GOODBYE TO THE CLASSROOM

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The adoption of programming principles together with modern technology provides the basis for a remarkable extension of education into the home, the factory, the office and the shopping centre.

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The accelerating need for education may best be met by a plan for education which recognizes the different environments and circumstances under which it can take place. If the objective of education is to prepare people for productive lives in which they maintain gainful employment, participate in civic and community activities contributing to the welfare of society, and live within the confines of accepted morality and legal limitations, then it must provide those contacts and experiences which foster the achievements of these goals.

Traditional methods of teaching must give way to a wider understanding of the process of learning and the need for spreading education among the members of a community so that education becomes an integral part of both community life and the growth of individuals.

Modern technology permits almost instantaneous interchange of information between men on earth and devices on the moon and beyond. Yet the transfer of information between teacher and student is confined to the limits of normal, unamplified sound transmission—to the classroom. Education must make use of technology.

The recent development of the programming of instructional materials has given emphasis to the possible improvement of self-teaching devices such as textbooks, films, etc. The adoption of programming principles (small learning steps, frequent success, avoidance of failure, and repeated review) together with modern technology provides the basis for a remarkable extension of education into the home, the factory, the office, the shopping▷

The resultant patterning is socially more valid to apply to community in general than

centre, and the introduction of special facilities designed to produce skills, knowledge and attitudes.

A teaching model may be developed using portable learning packages and two-way communication terminals or consoles in the home, together with specialized facilities for occupational training in most (if not all) major business institutions and service agencies.

Teaching technology will develop within the coming years to provide instructional materials that are largely but not completely self-instructional. But the educational plan will lay stress on nodes or educational centres, serving relatively limited population groups in the neighbourhood, to ensure interaction and to compensate for any inadequacies in partially developed and tested self-teaching materials.

At these nodes, learners would check-out, study, and proceed from unit to unit, course to course, and class to class in accord with their ability to do the work. The teacher would serve as a producer of materials to meet individual needs, an advisor on particular requirements, an explainer of obscure points, a tutor to stimulate and to direct further study and to prompt independent investigation.

Each node would be stocked with materials to serve learners of every age; care being taken to avoid the isolation of particular age groups in casual contact, rather to ensure that there are models of social groups of all ages and interests and stages of development.

Some of the nodes would include areas and facilities for fine arts activities for all age groups, choruses, bands, and drama groups, as well as opportunities for concerts and creative arts. Some of the nodes would provide basic exercise or health club facilities for physical fitness. There would also be provision for football and athletic activities requiring large areas of land.

Opportunity for individual instruction and for sustained high productivity and high intensity contact between learner and teacher will be greatly increased by providing self-instructional materials, using a wide variety of audio-visual media. The ease with which such self-instructional materials can be moved will also provide a home-study unit which, when coupled with telephone or television tutoring, will provide the foundations upon which expanded and extended uses of technology can be based as they are developed and tested.

The objective of the plan is quality education, quality education being *the successful understanding of the maximum amount of demonstrable cognitive, psychomotive and affective knowledge by individuals with a wide range of abilities, in the minimum amount of time, making the best use of the investment of human and material resources.*

In this definition, are listed four specific aspects that require to be stressed:

Programmes are needed for *individuals with a wide range of abilities* rather than just the able, or those with cultural advantages or—at the other extreme—for special education for the physically or mentally retarded.

Successful accomplishment by the individual in *demonstrable cognitive and/or psychomotive and/or affective* areas, needs to be emphasized rather than thinking of 'failing 30 per cent' with such vague objectives as 'releasing the spirit', which cannot be demonstrated.

The *amount of time* consumed in learning must be recognized as one of the most important variables, varying significantly from individual to individual and even for the same individual with different tasks. Thus the hour, day, week, and certainly the term have no significance as measures of time for learning, and these must be varied for the individual and the task.

Strategies must be developed to make the best use of *the investment of human, physical, equipment and material resources* for the best individual results, with an awareness of the trade-offs possible to retain the results with greatest cost-effectiveness.

Each of these four points can be amplified by examples:

Dr Gabriel Ofiesh, Professor of Educational Technology at Catholic University, has recognized the 'black coffee syndrome'. Students go to the cafeteria and—even if machines alone are used—can get 1, black coffee; 2, coffee with cream; 3, coffee with sugar; 4, coffee with cream and sugar; 5, coffee with heavy cream; 6, coffee with heavy sugar; 7–12, tea with all the options; 13, hot chocolate; 14, soup, etc.... Yet, when they go to the classroom, the different abilities, preparation and experiences are not known and acknowledged—all students are given black coffee.

Dr A. A. Canfield draws a parallel between education and the organization of a hospital; teachers are doctors. How long would a doctor survive or a hospital stay open if they gave the same prescription for shortness of breath, stomach cramps, dizziness, etc. In most cases, this is what happens in education.

