DOCUMENT RESUME

ED 260 258 CE 042 256

AUTHOR Fahy, Patrick J.
TITLE Introducing Individualization with Computer-Managed Learning: An Example from Adult Basic Education.
PUB DATE 85
NOTE 28p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Adult Basic Education; *Adult Learning; *Andragogy; *Computer Managed Instruction; Computer Oriented Programs; Computer Software; Curriculum Development; Educational Philosophy; *Individualized Instruction; Programed Instructional Materials; Student Motivation; Teaching Methods
IDENTIFIERS *PLATO

ABSTRACT

This report presents findings from four pilot projects introducing computer-based individualization in adult basic education programming. The report includes a description of the andragogic and developmental studies underpinnings supporting the principal project goals of responsiveness in the learning environment and choices for students. Elements of the report are the following: (1) educational crises promoting widespread criticism of learning and teaching at all educational levels; (2) andragogy as a philosophy of adult learning; (3) curriculum design principles from the field of developmental studies; (4) description of the learning environment in which the projects occurred, of the projects themselves, and of the PLATO Learning Management (PLM) computer-management facility; (5) findings of the projects for students and participating staff; (6) broad implications of the projects (i.e., what responsiveness and student choice mean in educational practice); and (7) discussion of social and workplace trends forcing adult education to recognize the need for student self-direction and self-pacing, and, in so doing, to make greater future use of technology. Fifty-three references are cited. (Author/KC)

INTRODUCING INDIVIDUALIZATION WITH COMPUTER-MANAGED LEARNING: AN EXAMPLE FROM ADULT BASIC EDUCATION

Patrick J. Fahy, Ph.D.
Director, Research and Evaluation
Alberta Vocational Centre
Edmonton, Alberta

The Crisis

Education at all levels is in trouble: in the same year, a major report condemned public schooling for placing the future of the entire nation in jeopardy (U.S. Department of Education, 1983), while another, written by a distinguised and presumably sympathetic educator, concluded after exhaustive research that, as part of making things right in public schools, teacher training programs should "separate the new practitioner from the conventional wisdom of the past and much present practice" (Goodlad, 1983:6). At the same time there is skepticism, even from its supporters, about education's fair-haired child, computer-based learning. The fear has been expressed that CBL will merely exacerbate present educational inequities (*The Computing Teacher*, 1983; Sturdivant, 1983:62), that present implementations of

CBL are often not "wise" (Rockman, t. al., 1983:18) or even educationally sound (Roblyer, 1983), and that, because hardware is becoming so cheap, careful planning of computer use will become an increasingly lower administrative priority (Van Dusseldorp, 1983), resulting in the loss of "an opportunity that may not come again" (Roblyer, 1983:31).

In Adult Basic Education (ABE), as the fact of adult illiteracy and its human and economic costs has become better understood (Hunter and Harman, 1979), similar concerns have arisen, especially about teaching assumptions and practices. A UNESCO Policy Working Group (1982:7) recently put its opinion of the curriculum situation this way:

> There is scope for much inprovement in development of curriculum and content of instructional material and methods to quicken the pace of literacy learning.

In this paper, I will describe the outcomes of a project in which individualized learning based upon computer-management was introduced in a traditional, teacher-centered ABE program. The project was intended to increase the achievement and satisfaction of the adult students in their learning of a variety of basic subjects, while freeing the instructor to focus on defined student needs *individually*.

Though the study was conducted with adults, many authorities would argue that its rationale and findings are applicable to education at *every* level (Bloom, 1976; Gregorc, 1979; Knowles, 1978; Roueche, 1977; Kidd, 1973). Throughout the article, the reader is invited to consider in what respects the learning

problems dealt with in this study of adult learners are similar to those found at other educational levels, and how the solutions proposed might be applicable to students of any age.

