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1970
Johannesburg College of Education
https://hdl.handle.net/10539/27485
Chapman, A.S., & Unwin, D. (1969/1970). Educational technology at large: Different emphases, different directions in different countries. Symposium: A Journal of Education for Southern Africa, pp. 71-77.

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Educational Technology at Large: Different Emphases, Different Directions in Different Countries

by ANDREA S. CHAPMAN *and* DERICK UNWIN

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'There may well be an "industrial revolution" in education. The ultimate results may be highly beneficial. Perhaps only by such means can universal education be made effective.'

(S. L. PRESSEY, 1932.)

'We are on the threshold of an exciting and revolutionary period . . . a sweeping revision of educational practices is possible and inevitable.'

(B. F. SKINNER, 1954.)

THE TITLE of this paper includes a jargon term which means many different things to different people, and which arouses a remarkable degree of passion among educators at large. '*Educational technology*' (ET) brings into juxtaposition two concepts which are often deemed to be as immiscible as oil and water; it is argued that nothing good can come from applying the coarse mechanistic ideas of technology to the sensitive flower of education. It would be idle to pretend that such fears are, *a priori*, totally groundless, especially if some utterances of affectionados of technology are taken at face value.

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Mr. Unwin is the author of a number of programmed texts in physics; he is co-author of *Programmed Learning in the Schools* (Longmans, 1965) and *The Computer in Education* (Library Association, 1968), editor of *Media and Methods* (McGraw-Hill, 1969), and co-editor of Aspects of *Educational Technology* (Methuen, 1967). He has published numerous articles and papers in the general field of educational technology.

Unfortunately, as implied above, there is no clear agreement as to what precisely is meant by ET: does it, for example, mean 'audiovisual aids'? Or does it mean 'programmed learning'? Or should ET be properly reserved for the highly potent engines of instruction now emerging in the U.S. and elsewhere? Undoubtedly the last of these possible definitions is the one which has captured popular imagination and is seen as posing the maximum threat or blessing, according to your predilections. The digital computer, the dial-access information retrieval system, closed-circuit television, even the language laboratory, these are clear evidence of technology at work and it is only too easy to assume that ET comprises just such expensive pieces of hardware.

If this were the case then ET would be the exclusive preserve of wealthy industrialized countries, and would have no relevance to the enormous problems of ignorance and lack of opportunity facing so much of today's world. Luckily, there is a side to technology which is in no way dependent on gadgetry and electronic wizardry, but which is capable of bringing relief and improvement to teaching and learning problems in any context, in any circumstances. This aspect of ET is concerned with the *planning* and *organization* of learning, with the *structuring* of the learning experience, with manipulation of the *conditions* of learning.

Great improvements in the efficiency and profitability of companies can be achieved by calling in management consultants. These analysts concern themselves with the objectives of the firm concerned,its resources — both human and otherwise, and with the relationships between these resources and objectives. By abandoning preconceived notions, often arrived at for reasons long forgotten, the consultants can produce a plan which seeks to maximize profits in a manner consonant with available resources. Such activity is directly analogous to the aspect of ET just introduced. It is of course not necessary to call in outside consultants when the task is only to improve the performance of a small number

of students. But no matter how limited the scale, there may be much that can be gained from this so-called *systems analysis.*

In essence, when ET is to be applied in this way, it means that the 'analyst' — whether he be class teacher, school superintendent or professional educational technologist — must carefully consider the learning objectives and the human and physical resources. It is, in one sense, immaterial whether these resources comprise a digital computer and every conceivable requirement in buildings, books and all the other educational impedimenta, or if they are restricted to a pointed stick and a flat stretch of sand. Whatever the realities of the situation, the analysis will hopefully produce a 'best buy'. Naturally, in education as in industry and commerce, optimum results demand an open mind and a willingness to abandon time-honoured practices where this is indicated as desirable.