While not agreeing on all points with Professor B. F. Skinner, of Harvard University, the statement attributed to him that 'We can teach anyone anything, if the material is sequenced and the individual is given enough time', seems perfectly sound. An example of this point and some others can be shown by the students who successfully completed two years of secondary school work and never set foot on the school grounds. This was at Chicago Junior College—the students were in Joliet Prison. Similarly, Dr Samuel N. Postlethwait, of Purdue University, has had considerable success with a wide range of student abilities using his 'audio-tutorial' method in botany and biology—with almost no large group sessions.

A review of the literature reveals that a variance in time is one of the most important factors in bringing about successful learning. The constant inclusion of a human (often called the teacher), who is the most expensive resource in education, requires us to have groups, class hours, school days, terms—none of which are geared to aiding learning. Once again B. F. Skinner's statement is sound—'Any teacher who can be replaced by a machine—should be', for the great teacher does not just pass on facts and information—this can be done much more efficiently by a machine, audio tape, film, slides, etc., or a book.

In March, 1962, a two-week conference sponsored by the United Nations at UNESCO in Paris, was attended by educational representatives from a majority of the countries of the world. The subject of the conference was 'New Methods and Techniques in Education'. One of the major conclusions of the expert group concerned the implications of the new media and methods for education:

Particular attention is recommended to the development and use of imaginative ways of combining, for maximum educational gain at minimum cost, the resources of mass-media, of self-instructional programming methods, and of teacher-teams....

Special emphasis should be placed on adapting to all media, the techniques of feedback from individual students.... Such feedback to the producer should consider factors of acceptance and attitude as well as instructional efficiency.

Research of a fundamental nature is needed to improve basic understanding of the learning process....

Special emphasis should be placed on developing the potential of individual programmed instruction methods....

An intensive effort should be devoted to obtaining and collecting data on comparative monetary costs and expenditures required for alternative means that seem to be capable of attaining a particular kind of needed educational outcome. Factors taken into consideration in collecting such data should, however, not only be the monetary outlay, but also the effect on manpower, on the required time, and on the improvement of quality of instruction.

But some of the most dramatic savings in current practice to provide the funds for high quality education can be in physical facilities. This can be demonstrated with conventional programmes, and the use of programmed instruction, self-instruction and possibly teaching machines could further reduce the investment in brick and mortar for better quality education.

With the tremendous increase in the enrolment of students approaching higher education, an enormous investment in physical plant is foreseen in the USA. Some have predicted the doubling of the physical plant built during the last 300 years within the next decade. The cost will be astronomical. The basic assumption is that buildings will continue to be used the same way in the future. In many cases this is only 30–50 per cent of the week, from 8 a.m. to 5 p.m., Monday to Friday.

Any significant increase in the time of occupation would materially reduce the financial outlay. In the belief that the public is going to demand greater use of educational facilities, various plans for year-round operation, co-operative education and study abroad have been introduced. But these overlook that method of providing for the new students with the least possible amount of building—the increased use of both existing and new buildings.

Working with the McDonnell Automation Center in St Louis, a division of the McDonnell

merely an individual school, which, once freed of an imagined comprehensive role.

Aircraft Corporation (the prime contractor of the Mercury and Gemini programmes and the F4h fighter used by all three military services) we learned of a method of simulating the fighter on the electronic computer and 'flying' it many times, with major and minor changes made between each 'flight'. We asked, 'Why not fly a college on the computer?' We undertook a computer simulation of Meramec Community College, one of the three proposed campuses in the St Louis Junior College District.

The programmes for 4500 students, number and size of rooms planned, intended staff, and various time patterns, provided the input data. In five minutes the computer went through the thousands of combinations possible and started to print a schedule. Twenty-five minutes later the use of rooms, including each faculty member's schedule, each student scheduled, the percentage of rooms used, the percentage of seats occupied and other pertinent information covering some 100 pages was available for analysis.

From the outset we had been concerned about seat occupation as well as the use of rooms. If 25 students were in a room furnished for 50 students, this would involve 100 per cent use of the room for an hour but only 50 per cent seat occupation. Thus, in each of the 27 computer runs we changed the size of some rooms. In this way we reached 82 per cent use of the classrooms and 66 per cent of the laboratories.

The 7094 computer at McDonnell Automation Center was used with the GASP programme developed by Robert Holz of MIT. The final results were:

Room	Our total	Similar colleges Same enrollment A	B	C	Our room use per cent	Our seat use per cent
Classrooms	37	84	63	82	82	87
Lecture Halls	6	1	5	5	86	86
Science Labs	15	33	38	21	66	91
All Others	27	23	30	41	72	88
Total Rooms	85	141	136	149	77	88

In addition to proving that the desired occupation for each type of room could be obtained within the proposed master plan, it was shown how the master plan could best be modified. Conservatively this could mean a saving of $3,000,000 on this one project. Other studies would confirm that such concentrated use is possible—particularly with the use of the computer as a check in the development of a master schedule for planning and operation. These are dramatic figures and the $10,000,000 not invested in the three projects could provide the basis for quality education.