Andragogy: a philosophy for adult learning

There is an entire philosophy of adult education, *andragogy*, which attempts to define and respect the special needs and motivations of the adult learner (Tough, 1979; Knowles, 1978). Andragogy emphasizes the adult's "*need* and *capacity* to be self-directing, to utilize his experience in learning, to identify his own readiness to learn, and to organize his learning around life problems" (Knowles, 1978; emphasis Knowles'). While Knowles maintains that these needs for self-direction are greater in adults than in children, he adds emphatically:

> I believe that the assumptions of andragogy apply to children and youth as they mature, and that they, too, will come to be taught more and more andragogically. (*ibid.*)

There are reservations about andragogy (Cross, 1981) because it appears to emphasize concerns of adults who have already achieved high levels of self-direction, and who voluntarily undertake learning projects because they have found learning rewarding and enjoyable in the past. These are adults who enjoy favorable "organizing circumstance" for learning -- a psycho-physical environment supportive of successful non-formal and formal learning projects (Spear and Mocker, 1984). In contrast, the motivation and learning

history of ABE students in formal learning situations are often much different. Frequently, previous learning has been humiliating as well as unsuccessful. There is an understandable fear that return to learning will mean return to conditions which they learned in childhood were unsuited to them. Kidd (1973:35) describes the effect and its results on the adult:

> ... environments which deter learning in children seem also to have a serious effect on adults. A man or woman who has learned to accept or live with a detrimental environment is not a person who will readily undertake another learning experience. He foresees only one more painful step on the long trail of failure and shame.

Developmental Studies: learning designed for adults

When adults with this sort of learning history return to school they are often regarded as "high risks," and placed in special "developmental studies" programs (Snow, 1977; Moore, 1976). While the practices of developmental studies programs are generally valuable to adults they are particularly relevant to the learning problems of ABE students, who often have special personal and learning needs.

Developmental studies students initially do not meet andragogic assumptions. According to Spann (1977:26), they "demonstrate very little self-directing behavior and a great deal of dependent behavior." He ascribes this to "years of conditioning in a learning environment generally unresponsive to their needs" (*ibid.*). The agenda of developmental

studies programs thus includes both academic deficiencies and personal insecurities:

> As a result of this binding and retarding experience [of previous schooling], one of the major tasks of the developmental educator is to help the adult learner meet the need for self-direction by structuring the learning environment that weans the student from dependence and encourages interdependence. (*ibid.*, p. 26)

Developmental studies students require a *responsive environment* in which individual attention is paid to each students' needs and capacities. A Carnegie Commission study (1973) forcefully stated the need for such an environment over ten years ago:

> We are talking about an attitude which puts the student first and the institution second, concentrates more on the former's need than the latter's convenience, [and] encourages diversity of individual opportunity....

What does "responsive" mean in practice? Mink (1977) maintains that a responsive environment implies *choices* for students, including, for example, self-pacing, variable kinds and amounts of feedback, provision of structure to encourage development of good habits, and a new role for the instructor as "learning assistant." Crane (1983) states that a responsive learning environment must include clearly stated learning objectives and mastery learning conditions. Moore (1976:60) defines the "heart of developmental education" as accurate diagnosis and individual remediation. Based on their experience, Roueche and Mink (1975) conclude that students provided with this kind of responsive learning

environment develop greater feelings of control over their lives, an outcome which they associate with improved mental health as well as the greater "adult" independence and self-direction that are the goals of andragogists.

Individualizing an existing, traditional ABE program

The problem, of course, is *how* to provide andragogic learning conditions -- where careful diagnosis of individual learning needs occurs, where remediation is based on the individual's diagnosed needs (including needs for flexible access), and where students also have their non-academic needs addressed -- *when this is not the way the instructional program operates now.* Even with the assurance that most educators don't necessarily reject the need for individualization, since evidence supporting the need for recognizing and acting upon individual differences has been accumulating for 150 years (Berte, 1975b:3), there is much inertia to overcome in persuading instructors to change their traditional teaching-centered approach for one focused on individual learning success. As Berte notes, the problem is that while "... most educators would agree that the individualization of learning is a good ideal .... it is extremely difficult to accomplish" (1975a:vii).

In the 1982-1983 academic year, a series of projects intended to produce individualized learning conditions in part of the Adult Basic Education program was conducted at

the Alberta Vocational Centre, in Edmonton, Alberta. The projects had four goals: 1) to permit students who were already capable of it to exercise considerable self-direction in their learning; 2) to foster development of self-direction among students not already capable of it; 3) to promote increased academic learning among all students by more effective use of all learning resources, including the instructor; 4) to assess/demonstrate the compatibility of computer-managed individualization within the ABE program, particularly as related to instructional staff and participating students. This last goal was intended simply to improve the environment within the program for further experimentation with individualized learning projects in the future, as a way of gaining more experience and reducing fear of the unknown (Rogers, 1962).

