# SYSTEMATICS

THE JOURNAL OF THE INSTITUTE FOR THE COMPARATIVE STUDY OF HISTORY, PHILOSOPHY AND THE SCIENCES

VOL. 6 No. 4 MARCH 1969

## THE EDUCATIONAL CHALLENGE OF THE DEVELOPING COUNTRIES [1]

J. G. Bennett

My theme today is Educational Technology; not the educational process in general, but the application of modern techniques to increasing the efficiency and efficacy of the educational process. Various departments of human life have advanced to different degrees in their use of technological aids. The first of these was manufacture of goods, and the industrialization of the world is at least 150 years old. Next came the technical revolutions in communication and medicine which are about 100 years old. The development of education is still in its infancy: that is we are only now beginning to move away from educational methods that were used since the sixteenth century when Comenius and the other great innovators in education first suggested that the pupil rather than the teacher, is the element that matters in the educational process. If we are to reach the point where the individual is the master of the educational situation teaching means must be available which enable each individual to learn in his own way. This individualization of the educational process is completely necessary if we are to achieve a society which is able to deal with the world situation which is going to arise over the next 30 years, but it is evident that the individualization of education cannot take place by personal teaching. One cannot have one teacher to one pupil which would require something like 600 million teachers in the world.

Because education has made so little use of the discoveries of science and technology, including the science of psychology, till very recent years, it has remained in effect an undeveloped section of the human experience. Because of this primitive state of the education system, the whole world can be called a developing area as far as education is concerned. This is fully recognized in the countries which have made the greatest progress towards the introduction of technological aids in education, such as the United States of America, where they speak of the 'necessary revolution in education'. There is throughout the world an educational crisis due to the impossibility of meeting the demands of the future with our existing resources. Therefore, when we study education, we study a subject of special interest because of the relatively smaller distinction between developed and undeveloped countries than, let us say, in the case of industry and possibly to some extent of agriculture.

There are two main factors or groups of factors. The first group is a universal group. There is the explosion of educational demand. This begins with the population explosion the figures of which are no doubt familiar to you, but I will just quote them for emphasis. We expect the world population in 1970 to be 3.626 milliards, in 1980 about 4½ milliards[2], in 1990, 5 milliards and in 2000 nearly 6 milliards. These are conservative estimates, for if the present acceleration is maintained it may even be as high as 7 milliards. There will therefore be an increased demand for education because of the increase of population alone, but in the developing countries there is also an increasing demand for education with regard to the population at any given time. In fact on an average the intake of the educational system grows three times faster than the population itself, and the same is true of the proportion of expenditure on education to the total budget. This intake exceeds the growing capacity of the schools. There is yet another explosive factor and that is the demand for higher quality education. Primary education, as I shall show in a few minutes, is in many respects defective, secondary education is not satisfactory at all in any part of the world, and higher education is far too restricted in its availability. Not only this, but the actual quality of the teaching, the standards that are required are constantly growing, possibly even to the extent of an annual increase of 10% -20%. If

[1] Transcript of an address to the University Session (3rd week) of the International Symposium on Development, Monaco, February, 1969.

[2] Bennett uses the old British term, equivalent to the better known "billion" or $10^9$

we multiply these factors together we arrive at the extraordinary conclusion that the educational demand of the world is growing at the rate of something in between 7% and 9% per annum.

The second universal factor in the educational crisis is the knowledge explosion. Scientific and historical research, anthropology, sociology; every field of human knowledge is exploding. Man's discoveries are increasing at an accelerating pace. It has been estimated by good authorities that whereas formerly knowledge doubled once in every 2000 years; now the sum of human knowledge doubles once in every ten years. If the educational process is to keep pace with the growth of human knowledge it will clearly be put under an unbearable strain.