It may be possible to reject altogether the classroom as we know it. A revolution is already apparent in the ungraded classes of schools, team teaching, continuous progress, modular scheduling, instructional systems, the 'organic curriculum', and such hardware as TV, dial-access, and computer-assisted instruction.

The dispersal of education could be furthered by self-instruction and electronics in the home, the shopping centre and office buildings.

A possible programme for the node or education centre might be:

For the infant (under 2 years of age) and the elderly and infirm, educational toys or packages of materials to be checked out from the node and used in the home. These students could be visited on a regular basis, to determine their progress, interest, and reactions.

For the child between 3 and 6, the neighbourhood node would be available from 9 a.m. until 4 p.m. These would be prime hours and would provide both self-instruction and a large amount of group activity ensuring social interaction and the growing maturity of emotional responses. The major emphasis would be on the development of learning skills—reading, problem solving and techniques of investigation.

For the adolescent, from 7 to 12, the same node would be open from 7 a.m. until 6 p.m. The emphasis would be upon continued development of learning skills and the absorption of certain levels of information on arithmetic, English, speech, history, geography, etc.

For the teenager and young adult (ages 13 to 18), the same node would be open from 6 a.m. until 9 p.m. This group would have small group discussions in which they would compare and contrast interpretations of possible solutions to social and technological problems, as well as undertake work in social science and physical science areas. An introduction to the fine arts would begin with this age group, having approached them as recreational or play activities in earlier years.

Depending upon the demand, the nodes could remain open around the clock.

As the effectiveness of self-instructional materials increases, the need for tutors in the nodes will decrease. Similarly, the effect of curricula material development specialists will become increasingly effective, reducing the number of educationalists required. It is estimated that a staff-student ratio of 1 to 45 would suffice for the year 1980, a ratio of 1 to 60 for 2000, and a ratio of 1 to 150 for 2020.

As the need for teachers and media specialists decreases, however, the need for recreational/cultural activity supervisors and for monitors and leaders of discussions and social activities will remain about the same or increase slightly as the work-week is shortened, the retirement age is lowered, and the amount of free time for such pursuits increases.

The basic facilities required will include:

An administrative centre
Radio and TV studios
Information processing centre
Media preparation, production, storage and circulation centre
Instructional materials development and pre-test centre
Performing arts, conference, art collection and learning materials centre.

A node for cultural/recreational activities in each of the neighbourhoods. The nodes will be largely made up of open areas with varying sizes of self-study facilities and substantial storage and retrieval areas for unused material.

Many of the nodes will have a major facility for outdoor recreation, larger assembly facilities, and large areas for creative arts and crafts, including music and theatrical performances.

Nodes for study and discussion should be included in industrial, business and commercial establishments. These nodes would parallel the residential nodes and provide an environment for the adult at work, shopping, or waiting for children at the doctor or dentist, to maintain his speciality, learn new materials, and engage in discussions with others in a pleasant and convenient environment.

The primary changes in the educational process will involve the gradual and continuing shift away from hand skills, semi-skilled occupations, and narrow trade or vocational fields such as lathe operators, punch card operators, etc., and move toward intellectual/mental skills, semi-professional occupations, and generalized vocational fields such as metal forming, information processing, etc.

Additional facilities would be necessary to cope with the increase in non-employed adults resulting from combined effect of an increased life span and a lower age of retirement.

As education is moved from the school into the home and place of work, cultural/recreation centres will enhance and combine many of the cultural/educational/recreation activities formerly associated with separate institutions, such as the sports ground, art gallery, library, museum, elementary and secondary schools, university and factory.

If we wait for isolated efforts at innovation to make an impact on the educational establishment it will take fifty years or more to bring about change. Thus, with increasing numbers, costs will then be more or the same expenditures will result in lower quality education.

With the many restraints of deeply ingrained custom and tradition, it will not be easy for local school boards, civil servants and ministries to formally or informally bring about the desired changes, but it is possible.

Funds to further these innovations—outright experiments—must be found. The kind of funds needed for R & D (Research & Development) are essential to the free enterprise system of business and industry and are vital to military programmes, yet they are almost unknown in the field of education. With education consuming more of local and state finances, it becomes an increasing percentage of the gross national product. As more funds are invested for increasing numbers of students, 5 per cent (or even a start of 3 per cent) of the total R & D funds need to be invested in research on how humans learn, using different media and instructional strategies, with the knowledge that some 'Edsels' will come and some (like test missiles) will never become operational. If we do not do this, resources—financial and otherwise—will be consumed in ancient, inefficient organizational patterns and out-moded education.

A great teacher once viewed an innovation with alarm. He said, 'This invention of yours will produce forgetfulness in the minds of those who learn it, causing them to neglect their memory'. The speaker was Socrates—he was talking about writing. □