The projects varied in size and complexity because they depended upon the willingness of various instructors to engage in experimental use of individualized delivery methods. As project manager, I assisted interested instructors to assess needs for individualization within their courses, then made recommendations for a manageable project. In all, 4 instructors participated, as follows: 1 math instructor, for the entire academic year (40 weeks), 2 High School English instructors, for 10 weeks each, and 1 ABE English instructor, for 10 weeks.

Because it was the largest project and had the longest duration, I will describe the ABE math project. It differs

from the other projects chiefly in scale, though where other differences exist I will point them out as I go along.

As a first step careful diagnostic testing was done to determine each student's remedial learning needs. (All students in the ABE math project had already failed at least once to pass the basic fractions and decimals math course in which the project was conducted.) After testing, the instructor recorded the paper-and-pencil pretest results on a "Student Profile" sheet, a copy of which was kept by both the student and the instructor. Students were then told the course ground-rules: all students would be required to report to the classroom daily, for attendance purposes; instructional materials (except the PLATO computer terminal, which was installed in another area) would be stored in the classroom, and could be used by students at will; the instructor would be present to provide help, if asked; students were encouraged to work together if they wished; PLATO would be available on a reservation basis for students who wished to use the drills and exercises available on it; all students would write the course final exam at the end of ten weeks, unless in consultation with the instructor it was decided they were not yet ready to do so.

The computer system used was the Control Data PLATO system. As a mainframe system specifically designed for instructional applications the PLATO system contains an enormous variety of instructional materials, but of special interest in this project is PLATO's computer-managed learning

authoring system, PLATO Learning Management (PLM). PLATO Learning Management is described by Control Data (1982:1) as follows:

> The PLATO Learning Management (PLM) system is a computer-based system that helps authors organize instructional materials for individualized delivery and manages the delivery process for students. Authors need not acquire programming skills in order to use the full power of this system to administer tests, prescribe individual study assignments, and keep important records. PLM is designed to support a well-defined model of instruction characterized by modular organization of content and materials, defined mastery criteria, and self-pacing.

In the summer of 1982 the Fractions portion of the basic math course was modularized (i.e., instructional materials were packaged for carefully identified discrete learning objectives), and PLATO Learning Management was used to enter tests and exercises into the PLATO system. A pool of 520 items was entered into PLATO in this way. After an initial ten week trial of the Fractions materials, during which students and the instructor provided feedback and suggestions, the materials were revised and the decimals portion of the course was modularized, with an additional pool of 360 items entered via PLATO Learning Management.

While the opportunity for individualized learning was extended to all students in the form of individual diagnostic testing and provision of a variety of learning resources from which students could choose, it was clear early in the project that some students made better choices than others. This finding was not surprising; as Boud (1981:27) notes:

> All students are capable of working independently; it is not the exclusive province of the most able. Autonomous learning can take place at any level or at any age; *however, it will not manifest itself in the same ways in all situations.* (Emphasis added).

In response to the fact that some students required different conditions to exercise autonomy effectively, the instructor developed a learning contract system. The learning contracts were not punitive, but were cooperatively constructed after the instructor had discussed matters with the student and it was agreed that, for whatever reason, a learning problem was present. (If, as is often true in ABE, the student had legitimate reasons for poor performance, the instructor and the student had great latitude in dealing with the situation.) Overall, the contract system was guided by Hodgkinson's (1975) advice that individualization must take differences into account instead of ignoring or trying to eliminate them.

Built into the architecture of the PLATO Learning Management package is an array of records, including records of student access to the system, the amount and kind of work done, and, in great detail, the success achieved. Most of these records are also available to the student, which permits self-monitoring of the learning process. In the experiment, the instructor prescribed a different study plan for each student, based on pretest information. The student was then taught to use PLATO as both a drill and practice source, and as a recordkeeper. As work was completed, PLATO showed what was done and what remained to be

completed. The "Student Profile" sheet could be updated from PLATO records to provide a hard copy of progress, if the student wished. Students had the option of reviewing all modules, including those from which they had been exempt based on pretest results. (PLATO records showed that many students reviewed previously completed PLATO exercises, which was seen as evidence of self-monitoring of learning needs.) A wide variety of learning resources, which were entered as instructional prescriptions in PLATO, were available in the classroom, including the instructor himself.