The third factor is the technological explosion which is distinct from the explosion of knowledge. It is the explosion of man's technical achievements. If you will look at Fig. 1 you will see a rough history of human achievement over the past million years. This chart uses a logarithmic time scale, which is the only way it is possible to set out human achievement in a compact form. The exponential growth of human achievement has been noted by both historians and students of science and technology; there is nothing original about the chart I have drawn but it does illustrate a very extraordinary situation. We have covered far more ground in the past hundred years than in the first million years of man's existence on the Earth and the acceleration continues. New discoveries in technology are coming at a greater rate than they have ever come before, and they are doing it at such a way as to transform entirely the human environment. From the year 1990 onwards to the end of this century, that is a period of time which should be of great interest to all of you, there will undoubtedly be profound changes in the human environment, due to technological progress at present unforeseen but which will certainly include new methods of communication at present unthought of, new media, an enormous increase in the power of what are called 'computers', and new sources of energy and new means of locomotion. On the side of art and human experience there will be new media of expression, new forms of communication all of which will create before the end of this century a world which will be totally unlike the world that we know today. Just as the world that we now know, for a man of my age, is totally unlike the world of my boyhood, when motor cars and aeroplanes were rare, when one was accustomed to travelling by horse and carriage, when the telephone was a very unreliable instrument, when using any of these technological means required a high degree of skill. All of these are available today for a child to use and enjoy. When I was a boy a journey round the world was a great event. It could take place once in a lifetime. Now it is something that one can do, if one wishes, in three or four days.

The changes have their impact on education in two ways. First of all, the technological means that are becoming available must change the educational process itself; but more important than this, is this need to prepare for these changes, by educating in a different way from what has been adequate in the past. Until recently, it was sufficient to have an excellent education up to the age of twenty or twenty-two, including a university degree, and one was established as an educated and cultured man for the rest of one's life. An engineer who had a first class training in his youth, remained as an engineer able to deal with situations in his special field for the rest of his working life. Today it is not like that at all, retraining has become an essential part of industrial life. No engineer, no chemist, no biologist, no-one concerned with any scientific or technical activity can any longer rely upon the training that he received in his youth. He has to bring himself up to date, and the educational system will have to adapt itself to this. At the present time there is probably over-teaching in the early years and under-teaching in the later years.

Total or permanent education is rapidly become a necessity and this requires such revolution in the educational process that only a few experiments here and there can indicate what kind of thing will be required. In England we are planning a University which people will enter only when they reach the age of thirty or thirty-five; that is a project for a University entirely concerned with retraining and not with primary training. Mid-career training for professional men and women of 45-50 is an accepted necessity in several professions. Apart from this, there is the growing demand for adult education to enable people to make fuller use of the increased leisure that technology is bringing to the industrialized areas of the world.

These are some of the universal general factors which operate throughout the word to create the crisis in education. There are also accidental factors that operate at the present time because of defective world institutions and societies. There is the serious imbalance in the educational effort in different countries. It was estimated by the Commissioner for Manpower of the American Army recently that the total U.S.A. budget, Government, Federal, State, Industrial and Private for education and adult training was $80 milliard a year and that it would rise by 1975 to over $100 milliard a year. It is very difficult to picture a sum as great as that until one makes a comparison, probably the entire world budget for education and industrial training does not exceed $160 milliard. That for

education alone is probably not more than $100 milliard. The whole of the developing world which constitutes 70% of the population only spends about $12 milliard on education, that is to say that if the whole of the educational effort in the developing world is probably not one sixth of that of the United States alone. On top of that there is the 'brain drain' to which references were made yesterday. Even when educational opportunity does reach the people of the developing countries, there is always a temptation for them to turn to the highly industrialized and highly scientific countries for a more promising career. I should, of course, say that within this enormous figure for education and training in the United States, $80 milliard, a proportion is spent in giving facilities for training and education to the developing countries but the actual volume is not as much as $100 million, i.e. little more than a tenth of one per cent.

The second very serious, though accidental, factor in the educational crisis is the high fall-out of the educational process in the developing countries from primary schools onwards. Where educational facilities are available, out of a hundred children who could enter a school not more than 60 enroll; but, according to the figures published by UNESCO, not more than 10 out of the 100 actually complete their primary education. This means that the total educational effort in the developing countries must be very seriously out of balance with the educational effort in the OECD countries. This is partly confirmed by the figures of adult illiteracy. Although the percentage of illterates is falling the absolute number is increasing. In 1960 there were 740 million adult illiterates. It is estimated that in 1970 there will be 810 million illiterates in the world: that indicates the inadequacy of the world educational effort.
There is a further very important factor to be taken into account which is the Revolt of Youth: the moral and social rejection by young people of the social conditions which they are finding in the world. This in one sense disturbs and disrupts the education process and makes it apparently more difficult for advances to be made; but on the other hand it does perform, in an objective sense, an extremely important function in loosening the rigidity of the traditional system which is one of the main reasons for the stagnation of education to which I referred at the beginning. We have a combination of factors which are out of human control, those that I spoke of first, that I called universal factors, and a number of factors that are theoretically under human control but very unlikely to be controlled; that is a redistribution of the educational expenditure between different sections of the world population.
Now I pass to the second part of this expose and that is the requirement of a solution. I have spoken of the necessary revolution in education. I want to go very quickly through the main transformations that are required. I have already referred to the need to pass from juvenile education to life-long or permanent education.