So in addition to comprising a catalogue of sophisticated hardware, ET is a concept with relevance to any educational situation. Historically this broader view is a natural consequence of the development of *programmed learning.* The launching of the first Soviet satellite brought about an immediate colossal investment of funds in American education, including educational research. These events coincided with Skinner's re-discovery (Pressey is commonly considered the originator, back in the 1920) of programmed methods, and rapidly brought about a great number of research studies aimed at establishing the important variables of a programme. This is not the place to examine the curiously inconclusive results obtained from several years of eager experimentation, but very evident is the gradual enlargement of the programming concept: starting with the programme as a set of verbal learning materials (i.e. the programming of a textbook), leading through the use of visual and aural aids and finally reaching a position where *any teaching/learning* situation could be 'programmed'.

In the context just mentioned, 'programmed' is taken to mean the application of the principles of programmed learning to the didactic situation. By 1966, Edwards could speak[1] of programmed learning, as 'the language of these new systems of learning.'

From such a standpoint it was a short step indeed to the wider notion of systems analysis which includes programming within its more multidimensional ambit. Broadly speaking, ET today should, in the authors' view, properly be taken to mean the application of systems analysis to teaching and learning, *including* the study and use of new media, methods, and machines; but these things are, or more realistically, should be only of secondary importance. Innovation is exciting and captures popular attention; it does not follow that the introduction of new and expensive gadgets is the only or best method of scoring major educational gains.

If it is conceded that ET need not be an expensive luxury, then it is no longer restricted in application to countries having advanced technological resources. Indeed, the very opposite can be argued: in situations where finance and resources are surely limited will not ET offer the greatest rewards? Under such circumstances there is every chance that a rigorous systems analysis will yield gains out of all proportion to the investment made. Only prosperous countries can afford inefficient learning!

Some while ago the authors agreed to guest edit an issue of the U.S. journal '*Educational Technology*'[2], the contents being devoted to ET around the world. In part fulfilment of this task enquiries were addressed to educationists all over the world, seeking information on the use of ET in their country, whatever ET might mean to them. The remainder of this present paper is taken up with summaries of part of the responses. No attempt has been made to pass any judgment on the various activities reported, and the responses are given to the reader with similar emphases to those contained in the uncondensed originals.

. . . . . .

For obvious reasons we are making no attempt to summarize the U.S. scene. American books and periodicals dealing with all aspects of ET are legion and only a prolonged and detailed study can give any insight to the many exciting developments. Developments which, incidentally, will almost certainly be enhanced by the Educational Technology Bill presently before Congress.

It goes without saying that technological innovation in *Canada* is greatly accelerated by proximity to the U.S. Some trends, however, emerge more clearly in Canada, the most important being a realization that a fundamental change in the teacher's role is necessary in a technological learning situation. The shift is seen as being from one-way transmission to the management of a total learning environment. ET is seen as an ally in the struggle for a more flexible educational system, providing maximum choice for the pupil. The Hall-Dennis Report (accepted by the Ontario government as a blueprint for the future), shows the full extent of this kind of thinking in Canada.

A second emergent trend is the provision of Central Resource Centres for storing materials and equipment, preventing unnecessary duplication in the various schools in a particular provincial area. These pools contain programmed texts, projectors, tape-recorders, etc. The system requires a high degree of co-operation among schools, and flexible timetabling.

Thirdly, Canadian schools are able to use obsolete machines from industry. Computers are rented for $1,000 per month; printing presses, television equipment, are available at a fraction of their original cost. In Ontario and Alberta modern architectural planning has become a special feature — schools have been built with moveable walls to accommodate different sized groupings.

Also well to the fore of the ET scene is the micro-teaching clinic, where teacher-trainees can criticize the individual aspects of a video-taped lesson given by one of their number.

There are numerous courses offered in the universities in the field of ET. Emphasis varies, but teachers in most areas of Canada have access to ET instruction.

In a recent survey of the Use of Educational Technology in *Australasia*, D. V. Connor[3] writes: "Educationalists in Australia and New Zealand have tended not to capitalize on what educational technology has to offer and to be content with teaching procedures tied to concepts justified on historical and traditional grounds".

Educationalists have been slow to realize the potential of programming, although the Modern Teaching Methods Association, and the Association for Programmed Instruction and Educational Technology in Australia are actively promoting its acceptance. Considerable use is made of instrumentation in Australia, but many communications media are inadequately used — educational television has, on the whole, been disappointing — and Computer Assisted Instruction has sometimes misled its advocates into concentration on the medium rather than the teaching programme.