Project Findings

Other projects in individualization employing computer-assisted and computer-managed learning had shown that students learn, and that they find the learning process enjoyable (Alderman, 1978; Boettcher, 1981; Holmes, 1982; Ryba and Chapman, 1983; Bright, 1983). It was not surprising, then, that most students in the ABE math project showed evidence of remediating some of their math deficiencies: on a second writing of the course final exam, which all had failed to pass ten weeks previously, one-third of the students were successful. All students made progress, including some who had developed deep aversion for math and who were considered "unteachable" by regular methods.

Interviews and an attitude survey were used with students to determine affective response to the individualized learning conditions provided in the math project. In a survey conducted before the project, students in the project class had been uncertain or negative about the following statements:

-- I usually do well in math.

-- Math is easy for me.

-- I usually learn new things as fast as most people.

-- I learn math more easily than I learn other subjects.

On completion of the course, the students were much more positive on these four questions, for reasons which were clearer from the interviews.

Interviews were conducted with students to determine what elements of the course and what general learning factors they felt affected their learning or their satisfaction. Two findings of the interviews were especially important. First, several students commented on the difficulty of doing any studying at home. They described conditions which obviously made homework incredibly difficult, if not truly impossible. These students felt that self-pacing lessened the disadvantage they faced, since they were not in competition with other, more fortunate students, but were working at a pace and on a schedule which recognized their limitations. A second discovery was that students found learning from one another, or from the print modules, frequently more helpful and enjoyable than being tutored solely by the instructor. Without reflecting in any way on the instructor's abilities as a tutor, these students reported less stress and more opportunity for questioning and explanation when they learned from their peers, or when they could review carefully written materials on their own. They appreciated that the instructor was also present, however, and reported that they consulted with him, too. Finally, feelings about the PLATO computer system as a learning aid were

strongly positive. Students cited as "likes" several features of computer-based learning reported elsewhere, including a feeling of better mastery of the material (Magidson, 1978; Hannaford, 1982; Cole and Hannafin, 1983; Jamison and Lovatt, 1983; Poore and Hamblen, 1983). Their only complaints were that one terminal was not enough, and that their other courses did not use PLATO, too

As the projects proceeded it became apparent that they were addressing a major reservation about individualization which existed in the institution. The concern fits Apps' (no date) definition of a "zero order belief," because, though it was never examined closely it was fervently held. This belief is that all students want and/or need regular (usually defined as daily) instructor contact, through classroom lectures or group activities, in order to grow in communication and interpersonal skills, and to maintain high levels of motivation. The argument sometimes advanced is that, while individualization might meet some students' academic needs, it would short-change them of their broader human development. (Gaff [1978] reports that many students share this belief: he found that only 37% of students expected individualization to be helpful to them before they experienced it.)

Interviews with staff who had not volunteered to participate in the individualization projects were helpful in understanding this belief. The interviews showed that some instructor bias against individualized learning was the result of misunderstandings about what individualized learning implies, understandable since there are "almost as many definitions of

individualized instruction as there are persons using the term" (Dick and Carey, 1978:2). As a result some instructors concluded that individualization precludes group work and interpersonal contact generally. They equated individualization with programmed instruction and correspondence learning. The interviews also documented views among some instructors that students functioning at low academic levels could not, and even should not, be permitted choices in learning, because of deficient reading abilities.

On the other hand, instructors who were directly involved in the pilot projects concluded that individual treatment of students was not isolating dehumanizing. One instructor put his concludions into a single sentence: "I am now convinced that the initiatives of the project must find their way into the mainstream [of instruction in the program]." A survey of the five instructors who participated in the projects yielded these results:

-- "Are the results of this project useful to students in the course for which they were developed?"
Replies: Yes, definitely = 3; Yes = 2.

-- "Would a similar project be useful in any other courses?"
Replies: Yes, definitely = 3; Yes = 2.