There is also a need to pass from teacher-centred to pupil or student-centred education. There is an almost universal demand on the part of youth to have a more effective say in the direction of their education, and this is right and it is necessary under the changing conditions of the world. Where there has been acceptance of the change from teacher-centred to student-centred education, the results have been quite startling. We have made the experiment with colleges of technology in the London area where we have arranged it so that the students can themselves choose and direct their educational process and the results were superior to those where the education was directed by the professor or the teacher.

The third factor to which I have already referred is the transition from collective teaching to individual learning. There is no other possible way of establishing an equilibrium in the world social system than to enable people to learn and develop themselves individually. The method of class-teaching that has obtained in education until recent times results in undue advantage to those that have certain special kinds of gifts, and unfair disadvantage to the slow learner who might in the end be a more valuable member of society. This leads to great waste of potential, which was not a serious matter in a non-technical age; but is quite unacceptable today. There are too many unskilled workers in the world, who could do far better for themselves if they could receive proper training. Wherever individual learning has been successfully introduced there has been a marked levelling of the achievements of the different elements within an educational system; proving quite definitely that there is far less difference in the abilities of people than the educational system appears to show. Many of the differences in ability are probably attributable to the unfair working of the educational process as it is at present rather than to inherent differences. Of course, these differences do exist and require to be encouraged but also this can only be done through individualized learning.

The fourth necessity for a successful educational world system is the abandonment of the static curriculum with fixed syllabus of instruction varying every ten, twenty years or more, which has been the custom throughout the world. In some countries, the curriculum has become so static that it doesn't change for forty or fifty years and this does not apply to only the developing countries. In England, the teaching of mathematics in many cases remains the

same as it was when I was learning as a boy nearly fifty years ago. This terrible stationary curriculum has the effect that a great deal of that _which is taught at school is not relevant to the requirements of modern life. It cannot keep pace with the knowledge explosion and it cannot make use of the new technology, and therefore the transition from the static to the evolving curriculum is one of the necessities of an educational revolution.
The fifth requirement is the elimination of the competitive or qualifying examination in favour of a method of total assessment. Qualifying examinations, as all of us know, are really fundamentally unfair. They are bound to favour students with certain particular characteristics which characteristics may not be at all significant for later life. This is amply proved by the statistics of the subsequent success and failure of those who achieve high notes in the examinations and those who did relatively poorly. I think that it has been sufficiently demonstrated that for everyone to be bound to accept it the qualifying examination is a great social disadvantage; but it is hard to see what will replace it with the present structure of the educational system.