In contrast, the language laboratory has been widely accepted in Australia — good use is made of it at every level — and this country has been instrumental in pioneering effective approaches to the teaching of English as a second language.

The chief weakness is the lack of an overall integrating approach to ET, which will define the appropriate roles of each component in the ET system.

Of course lack of finance is a major problem, and *New Zealand* has some particular difficulties in this direction. Most items of equipment at every level of education have to be imported, a situation likely to continue. Prices have risen too, since the recent devaluation of the currency.

However, despite its small population (under 3,000,000) New Zealand's overall educational provision compares favourably with larger, more established countries. Each of the teachers' colleges makes some provision for training students in AV aids, and the Department of Education has established a Curriculum Development Unit responsible for organizing in-service training.

In general schools are not well provided with printed media — maps, textbooks etc. — only a limited amount of these materials being eligible for an educational subsidy. Filmsstrips and slides are well-established, and although secondary schools must buy their own, a filmstrip/slide projector is basic equipment in all primary schools.

In the main the traditionally academic bias of the secondary schools has militated against the use of broadcast material, and at present all radio programmes are designed for primary schools, creating a gap which really needs filling. Open channel ETV has not yet been introduced, this is promised for the 1970s.

Language laboratories, teaching machines, programmed learning, are still very much in the experimental stage in New Zealand, and the last especially has received little encouragement from the Department of Education.

Conscious of the lack of knowledge about ET, a Society for Audio-Visual Education (SAVE!) was formed in a teachers' college two years ago, and campaigns vigorously to educate teachers in new media. This year the first ever Visual Aids Conference and Exhibition is to be held in Wellington.

It seems that until now economic considerations have outweighed educational ones, and vigorous campaigning among teachers, to create demands for better facilities is the only answer to this problem.

The difficulties of financing new schemes for education in underdeveloped countries must often appear insurmountable to those involved. Emphasis tends to be placed on financing new industrial projects which will show tangible results, at the expense of the less obvious benefits following investment in training. It is startling to find that in some states of *India* a teacher is paid less than the lowest paid government office employee, or an unskilled labourer in industry. Additionally, his fear of redundancy in a technological environment is bound to be greater than his concern to improve the educational process.

Thirty three radio stations in India broadcast in various regional languages. Over-large groups, poor classroom acoustics and insufficient pre- and post-broadcast activities, all contribute to the lack of success of some broadcast programmes. Television operates only in Delhi and its environs, although other centres are planned. It supplies a real need in the schools, for very often teachers are not well-qualified, and lack equipment such as good laboratories. Again, however, classroom follow-up is invariably lacking.

A frequent criticism, both in India and elsewhere, (as we have seen in Australasia) is that schools do not have access to adequate, varied supplies of software, even where film projectors and other items are provided in many of the schools. Forty per cent of Indian high schools possess a projector, but films are often shown on Open Days and special occasions rather than comprising an integral part of the curriculum. The Government is aware of this shortcoming and is seeking to remedy it.

It is interesting to find that in spite of the far from satisfactory school broadcasting situation, the National Council of Educational Research and Training is experimenting with more sophisticated media. Language laboratories have been set up in some University departments (Poona, Annamalai etc.), although as yet no school can afford to maintain one.

The Council also organized a seminar in 1965 on the implications of programmed learning, and pilot studies were conducted.[4] This has had the beneficial effect of encouraging a systems approach to existing methods and media, to improve their results. Educationalists in India are aware of the potential of ET in remedial teaching, inculcating habits of self-study etc. It now remains for those involved in the practical process of education to be convinced. Finance, inevitably, is the primary problem.

The Ministry of Education in *Turkey* has a Department of Educational Aids and Technological Co-operation in Ankara, which distributes science apparatus, working models etc. to 32,000 primary and 1,500 secondary schools. It also supervises the Educational-Film-Radio-Television-Centre (EFRTC) in Ankara. This Centre engages part-time teachers to plan and produce educational films, filmstrips, wall-charts and radio/television programmes. It is soon to move into spacious new premises containing radio and television studios.