-- "Is this project compatible with the goals of the department?"
Replies: Yes, definitely = 3; Yes = 2.

And, interestingly:

-- "Would other instructors be interested in participating in a similar project?"
Replies: Yes, definitely = 1; Yes = 4.

There was consensus among participating instructors that the projects had shown even low functioning students were able to *improve* their self-directive behavior; group work and peer group interaction were not only possible in an individualized environment but, in the view of one instructor, were more frequent than in regular ABE math classes; students could manage the the reading required in the course, especially with peer assistance. In sum, the results of the project did not support reservations about ABE students' abilities to learn in, and enjoy the experience of, individualization, nor were fears of staff alienation or feelings of redundancy realized. Put more positively, the projects demonstrated the compatibility of individualization with present practice, at least of those staff who were brave enough to involve themselves in them.

Implications

It was clear from the interviews that many instructors had reservations about individualized instruction because they could not imagine a role for themselves in such a learning environment, nor could they see an urgent need for the changes it entailed in their role. This outlook is not at all unusual in adult education; as Hoare (1984:11) notes, "Denial of the proximity and intensity of change is apparent in many practitioners ...." Instructors extended their reservations to computer-based learning, perhaps realizing that computer-based learning is necessarily individualized (Brudner, 1982), and that it therefore holds the potential

for a new educational order. The fact that most instructors, in ABE and elsewhere, have no training or experience in meeting the individual needs of students, or of facilitating learning outside a formal classroom, adds to their natural misgivings about the unfamiliar (Nikolai, 1983). Knowles (1981:8) speaks of the need for a new role for the instructor, "refined ... away from that of transmitter and controller of instruction to that of a resource person to self-directed learners." He adds: "It is frightening. They [instructors] do not know how to do it" (*ibid.*).

A hopeful finding of the projects was the positive responses of participating instructors. Those who actually experienced individualization in the projects found that computer-management is capable of addressing many instructor reservations about, and of providing a relatively painless introduction to, individualization. The reason may be that, as practiced in the pilot projects, computer-management need not radically change the instructor's role. In the projects I have been discussing some participating instructors chose to continue to meet with their classes much as they would in a traditional group-paced instructional environments. They could arrange demonstrations or other group-directed activities; they could organize and group certain students for special activities; they could see students at work and mark the students' work themselves; they could direct students to alternate learning resources, if problems with the regular modules arose (this could also be done with

instructional prescriptions entered into PLATO); and they could exercise the traditional role of class leader, motivator, and evaluator. There is one crucial difference, however: instead of facing the necessity of providing something general enough for everyone daily, with computer-management of carefully designed learning materials the instructor is available to focus his attention on those who need it most. Because diagnostic testing has been done, the learning needs of each individual are known and available to the learner himself; because modularized materials are available for students to use on their own or in groups of different types, they can proceed independently until they need to seek help. Given their choice, in these projectst some students worked almost entirely apart from the instructor, while others used the instructor almost as a tutor, and some students worked regularly with peers. The point is that because differences were carefully evaluated, and different treatments made available based on the diagnosis, and because students were allowed and expected to take initiative and responsibility, the emphasis was clearly on *learning*. No gratuitous or inefficient teaching occurred because of failure to determine individual learning requirements.

Latitude for variety and student choice exists with CML. It is feasible for some students to work independently because the instructor can follow their progress in detail, and even communicate with them, via the computer. Other

students may not use the computer at all, and for these the instructor is free to provide other learning opportunitiess because he is not trying to provide something interesting and productive for everyone, constantly. A CML model recognizes that some students can learn when no one is teaching them -- in fact, some may learn better, faster, with more satisfaction, and, because they are practicing self-direction, with more attendant non-academic personal benefits, than if they were being led lock-step through the material as part of a group. It may even happen, as Bloom (1974:686) has found when students have choices in their learning, that under these conditions some students "learn to learn." Certainly, if these outcomes were even partially realized they would reflect enormous achievements on the present educational scene, and, at the very least, would gratify the ratepayers.