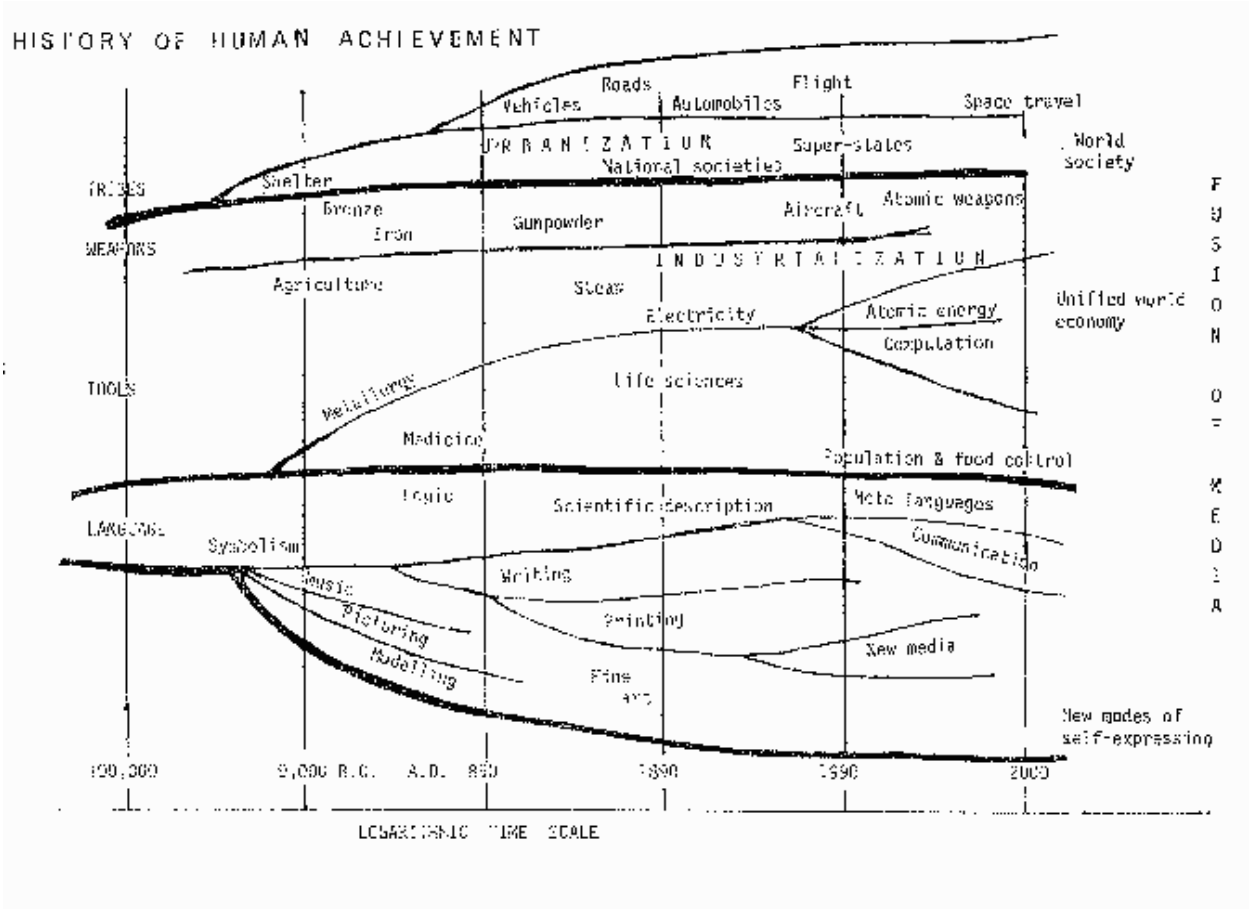
I have set before you five requirements which you may think Utopian, but they are requirements, they are not aspirations; they are not things which it would be very good if we could achieve them. They are necessities without which we shall not be able to deal with the situation that is going to exist over the next twenty or thirty years. The first obvious conclusion is that it is impossible to do this simply by increasing the number of teachers. If we were to increase the number of teachers sufficiently to meet these five requirements all the students graduating in all the universities throughout the world would have to be drawn exclusively into education and even then they would only meet one third of the world's needs. In other words, there is a material impossibility of satisfying these requirements by increasing the number of teachers.

I now pass to the third part of this expose and that is, to examine the means for a solution. First of all, I postulate as almost axiomatic that this will have to be done through increased automation. There is no possibility of resolving even a fraction of the education crisis without an enormous use of automation, comparable to its use in industry at the present time. The first form of educational automation which has now been in fairly general use for many years is improved presentation. Lecturers have to spend less time because textbooks are more attractively presented. Audio-visual aids are being increasingly used. At the present time, in the United States the capital invested in audio-visual aids for education alone is more than 5500 million and this is a rapidly growing industry in America. It is expected that something like $3 milliard of equipment will be installed in American schools by 1975. These improved forms of presentation are very good but they have serious limitations. They provide no feed-back. There is no way by which the student can test for himself whether he has understood what is presented to him, and they are not at all individualized.

