Dominance by U.S. companies also means that the systems will continue to have much U.S. content and too little Canadian content, especially in areas such as social studies. It is possible, of course, that some Canadian version of the systems could be developed, much like the CBC inserts on Sesame Street.

Fragmentation

The fragmentation of adult education in Canada has already been noted, and is certainly an issue reflected in the majority of the programs included in this study. Most programs operate as largely stand-alone operations, unconnected to a larger

system. Much could be done to link programs for purposes of mutual learning, shared professional development and other communication that would strengthen all the programs. The needs and contexts of learners vary greatly, and the strategies that will be effective are also likely to vary. It is particularly important that efforts be made to allow people to learn from their own and others' experience. Models available in other fields suggest many possibilities, such as creation of national or regional networks and organizations, conferences and other professional development opportunities, newsletters and other communications vehicles (including electronic communications) and an organized program of research and dissemination.

Sponsorship and links to work or further education

The data from site visits and site surveys indicate that site focus on academic achievement more than on any other goal. Moreover, the stand-alone nature of most programs means that connections to work are necessarily indirect. Most sites are sponsored by educational agencies such as school districts or colleges. Of the 34 sites visited, 20 were sponsored by public education agencies, five by for-profit companies, six by non-profit training organizations and the remainder by a union, a chamber of commerce and a board of trade. Of the 139 sites surveyed, one listed an industry as sponsor, while some two-thirds were operated by public education agencies. The sponsorship of sites largely by educational agencies may well have important advantages in terms of program quality. However, their sponsorship also leads to a greater focus on academic skills and educational credentials, perhaps at the expense of workplace preparation.

Even though many sites are under the aegis of educational institutions, few programs offer credentials that have any real labor market value. Most focus either on high school completion or its equivalent (GED, Adult Basic Education certificate), which are not useful credentials except insofar as they may allow a person to continue further education or training. High-school graduates without post-secondary education have employment outcomes that are not much better than high-school dropouts (Levin, 1995). There would seem to be considerable scope for action to improve the link of program outcomes either to workplaces or to further education.

The Unique Nature of Computer-Based Learning

Much of the content in the computer programs and many of the programs using computers are quite conventional in educational terms. Real innovation in learning materials is just beginning, assisted by the increased possibilities of using audio and video and the vast storage capacities of the CD-ROM. The companies all agree that their products can and will improve greatly by becoming more stimulating, drawing on learners' prior knowledge and stressing higher-order thinking skills.

As mentioned earlier, the systems focus much more on coverage of traditional school content than on workplace skills; for the most part, their curriculum is organized around the same disciplines and topics as one would find in schools. Although most of the program sites included work-related skills such as job-finding,

resume writing and group dynamics, these were typically taught away from the computers in small-group sessions using more traditional teaching approaches.

The basic assumption underlying the systems and most programs visited is that certain skills, especially in mathematics, reading and writing, are prerequisites to employment. Yet it may be that programs would have greater success if academic skills were integrated with skills leading to specific jobs, rather than preceding them. The history of adult basic education is full of learners who "go around several times", in part because they do not see how these programs are connected to real work that they might do. Learners are more motivated when they see the skills they are learning clearly connected to a job they are doing or are very likely to be doing (Unruh & Levin, 1990).

One of the paradoxes here, however, is that learners respond well to material that looks like "real school" (Metz, 1990). Since many of them see themselves as having failed in school and believe they need to master these skills, material that is too relevant ironically may be rejected as not being really educational! Still, every effort should be made to ensure that the content of pre-employment programs does indeed deal with employment-related skills.

At the same time, in almost every site visited learners had a much more central and autonomous role than is the case in most schools or post-secondary institutions. Staff were more likely to act as guides and advisors rather than directors and controllers. Learners were therefore more likely to come to see themselves as capable of autonomous and self-directed learning (Levin, 1994). Despite rhetoric to the contrary, classroom-based programs at all levels seem to have difficulty moving away from teacher-controlled models. Given the fundamental importance of motivation in shaping student outcomes, educational institutions at all levels would benefit from trying to build this greater level of autonomy for learners into their programs.

Also important is the ability of computer-based learning systems to provide customized instruction. The companies in this study are looking for ways to tailor what they do to the wide variety of potential users. Learning need not be confined by established curricula with single texts, or by the requirement that everybody study the same thing at more or less the same time. Formal education has had great difficulty making the shift to truly individualized learning; computer-based programs offer some promise in this direction..

The increasing availability of computer-based learning poses a major challenge for adult education, as there will be increasing capacity to provide learning opportunities to anyone, anywhere, at any time. Some learners might only need contact with a site when they required some assistance, and even that could be delivered at a distance. Even learners who required more intensive assistance could easily have much more control over their own education than currently exists in almost any educational setting. Given the unlimited potential demand for adult learning, the capacity of computer systems to provide many more opportunities is of potentially great significance.

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