Another practical advantage of computer-managed learning is that it is something schools can try on a small scale without undue expense or burden; and such trials, as Rogers (1962) has demonstrated, accelerate the adoption/rejection of innovations. Presently, much attention is being given to the fact that computer-based learning is not being embraced as enthusiastically as its supporters would wish (Gaff, 1978; Lidtke, 1981; Rose, 1982; Grossnickle, 1982; Gordon, 1983; Coder, 1983; Educational Technology, 1983). As others have shown (Beder and Darkenwald, 1974), education has always suffered from failure

of research to influence practice, even when the evidence and need for change was plain. (Rogers [1962:2] found adoption could lag as much as 50 years behind discovery, for some innovations.) Computer-management projects might be easier to initiate simply because they are cheaper and less complex than computer-assisted learning (CAL) projects -- as well as being less threatening to the majority of instructors who still view computers with concern. It is not the *degree* of change that is important, but the *kind* of change that is occurring. With computer-management, what the student experiences is fundamentally different: *learning conditions intentionally and regularly adjusted to his needs and abilities*, even to his *wishes!*. But what a visitor to the school would see is business pretty much as usual: most students and their teachers still meet at scheduled times, in classrooms, on a regular daily schedule; students still work in learning groups; the teacher still has responsibility and authority (*but so does the student!*).

Why Individualize *Now*?

The above scenario, with CML applied in otherwise traditional educational surroundings, is a necessary beginning but it is a passing stage only. Futurologists' predictions of rapid social and economic changes must concern educators at all levels. For example, Miller (1982) warns that developments in new electronic media will soon make education in the home and in private learning centres more efficient, practical and economical than in traditional

schools (especially if present educational systems fail to try to improve their efficiency). But even more profound than where learning occurs will be the revolution in what will need to be learned, and how people will become accustomed to learning, both of which have enormous implications for curriculum and instructional methods. Miller predicts that the job skills of the future will be:

-- the ability to live happily and creatively with others;

-- skills in life planning;

-- decision-making skills;

-- skills for producing creative change;

-- skill in determining the need for stability versus change (*ibid*).

Dede (1982) forecasts future "intelligent work places," where workers will require combinations of skills to participate in machine-human partnerships ("ergonomics"). He points out that the retraining needed to permit present workers to enter new occupational fields will require cooperation between industry and business, and education, on a scale never before achieved. (He also remarks that the effort has been less successful in North America than elsewhere so far, accounting in part for the fact that Japanese and European workers variously increased their productivity from 18 to 38% in the 1970s, while Canadian and U.S. averages for the same period were 12% and 8%, respectively.) His conclusion is that retraining will be much more appealing and much more effective if it is flexibly available, and it will be much more flexibly available if it employs interactive technologies

extensively.

Traditional educational systems will have an ever-diminishing role in the post-industrial era if they do not master the new technologies (Miller, 1982:3). We already see signs of public exasperation with truancy, failure, and functional illiteracy of graduates. Put simply, educators need new skills: among them are the skills to apply technology to learning, to manage and design learning efficiently and flexibly, and to assure excellence. To do this there must be a commitment to meeting individual students' needs.

Experiences *now* with CML can begin the inservice development of the skills teachers need. Those who experience effective computer-managed individualized learning, and who are willing to acquire some basic design skills, will be prepared in three major ways for some major demands of the future. First, they will become basically "computer literate," a necessary first step in becoming "technology literate." Second, they will become learner- rather than teacher-oriented, as they witness "learning in the absence of teaching" (in the traditional sense). Third, they will experience their new role as instructional designers, managers (with the aid of technology), quality controllers, and motivators of learners. These are powerful and indispensible lessons for further growth, maybe even for survival.

In ABE (and in education generally, I believe) practitioners agree that changes are needed; studies of teachers' priorities show they are aware of their weaknesses (Mezirow and Irish, 1974;

Weleshuk, 1977). Constructive outside criticism can help educators decide goals and directions for change, but the problem of how to get there from here still remains. We are not short of visions of the future (Alberta Education, 1980; Toffler, 1980; Goodlad, 1983; Naisbett, 1984); indeed, this article is yet another one. But this article also suggests how to get from A to B without a revolution -- or a revolt . My basic assumption here has been that educational systems do not change instantly, no matter how powerful the impetus. Complex systems can, however, be shaped by variations of what Goodlad (1983:5) calls the "DDAE" process: dialogue, decisions, action, evaluation. I have described some experiences in ABE with individualized learning and computer-management of the learning environment. These reforms in teaching and learning could, if not silence, at least muffle criticisms such as are presently being made about "ineffective" and "boring" schools, by making all schools more "andragogic" (i.e., supportive of student self-direction). Brudner (1982:26) calls CML "the single most important need" in schools that now employ computers for learning. To the degree that computer-management also implies these andragogic goals, this is no exaggeration.