The next step, therefore, was the introduction of self-teaching systems. This was done partly through programmed instruction based upon psychological researches, mainly done by Professor Skinner at Harvard University, and by the psychologists of the American armed forces during the war. Programmed instruction was, a few years ago, looked upon as the key to many of the problems of educational development; but it has become more and more apparent that the programmed instruction by means of linear and branching programmes is only able to teach relatively simple subjects, mainly those that can be learnt by means of a drill, such as the knowledge of facts and the use of algorithms. Programmed instruction can be automatized with the help of teaching machines and it can be brought to a very high level of perfection by what is called CAI, *Computer Assisted Instruction*, which has been very actively developed in the United States. Many hundreds of millions of dollars have been spent on this method in which a dialogue is fed into the memory of the computer and the pupil enters his reply to the question and the computer feeds
back to him an appropriate response. This method so far has proved to be almost impossibly expensive. Its cost effectiveness is so low that compared with *Traditionally Administered Instruction*-TAI as it is sometimes called - it is as much as five times higher to learn by means of CAI. There are also very great limitations in the capacity of the computer aided instruction. It does, of course, have the great advantage in common with programmed learning using desk teaching machines that the pupil does receive individualized teaching. Each pupil can go at his own rate; learn in his own way, and this alone has proved a real asset in the American schools where it has been introduced. But in spite of this asset there have been no spectacular developments, chiefly because of the limitations of the system and its costliness.

This brings us on to the problem of making full use of the computer in education. Now you perhaps will allow me to tell a little about the computer. All of us have heard of computers, all of us know their prodigious capacity for

almost instantaneous calculation and so on. But the real character of the computer revolution is not sufficiently understood.




In the chart which I put before you (Fig. 1) you see a great number of achievements of man connected with various forms of machinery, of sources of energy, transportation and so on as shown on the upper half of the diagram above the middle thick line. All these consists in some form of transfer from the human or animal body of activities concerned with changing the environment or setting man free from some of the limitations it imposes on our activity. Man acts on the world through his body, through his hands and his feet. These are very limited instruments and machines of all kinds have increased out of all knowledge, the power of man to act upon his environment in the physical and bodily sense. But hardly anything has been done to relieve the human mind of its burdens. Even writing and printing, though concerned with metal processes, are, in fact, only extensions of the human void as a means of communication, or the human hand as an instrument for making signs. Ever since the time of Leibniz, people have searched for means of carrying out mental operations by means of calculating machines; but it was only in 1937 when three or four brilliant workers simultaneously in different centres began to see the possibility of using electronic circuits in the reproduction of logical processes and hence of calculators or computers. The first characteristic of the modern computer is its enormous memory. In the past, memory was regarded as a human characteristic. Men learnt stories by heart and reproduced from memory. They learnt how to read and write, but to use the written word, it was necessary to have the language and its operations stored in the memory box that we have in our head. The form of memory that you have in a printed book is dead until it is revived by a human agency: but the memory of an electronic computer
is able to call on its own reserves and stores. It is able to make its own combinations, in other words, it acts in the use of its memory in almost the same way as the human brain acts.

Again, and this is far more important, every kind of logical operation that the human brain can carry out, and the human brain is able to formu late as an algorithm for logical operation can be reproduced in a computer. The computer can carry out not only the simple Boolean logic with which computer science began; but all the modern indeterminate logics that have transformed the logical sciences of the last thirty years. At the time of Aristotle,

sound logical operations were regarded as one of the highest achievements of the human mind. For more than two thousand years, the capacity to perform logical operations analysis and synthesis were regarded as the exclusive prerogative of man. It was denied, for example, by Descartes and others to the animals-probably rightly. But the computer can, in fact, perform these operations. Of course, for this it has to be programmed and supplied with the logic with which it is to perform the operation. This is equivalent to saying that it has to be educated in much the same way as a child has to be educated to perform logical operations. This is the great feature of our modern age. I do not think I am exaggerating when I say that the advent of computers will result in greater changes in human society and the prospects of human life than has been made by all the previous inventions in the fields of mechanics or electricity. The reason is that a great number of operations that have hitherto been regarded as exclusively human can be and are being carried out by computers. This certainly does not make man unnecessary. On the contrary, the real significance of the computer revolution is that it liberates man from mental drudgery as all others forms of machinery liberate him from physical drudgery. The tedious mental processes of making arithmetical calculations, of searching through memory stores, of looking up things in libraries, reading all the literature connected with a subject that one wished to study-all these operations to which we have so long been accustomed, will certainly be taken over from man by the computer. Already what are called data banks or data bases are being developed, which enable the user of the computer, simply by setting up a combination of addresses, to call for information of an enormously varied character. Already something like ten million items of information are available at one's finger tips, and this is only the beginning.