School radio has operated in primary and secondary schools since 1963, and the large majority of pupils all over the country participate. Adult education too, is given a fair share of broadcasting time. Television is limited at present to Ankara and a 30 kilometer radius, but a current school television project envisages a series of science programmes, which would also be issued as films. Film/television collaborations of this type will, it is hoped, overcome the limitations of the television network. At present there are only 5,000 television receivers compared with 3 million radios in Turkey, though more high-powered transmitters are under installation, thus extending the television service to Izmir and Istanbul in the near future.

The situation in *Japan* reflects the American example, in much the same way as that of Britain. That is to say, similar work is carried out after a time delay of two years or more. Particularly intensively used in Japanese schools are audio programmed systems, such as the language laboratory and a variety of commercially produced audio teaching machines. The Richo Syncro-Fax (the 'Talking Page') is just one such example which is now being increasingly used around the world.

There is evidence that a theoretically based systems approach is gaining ground in Japan, and that this thinking is being applied to all variations of media and methods.

The Ministry of Education, *Thailand*[5] is planning a regular educational television service for secondary schools, and to this end is organizing an experimental ETV project comprising two half-hour programmes per month, one on Thai TV and one on Army TV. The latter is on mathematics this year (1969), and the Thai TV experiment is a magazine programme aimed at the 6-10 age group. ETV is still in its exploratory stages here; not so school radio however, which has been operating since May 1958. The General Educational Service which runs separately from the School Broadcasting Service, but is also managed by the Ministry of Education, operates for three hours a day, throughout the year. The school service occupies the main part of the weekday — from 9 a.m. to 2 p.m. About 6,000 schools participate, and three subjects are offered, *English Language*, *Music and Singing*, and *Social Studies* — which covers a wide range of material.

English language broadcasts are bilingual, and have been found to overcome largely the teachers' inadequacies in accent and information. The quality of the social studies series tends to be uneven, since owing to limited production resources some have failed totally to capture pupils' imaginations. Music broadcasts include folk-dancing instruction, and the introduction of Thai and foreign musical instruments. They have proved the most popular. Children have been

known to refuse to stay home from school if it means missing a music broadcast!

All broadcasts are backed up by teachers' handbooks etc. and schools are invited to give opinions and suggestions by questionnaire. The problems echo those described in Indian schools: poor reception, bad classroom acoustics, large classes and the teacher's assumption sometimes that the radio provides a free period and will do his work.

Under the Colombo plan, a new 10 kw transmitter is being installed with the help of the Australian government. In-service training in the use of radio is organized too, and these steps may go part of the way towards maximum use of broadcasting time.

Unesco also has a project under way to produce and develop materials, films etc., for science teaching in Thailand.

As benefits one of the most highly industrialized countries of Asia, *Hong Kong* educationalists make wide use of audio-visual aids. A government Visual Education Centre provides all types of projection and audio equipment on free loan to schools, and a full library of AV software is maintained. Language laboratories — particularly valuable in this bilingual community — are not uncommon but in general the more sophisticated educational media have not been developed.

In early 1970 an ETV network goes on the air, the first lessons including English Language, Modern Mathematics and Chinese Language. All schools are being supplied with suitable receivers.

In *Latin America* one finds at least one excellent example of the successful application of educational technology in extreme circumstances. Cultural Popular Action of Colombia (ACPO) issue a publicity pamphlet outlining its ambitious aims. ACPO "has as its goal, the integral education of the masses, particularly that of the rural adult through Radio Schools". Formal education opportunities are obviously impossible for the illiterate masses in Latin America, but ACPO's radio courses — reading, writing, agriculture, hygiene etc. — provide a pilot system with tremendous possibilities, which could be used as a model for other Latin American countries. The organization is the result of private initiative, and owns all its present installations and equipment (a publishing house, studios, shops and schools). Broadcasting and follow-up material are backed by rural organizers who have been trained for the purpose. Periodic inspection is carried out by experts in extension courses in farming etc. The aims are challenging and impressive, seeking to improve peasants' present living standards and thus gradually change their values and attitudes.