References

Alberta Education, (1980). A practical approach to computer-based instructional support. Edmonton: Planning and Research Branch.

Alderman, D.L., *et.al.*, (1978). PLATO and TICCIT: an evaluation of computer-assisted instruction in the community college. *Educational Technology*, 18,4, pp. 40-49.

Apps, J., (no date). Toward a working philosophy of adult education. Syracuse University: Publications in Continuing Education, Occasional Paper #36.

Beder, H. and G. Darkenwald, (1974). Approaches to upgrading applied research in adult education. Paper presented at the Adult Education Research Conference, Chicago. (ERIC Documents 092 793).

Berte, N. (ed.), (1975). *Individualizing education by learning contracts*. San Francisco: Jossey-Bass.

Berte, N., (1975). Individualizing and contracting. *Individualizing education by learning contracts*. Francisco: Jossey-Bass.

Bloom, B., (1974). Time and learning. *American Psychologist*, 29, pp. 682-88.

Boettcher, E., *et. al.*, (1981). A comparison of the effects of computer-assisted instruction versus printed instruction on student learning in the cognitive categories of knowledge and application. *Journal of Computer-based Instruction*, 8, 1, pp. 13-17.

Boud, D. (ed.), (1981). *Developing student autonomy in learning*. New York: Nichols Pub. Co.

Bright, G., (1983). Explaining the efficiency of computer-assisted instrucion. *AEDS Journal*, 16, 3, pp. 144-52.

Brudner, H., (1982). Microcomputers, special education, and computer-managed instruction. *Educational Technology*, July, pp. 25-26.

Carnegie Commission (1973). Recommendations of the Carnegie Commission on non-traditional study. *The Chronicle of Higher Education*, February.

Coder, A., (1983). Why do community college faculty resist media as an instructional delivery system? *Educational Technology*, May, pp. 7-11.

Cole, D. and M. Hannafin, (1983). An analysis of why students select introductory high school computer coursework. *Educational Technology*, April, pp. 26-29.

Control Data, (1982). *PLATO Learning Management, author's guide*. Minneapolis: Control Data Corporation.

Crane, J., (1983). Self-Paced learning and the non-threatening learning environment. *Groundwork*, Dec., pp. 11-13.

Cross, K. (1981). *Adults as learners*. San Francisco: Jossey-Bass.

Dede, C., (1982). The reshaping of adult, career, and vocational education by the emerging communication technologies. In *Communication Technologies: Their Effect on Adult, Career, and Vocational Education*. Ohio State University: The ERIC Clearinghouse on Adult, Career, and Vocational Education, pp. 5-15.

Educational Technology, (1983). The computer in education: adding on vs. building in. *Educational Technology*, April, p. 6.

Gaff, J., (1978). Involving students in faculty development. In J. Gaff (ed.), *Institutional renewal through the improvement of teaching*. San Francisco: Jossey-Bass, pp. 59-71.

Goodlad, J., (1983). Improving schooling in the 1980s: toward the non-replication of non-events. *Educational Leadership*, April, pp. 4-7.

Gordon, S., (1983). Faculty training and development in academic computing. *Journal of Computer-based Instruction*, 1, 1&2, pp. 51-54.

Grossnickle, D., *et. al.*, (1982). Profile of change in education: a high school faculty adopts/rejects microcomputers. *Educational Technology*, June, pp. 17-19.

Hannaford, A., (1982). Microcomputers in special education: some new opportunities, some old problems. *The Computing Teacher*, February, pp. 11-17.

Hodgkinson, H., (1975). Evaluating individualized learning.

In Berte, N. (ed.), *Individualizing education by learning contracts*. San Francisco: Jossey-Bass, pp. 83-91.