We must try to picture what changes in human life will come with the removal of mental drudgery on top of the diminution of physical drudgery. This has not yet happened. computer science is still in the developing stage.

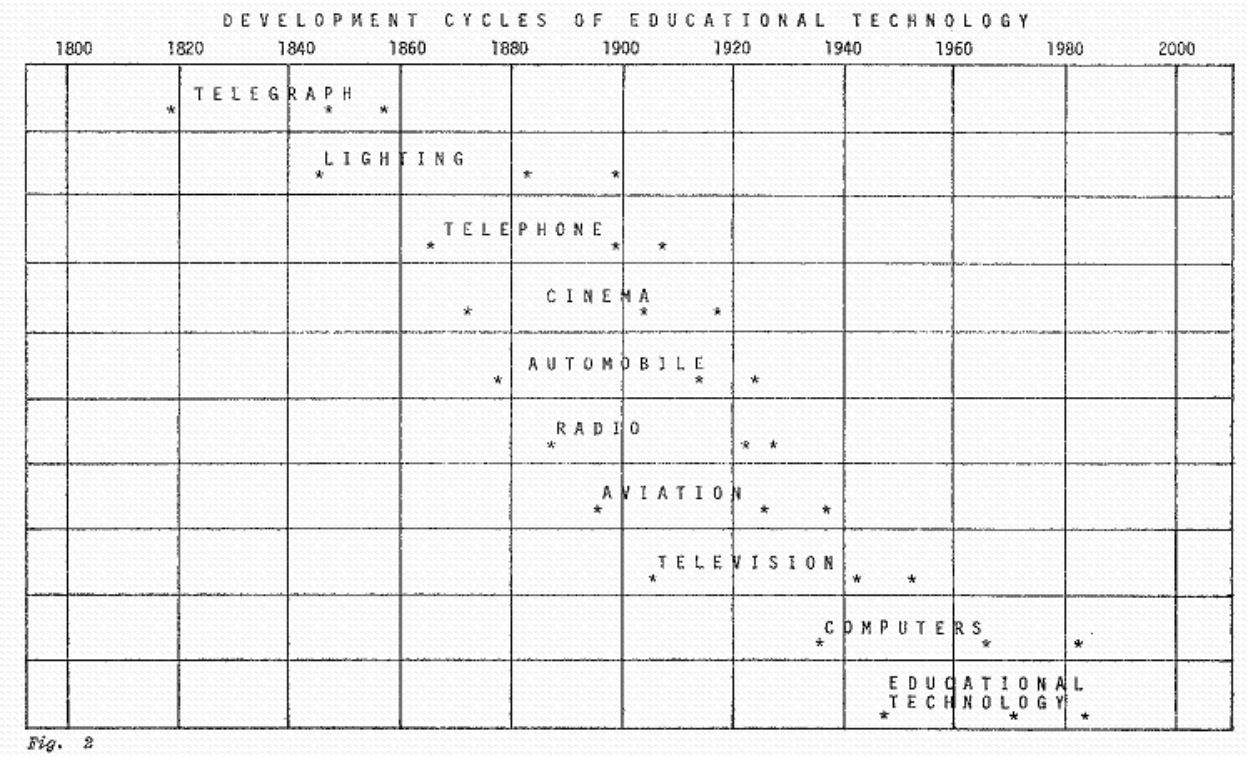



*Fig. 2*

In Fig. 2 you will see a diagram. This tabulates the development of various electrical techniques since Faraday discovered the electro-magnetic induction in 1920. This led to the development of the

260

electric telegraph, and so right on to computers and to what I shall speak of as educational technology. The study of these developments shows that there are three phases, one is the basic scientific discovery and usually there is about thirty years from the basic scientific discovery to its effective application in practice. Then there is a relatively short period which may be ten or fourteen years in which it changes over from being a specialized technique that requires experts to one which anyone can use. For example there is the automobile; at the beginning of this century to possess an automobile meant that one had to be an enthusiastic mechanic ready for anything, and ready also robustly to turn the handle in order to get the car to start. When the first starter was introduced and all the final improvements in the car it became such that a child was able to drive it today. Computer science is still in the development stage

but probably within the next twelve years it will come to the point where anyone without any special education or training will be able to call for information of any kind from the computer, to ask for logical, mathematical and analytical operations to be performed and to receive the answer almost instantaneously and then will be the time when one will speak of the maturity of the computer. This maturity of the computer is not so distant. It is probably within ten or twelve years that the present limitations due to the requirements of the software, the programming will have been overcome, and automatic programming methods will have become universal. So that anyone will be able to speak to a computer just as I am speaking to you now and also for the computer to be able to answer back, just as I hope very soon you will be answering me. That digression was really necessary because without that one cannot picture what the computer can do for education.

