IMPLICATIONS OF TECHNOLOGICAL/OCCUPATIONAL CHANGE FOR RECURRENT EDUCATION

Edmund King
Kings College - London
Great-Britain

Writing in 1976 (1), I emphasised that "Shifts in the occupational structure and its hierarchy imply re-learning and retraining and new relationships. Scholars now talk of the 'half-life' of professions (the time taken before the graduation package is half obsolete or only half complete) - five years in engineering, possibly eight in physics, five in medicine and so on. It was officially calculated last year that in the decade 1975-1985 there would be a 12 per cent job change in the European Economic Community. The figures do not matter so much as the obsolescence, with the need for 'recurrent education' in some form".

That was an under-estimate of the speed and extent of change. About 10 years ago (in 1975) it was generally accepted among experts that mankind's store of knowledge was doubling every seven years; now, in 1985, similar calculations inform us that the total of human knowledge is doubling every 2 1/2 years, and that by 1990 the multiplication of knowledge will be faster still - possibly doubling every year as 'fifth generation' computers already on display at Japan's 'Expo '85' in Tsukuba Science City seem to confirm. 'Artificial intelligence' is a serious study now.

Nor is mankind facing only the problem of ever-multiplying knowledge. Technological application of that knowledge brings profound re-ordering of industrial structure; re-location of industries and centres of communication or market power; re-instrumentation of the means of transportation and communication; transformation of the means of storing, retrieving and analysing information; new materials, new services, new life-styles; new relationships in family and social life; and, above all, acceptance of uncertainty in any preparation which school education and vocational training can make for the future.

In November 1984, OECD's Director for Science, Technology and Industry wrote in the OECD Observer, n°131: "Today we stand on the threshold of a new industrial era - an era driven by rapidly changing technologies and presenting major challenges and opportunities for strengthening economic growth". Among the major new technologies transforming the economies of countries and altering international relationships significantly he listed
"electronics, telecommunications, industrial materials, production automation, biotechnology, artificial intelligence, ... the more specific fields of fibre optics, composite materials, CAD/CAM, robotics, etc. *(2). He might have added, of course, space technology, lasers in their multiple uses (including that of storing and transmitting information), and the 'dawn industries' only now taking shape in the world's experimental centres. It is significant that the most remarkable of these are to be found on both sides of the Pacific basin - in the Western United States, in Japan, and notably too in what are now frequently classified as the 'newly industrialised countries' or NICs - South Korea, Singapore, the Philippines, and of course the People's Republic of China.

Constant, accelerating change in "knowledge, technology, needs and tastes, commercial, industrial and financial practices" was also pointed to by the Secretary General of OECD in the OECD Observer n°132, January 1985, as marking "a period of rapid transition to what may be a new world-wide civilisation, shaped by the technologies now evolving with explosive speed", and accompanied by occupational shifts with personal mobility and adaptability.

It is very easy for us to forget how far we have already moved along the technological path during recent decades, and how quickly. Ten years ago word processors were still very new. Computers - huge machines of room size in the post-World War II period - have been reduced to microcomputers, whose sales are now greatest among children of school age and pensioners. Advanced word-processors and elaborate computers have been combined to enable Japanese printers not merely to print instant newspapers and books with the thousands of characters that their script requires by using a computer keyboard, but to speak to the screen and have the machine present a visual display of what has just been said, before setting the printer in motion. Indeed, the Japanese language spoken in this way can be instantly translated into English by the instrument for immediate printing or for world-wide transmission. It is said that the Chinese, too, are making rapid strides in the same direction.

Let us think of the pace of change in travel and communications - with their implications for all kinds of contact and human relationships. The first-ever jet air service began in 1954, yet in 1964 I was lecturing in Tokyo one day and teaching at King's College in the University of London on the following morning. Since then I have been to Japan for the weekend! Again, the first artificial satellite was launched in 1957; yet 15 years later there had been more than 500 Soviet satellites alone, and now telecommunications depend on such things as a matter of course. In 1969 the first moon-landing was watched simultaneously or on the next day by a quarter of mankind, and for the first time we
all saw the earth from outside as a little blue ball covered with
wisps of cloud. Microprocessors now control many industries, and can regulate
processes (and sometimes human responses) not only within single
countries but right round the world. Few industries can now
operate independently within the confines of one country: some of
the larger ones (like aviation, electronics, motor-car
manufacturing) by the multiplicity of their demands are necessarily
international; and others which might seem to be locally
based (like farming or retail shopkeeping) depend on international
stock-exchanges and other regulations of enterprise. Indeed, it is
a commonplace that the world's heavy industries have moved away
from Europe and industrialised North America — and even away
from Japan — to Korea, the Philippines, Mexico, and urban
centres in half-developed countries. Meanwhile, a transformation
both of these older industries themselves and of the relative
distribution of work in the countries first industrialised is now
accelerating the change from manufacturing to automation or
robotics, and from "making things" to service occupations of
increasingly sophisticated kinds.