Holmes, G., (1982). Computer-assisted instruction: a discussion of some of the issues for would-be implementers. *Educational Technology*, Sept., pp. 7-13.

Hunter, C. and D. Harman, (1979). *Adult illiteracy in the United States*. New York: McGraw-Hill.

Jamison, R. and K. Lovatt, (1983). Classroom delinquency, achievement, and computer-assisted instruction. *Journal of Computer-based Instruction*, 9, 4, Spring, pp. 145-147.

Kidd, J.R., (1973). *How adults learn*. Chicago: Follett Publ. Co.

Knowles, M., (1978). *The adult learner: a neglected species* (2nd edition). Houston: Gulf Publ. Co.

Lidtke, D., (1981). Securing teacher acceptance of technology. Paper presented at the National Conference of Technology and Education. (ERIC Documents 208 871).

Magidson, E., (1978). Student assessment of PLATO: what students like and dislike about computer-assisted instruction. *Educational Technology*, Aug., pp. 15-19.

Mezirow, J. and G. Irish, (1974). Priorities for experimentation and development in adult basic education: Volume 1 of *Planning for innovation in adult basic education*. New York: Columbia University, Centre for Adult Education, 1974. (ERIC Documents 094 163).

Miller, J., (1982). Questions about communications technologies for educators: an introduction. In *Communication technologies: their effect on adult, career, and vocational education*. Ohio State University: The ERIC Clearinghouse on Adult, Career, and Vocational Education, pp. 1-4.

Moore, W., (1976). Increasing learning among developmental education students. In O. Lenning (ed.), *Improving educational outcomes*. San Francisco: Jossey-Bass, pp. 55-71.

Naisbitt, J., (1984). *Megatrends*. New York: Warner Books.

Nikolai, U., (1983). Implementing computer-assisted instruction in a maximum security prison. Unpublished paper, Edmonton Maximum Security Institution.

Poore, J. and J. Hamblen, (1983). Improvement of basic mathematical skills with PLATO: an experiment. *AEDS Journal*, 16, 4, pp. 244-259.

Roblyer, M., (1983). Toward more effective microcomputer courseware through application of systematic instructional design methods. *AEDS Journal*, 17, 3&4, pp. 23-32.

Rockman, S., *et. al.*, (1983). Computers in the schools: the need for policy and action. *Educational Technology*, November, pp. 13-18.

Rogers, E., (1962). *Diffusion of innovations*. New York: The Free Press.

Rose, S., (1982). Barriers to the use of educational technologies and recommendations to promote and increase their use. *Educational Technology*, Dec., pp. 12-15.

Roueche, J. and O. Mink, (1975). Toward personhood development in the community college. Paper presented at the Annual Meeting of the American Association of Community and Junior Colleges, Seattle. (ERIC Documents 114 137).

Ryba, K. and J. Chapman, (1983). Toward improving learning strategies and personal adjustment with computers. *The Computing Teacher*, Aug., pp. 48-53.

Spann, M., (1977). Building a developmental education program. In J. Roueche, *Increasing basic skills through developmental studies*. San Francisco: Jossey-Bass, pp. 23-39.

Sturdivant, P., (1983). Technology training: in search of a delivery system. *AEDS Journal*, 17, 3&4, pp. 55-65.

The Computing Teacher, (1983). 55,765 schools now teach with computers. *The Computing Teacher*, Dec./Jan., p. 8.

Toffler, A., (1980). *The third wave*. New York: Bantam Books.

Tough, A., (1979). *The adult's learning projects: a fresh approach to theory and practice in adult learning*. Toronto: Ontario Institute for Studies in Education.

UNESCO Policy Working Group No. 5, (1982). Towards total literacy. Unpublished draft report, Paris, October.

United States Department of Education, National Commission of Excellence in Education, (1983). A nation at risk: the imperative for educational reform. Washington, D.C.: U.S. Government Printing Office.

Van Dusseldorp, R., *et. al.*, (1983). Introduction. Applications of microcomputers for instructional and educational management. *AEDS Journal*, 17, 1&2, pp. 3-5.

Weleshuk, M., (1977). A study of the need for instructor development and perceived by instructors and administrators in Alberta colleges. Unpublished Ph.D. dissertation, University of Alberta.