Now I must very briefly give you a few facts. In 1965, there were 30,000 computers in the United States. It is estimated that there will be 85,000 by 1975. The most important computer organization, International Business Machines, IBM, has at the present time an annual turnover of $6 milliard. It is the most highly valued corporation in the world because of the belief that people have in its growth potential. All this has happened within the last fifteen years.

In education computers are still very behind, whereas there are more than 40,000 computers in use in business and elsewhere, only 600 American colleges have computers at the same time and not more than 800 school districts. In other words, the whole of the computers of the United States used in every form of education only represent 2% of the total use of computers. I must add that the computers being used in education were very much simpler and much less powerful than the ones being used in industry and in defence.
I want to go through a few of the typical applications of computers in education. The first and most primitive kind is where the computer is used exclusively as a memory for the teaching profession. 140,000 educators in New England are memorized on the central computer; their personal characteristics, experience, salary, and so on; twelve different characteristics are all stored in one single IBM 360-30 computer which is not a very big computer. Any administrator in the New England area covered by this project requiring a teacher or considering the advancement of a teacher can almost instantaneously search for information about each teacher's characteristics. At the time this was complied, about the middle of 1968, they had not yet started compiling information about students. This gives you an idea of the developing stage that there is in this. There are a number of systems of this kind where the computer acts primarily as a memory store, and does so, of course, in a far more efficient way than a human memory store. No person could remember the characteristics of 140,000 teachers, and to make use of ordinary data files would be an extremely laborious process.

A more advanced system will be explained to you this afternoon by Dr. Brudner the Vice-President in charge of Research and Development of the Westinghouse Learning Corporation. This is the Project PLAN[3] which uses a simple computer in the middle of the United States, in Iowa, joined by landlines to about thirty or forty schools, ranging from very advanced secondary schools in San Francisco district to ghetto schools, schools with mixed populations and so on. At the moment, more than 4,000 pupils are participating. Each of the pupils works through an individual course by himself or herself in front of a teaching presentation. He puts his answers on a card, which is fed in to a terminal and transferred to a computer in Iowa where it is examined and record is made. The next morning the teacher receives an analysis of the pupil's lesson, recommendations as to what he or she should study the next day. This is called *Computer Manager Instruction*-CMI. There is no direct dialogue between the pupils and the computer. It is mainly an aid to the teacher but the great thing about Project PLAN is that it is truly individualized. Every one of the 4,000 pupils works at his own pace in his own way or does not work at all, if he does not wish to, without any disturbance of the other pupils and receives advice and counselling according to his own achievements and needs. This is undoubtedly a very big step forward and it is becoming very popular in the United States. Many school districts want to join in this next year.

I would also like to refer to a project which my own Institute is developing in England in which we hope to cover a wider educational range than is possible in the Project PLAN, which uses a very simple method of testing. We have developed a system that we call Structural Communication, which introduces the tutorial mode and allows a full dialogue between the pupils and the author up to an extent that has never before been possible. For this we make use of a highly specialized desk computer which is either used by one or shared by a number of pupils. I shall show you a film of a group of young boys, studying a sociological theme, so I will not go into further detail now. In this

[3] Acronym for **P**rogrammed **L**earning **A**ccording to **N**eed

project, we shall be teaching all subjects, all ages and there will be an assessment of the pupils' achievement continually built up so that they will not have to have competitive examinations.
We hope that this system will meet all five requirements; but I must explain to you that this is still at its beginning. We are still carrying out preliminary experiments in several schools to test the feasibility of the scheme. It is, I think, the most ambitious scheme in the sense of its educational potential that I know of and therefore I have included it in this presentation.

So you have everything from a simple memory that helps the administration through various forms of individualized instruction to a project which covers the whole of my five requirements.