Just as we have left the U.S. out of this brief survey, so we feel there is little to be gained by a superficial description of Soviet work. This also is on a massive scale, with particular emphasis on algorithmic methods, reflecting the prevailing interest in cybernetic approaches to learning.

There are interesting ET developments in the *German Federal Republic* where foreign language teaching by means of language laboratories is very well promoted by education authorities. Languages have always figured prominently in the German higher education system, and there is great enthusiasm among teachers for keeping abreast of new media developments. There are more than 400 language laboratories at present in the schools, and this number is expected to rise sharply in the near future.

In the field of programmed instruction, larger scale projects are beginning to be envisaged, covering longer periods of the pupils' time, and greater sections of curricula. The Germans are moving away from translated and adapted American programmes and evolving their own theories on the shaping of programmes. There is a growing tendency to absorb the findings of Gestalt psychology, and to move further from the principles of behaviorism. Another school of thought is the cybernetic approach, which forms a link between computerized instruction after the U.S. manner, and the Soviet propounded theory of algorithmic teaching.

Hungary established its first Centre for Programmed Instruction in 1966, in the National Institute of Pedagogy. Experts investigated linear programmed text-books and encouraging results were exported to the UNESCO Conference in Varna, Bulgaria, in 1968. A UNESCO sponsored study-tour in Sweden and West Germany helped to study the possibilities of introducing the algorithm method into the production of their programmes.

National Programmed Learning Conferences have been held annually since 1966, and international links have been established with Czechoslovakia, Germany and Great Britain through visits and conferences.

There is widespread interest in the media, although as yet teaching machines, automatic and semi-automatic feedback classrooms (with a few exceptions), are still in the prototype stage. About ten book-form programmes are available on a small scale only, and in higher education some programmes have been adopted from abroad. Since 1964-65, publications on

new teaching methods have greatly increased in number.

Czechoslovakia entered the ET field around the same time as Hungary, in the early 1960s. They admit that one of the pitfalls resulting from the limited in-flow of information to the country, is that workers in ET often "discover" what is already known.

In the centre of Prague a permanent exhibition of AV aids and ET hardware has been established, and is open to everyone. Everything shown is at least at an advanced stage of development. As in Hungary, very few teaching machines have passed beyond the experimental stage, including a system devised in the Department of Cybernetic Pedagogy at Charles University, Prague for registering students' work with a machine by punched cards. The Electrotechnical Faculty of the Czech Technical University is also involved in the designing of teaching machines. In Ostrava an interesting project is being carried out — steel-working apprentices are taught welding by programmed instruction with a special system which measures their correct handling of the metal.

Their most sophisticated teaching machine, the first batch of which is to be exported this year, is the *Unitutor*, a 'universally adaptable' teaching machine. It is being produced at the Tesla Works in Prague. Labelled a "baby computer" at the recent Programmed Learning Conference in London, it consists of a work-table, display screen and keyboard.

In *Israel* one finds a readiness to look beyond established techniques, well illustrated by the Programmed Instruction project of one of the country's educational agencies, ORT (Organization for Rehabilitation Through Training) Israel. ORT Israel is a division of the World ORT Union, a non-profit international organization which provides educational opportunities for uprooted and underprivileged Jewish people, mainly in France and Israel.

Today 20,000 students are enrolled in 50 ORT schools, with ORT accounting for almost 30% of vocational and technical education in Israel. In the summer of 1962 the World ORT Union commenced an extensive in-service training programme in ET, starting with a seminar on PI in Geneva led by Robert Silverman.[6] As a direct result a project was organized to develop programmed materials for ORT's vocational high schools. A programme was prepared for first year (9th grade) algebra in 1963-4, and was tested with four classes. Results were favourable, the teachers were impressed and showed further interest.

In 1965 this programme was introduced in 20 classes in 14 schools, but teachers were not forced to use the material in any particular way. Only two expressed negative reactions, and they had used it as homework only. Their classes performed much less impressively than those of the eleven others. One observation emphasized by the researcher was that the teacher's role is far from minimized by programming; in fact, his willingness to act as an additional resource is crucial.