Before I close, I would like to say this looking at this as a world problem it is a very great pity that these experiments are mainly being carried out in Western countries. We have a very heavy obstacle in the traditional education and in the enormous investments that there are in the wrong kind of schools arranged for the out-of-date conception o€ one teacher sitting in front of twenty, thirty or more pupils. This is utterly contrary to all modern conceptions of what education can be. It is very much easier in many cases to carry out highly advanced experiments in the developing countries where there are not these commitments and where everything could be done *ab initio* making use of the new technical facilities. There is also another important advantage and that is the uncommitted situation regards education. Whereas in the Western countries, teachers are often the main obstacle to the progress of education because they have been trained in a certain way and they wish to teach as they were trained to teach. In some countries eight out of ten teachers actually oppose technological innovations, either because they feel that their jobs may be lost or that they will have to work hard to learn new methods, whereas they are able to work satisfactorily by the old way. These obstacles, I feel, are less likely to be met within the developing countries, and I think it would be a very fine thing if it were possible to persuade some of the big corporations that are interested in education and technology as well as the great foundations like Ford and Rockefeller, to initiate experiments in Asia, Africa and South America where the need for more education is so pressing. These great world corporations and as well as that some of the other international corporations such as the great oil companies who have a great need for trained personnel might well transfer some of their experimentation into the developing countries; and not call on the very limited funds that are available from the existing sources. The whole expenditure of the U.N.D.P. on education was in 1967 only $170 million. $170 million seems to be a nice round sum, but you cannot do enough with it in this field. Compared with the $80 milliard spent by the U.S.A. on Education and Training, $170 is a fifth of one percent. Why should we not ask for 1% of the expenditure on education in the developed countries to be allocated to the developing countries. Perhaps with the help of our Chairman, Mr. Mir Khan, we could make these possibilities better known and start a true Revolutionary Explosion in education throughout the world.

*REFERENCES*


AMERICAN INSTITUTE FOR RESEARCH, *Talent + Plan = a New Humanism*. Greater Pittsburgh Magazine, September 1967.
BOOHER, EDWARD E., *A Forecast of Education Technology in the 1970'S*. National Society for the Study of Communication 1968.
BRADDOCK, CLAYTON, *Computer fits teaching to Individual Student*. Southern Education Report, January/ February 1968.
BRUDNER, Dr. HARVEY J., *Computer-Managed Instruction*. Science, Vol. 162 pp. 970-976, November 29th, 1968.
CHARP, SYLVIA, *Computers and the Educational Program.* (Editorial) REDS Monitor 6: 25; September 1967.
CRAWFORD, P., *On Our Educational Task*. I.B.M. 1966.
DUKE, J. F., *Underdeveloped Countries-the role of educational technology and the mass media. National Council for Educational Technology.*
*Education in the '70s.* A Study of Problems and Issues Associated with the Effects of Computer Technology in Education. Washington, D.C.: Program of Policy Studies, Educational Policy Project, George Washington University, 1967, pp. 326.
FERRARO, EUGEN T., *Project Aristotle*. U.S. Defense Industry Bulletin, Vol. 3, No. 8, 1967.
GOODLAD, JOHN I., *The Future of Learning and Teaching*. Washington, D.C.: National Education Association, 1201 Sixteenth Street, N.W., 1968, pp. 24.
HAGA, ENOCH, editor, *Automated Educational Systems*. Elmhurst, Ill.: Business Press, 1967, pp.
HICHEY, A. E., *Computer-Assisted Instruction. A survey of the Literature*, third edition, 1968.

I.B.M. *Computer-Assisted Instruction*, System 1500. 1967.
JANTSCH, ERIC, *Technological Forecasting in Perspective*. O.E.C.D. Paris, 1967. McLUHAN, MARSHALL, *Understanding Media*. New York 1966. MACKENZIE, NORMAN, *Education and the New Technology*. Visual Aid Conference 1966.
R.C.A., Instructional 71 System. January 1968.
STOLUROW, L. M., What is Computer Assisted Instruction? Educational Technology Magazine 1968.
SUPPES, PATRICK *Computer Based Instruction. Electronic Age*, Summer 1967. Systematics, Vol. 4, No. 4, March 1967.
Systematics, Vol. 5. No. 3, December 1967.
Systematics, Vol 6, No. 2, September 1968, *The Progress of Educational Technology*. J. G. Bennett and A. M. Hodgson.
TOSTI, DONALD T., PRIME *-A General Model for Instructional Systems*. NSPI Journal, Vol. VII. No. 2, February 1968.