Special attention is now being paid to programming for disadvantaged children, who have not been effectively reached by the present programmes. ORT is also now planning to enter the field of CAI, and to develop its own experimental school. There are plans for animated transparencies to be used in conjunction with programmes, and CCTV to be used in the teaching of manual skills. ORT and the Ministry of Education have the software capability, and will no doubt develop hardware resources to make a real contribution to their educational needs.

The application of programmed instruction has spread during the last three years in the *U.A.R.* and the Arab world in general. It is included in teacher-training curricula and several local education authorities have held courses for teachers. Concentration is on book-form programmed learning, rather than teaching machines. The Division of Public Service of the American University in Cairo publishes "The Journal of Modern Education", in Arabic and English and distributes it throughout the Arab world. It plays an important role in disseminating information on PL, etc.

Language laboratories are, as yet, installed only in higher education and technical institutions, and — a frequent complaint — the production of programmes for the laboratories has not kept pace with progress in hardware provision.

ETV programmes are transmitted to secondary schools for two hours daily, and an impressive campaign to combat adult illiteracy in Cairo and Giza has been utilizing ETV since 1963. Obviously the Arab countries have some way to go— education is compulsory at present to the age of 12, and adult illiteracy is a big problem — but educational broadcasting in particular could help to solve some of the difficulties, by offsetting the chronic shortage of adequately trained and competent teachers at all levels of the system.

In *Sweden* the initial focus of the early 1960s, on teaching machines, language laboratories, etc., has in some measure receded to be replaced by a heightened awareness of the importance of

goal analysis — i.e. a systematic approach to the planning and providing of instruction.

The central authority for schools, the National Board of Education, and its smaller subdivision, the Bureau for Research and Development, has assumed the role of an evaluating body considering programmes intended for Swedish schools. If a programme is deemed adequate in terms of goal and content it is accepted for a probationary period of three years during which an accompanying manual must be prepared, and a systematic evaluation made. There are disadvantages; not many programmes are produced —publishers feel the field is economically doubtful — but the quality of demonstrated programmes is very high. The Board has also stimulated the development of self-instructional materials and other new methods, through research and development contracts with various research centres.

It is a massive task to try and discuss developments in educational technology all over the world. At best one can only hope to alight on some of the encouraging aspects, while at the same time pointing up such common difficulties as financial stringency. A few developments stand out clearly as being impressive within their own context, be it a highly industrialized environment or an underdeveloped country. The Central Resources Centres of Canada, the Radio-Schools of Colombia are examples of such developments. However, the overall picture is of a gradual move towards maximum opportunity and choice for the pupil — in the face very often of inadequate finance, communication difficulties, and not least resistance to new methods among teachers themselves.

(1) Edwards, H. J.: Opening address to the 1966 A.P.L. Conference, Loughborough, England. *In,* Unwin, D. & Leedham, J.: *'Aspects of Educational Technology'.* London, Methuen, 1967.

(2) This special issue is scheduled to appear in Autumn 1969.

(3) Connor, D. V. *Educational Technology in Australia and New Zealand.* Occasional Publication No. 1, Educational Research Unit, University of New South Wales, August 1967.

(4) The Indian Association for Programmed Learning Newsletter, entitled *Towards Educational Technology.*

(5) For further information see Wilbur Schramm's report in New Educational Media in Action — Case Studies for Planners No. 1, published by UNESCO: IIEP, Paris 1967.

(6) Professor of Psychology at New York University, and a consultant to the World ORT Union.

(7) For further information see Bjerstedt, A. Educational Technology in Sweden. *Didakometry* (Malmö: School of Education) No. 23, 1969.

A quarter of Germany's senior secondary schools and one-eighth of the primary schools use programmed instruction.*

American and Japanese schools lead the world with an estimated three-fourths at both High and Primary level using this approach.

Like all the teaching and learning tools that have supplanted 'talk and chalk' in the late 20th century, programmed learning is taking a little longer to reach more than a small percentage of progressive schools in our country.

The STILLITRON system is low in cost and the most advanced form of programmed learning, may we send you details?

* *Transvaal Educational News, Oct. '69.*

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