Throughout the nineteenth and early twentieth centuries, school
systems were more and more geared into the production of skilled
manpower. Almost mechanically, they structured learning (and
society) to serve the contemporary requirements of industry and
its ancillary services. It is unnecessary to repeat here the
impressive statistics of the changing balance between these
sectors; but it is worth remembering, perhaps, that in Britain
(for example) some 3 per cent of the work-force is sufficient to
produce more than half of what the country eats, while in the
United States less than one-third of the work-force is engaged in
the industries turning out such a flood of manufactures. In the
OECD, all member countries except Greece and Turkey had more
than half of their work-force in 'services' in 1983 and many had
approximately two-thirds so employed (3). Those two year old
statistics are the latest officially available in March 1985; but
informed calculations of trends indicate even greater swings away
from the kinds of occupation for which a reasonable secondary
school education would suffice towards those which demand a
sound basis for higher education, followed by in-service updating
if not reorientation. Re-education is now necessary in many
professions. It is taken for granted now that in addition to the
new industries constantly emerging, and to those whose internal
shape and external relationships are evolving fast, the next
decade or two will produce many more industries at present
unknown. Or at least, many occupations at present unknown.
Technological change so far has produced as much employment as
it has displaced. However, the hierarchies of employment are far
from being the same as previously. The older venerable professions are neither as highly regarded nor as relatively well paid as before, whereas some of the newer types of occupation (in 'communications' especially - including 'public relations' and selling things or finding markets and influence) enjoy high public esteem and publicity. Television, which itself began as a public service only in 1936 and which was available only to a tiny minority at the beginning of the 1950s even in industrialised countries, quickly captured the masses during the decade. Now, combined with teletext and microcomputers, it dominates many homes and is a tremendous power in the schools of all advanced countries. Even at home, children spend more time with television than they spend in schools; but when we add into our calculation the televised or distance-delivered learning available to schools and colleges of every type (not to speak of libraries and other documentation centres) we have to acknowledge how vast a change in educational prospects and requirements has come about through the multiple services of the communication industry.

Consequently, there has been a shift in the hierarchy of learning and in the motivation impelling learners to undertake particular kinds of study. Moreover, the previous importance attached to much memory-work, mathematical dexterity, and the like, has vanished now that we have instant recall of many details and instant calculations to short-circuit much laborious work; therefore the tedious martyrdom of so many school exercises and so much homework is of no more apparent virtue than calligraphy or weight-lifting - since much of it is certainly unnecessary. The school subjects which have come to the fore in popular choice as well as in official plans for educational improvement are no longer the classical champions of the curriculum but mathematics and the sciences - and, in many countries now, 'craft, design, and technology' as well as the imaginative activities of school life. Much advance now depends upon alternatives and adaptability in learning.

Since these changes - though important - are little more than detail of structural change within the curriculum (often accompanied, of course, by structural changes in scholastic institutions, in the teaching profession, and in the relative importance of qualifications), let us move on to consider generic and contextual changes affecting the schools and the outlook from them. To be frank, for most people the advantages of schooling have been measured in terms of improved job prospects. Advanced certificates and degrees from universities could be counted on to lead to distinguished - or at least comfortable and well-paid - careers which would be enjoyed in permanence, and often with social privilege. Now that expectation has been transformed, and
often shattered.
It seems strange now to look back twenty years on the 1960s.

That decade began with confident expansion - in education as well as in other investments for the future. Major industrial and commercial enterprises indulged above all in 'planning', drawing up schemes of continuous development and expansion for ten or twenty years ahead. During that period 'the economics of education' was invented as a serious, scientific study - but more as a branch of 'manpower planning' than as a matter of thrifty cost-effectiveness (as it has now become). Schools and colleges seemed part of a manageable - indeed predictable - vista of input-process-output sequences. That vista was a mirage that has faded.
The human element of choice was ignored until student reaction in the USA and Europe (East, as well as West) surged enough to make governments tremble. In any case, 'prediction' was shown to be little more than presumptive guesswork (4), based upon factors arrogantly ignored or upon false assumptions about how educational systems really worked and how employment really made use of education's output. Elsewhere (5), I have pointed to the central importance of judgement in influencing the way educational systems respond to people and circumstances but often circumstances alter in unpredictable ways, especially in consequence of world trade upheavals, wars, and technological reorientation.

All these points of challenge to educational complacency seemed to come together in 1973 - so much so that many people supposed that the 1973 crises in petroleum prices and finance (since the price of oil and energy increased fivefold) brought about the 'crisis in education'. That idea was grievously mistaken. The crisis had been visible for a decade or more. Secondary education of some type had become universal in industrialised countries; and full secondary education to the age of about 18 or 19 had doubled its post-compulsory enrolments, or in some case trebled them, until the great majority in most advanced countries embarked on post-compulsory education. Enrolments of over 90% were reached in Japan, over 80% in Sweden and the USA, over 70% in Norway; and in all the countries of North and Western Europe except Britain, Ireland and Portugal more than half stayed on for full-time education and training beyond the age of compulsory. As it happened, those were also the years when the post-war 'baby boom' was sending teen-agers through upper secondary and higher education. As long ago as 1958 the so-called Khrushchev reforms in the USSR had attempted to cope with a similar flood of aspirants for continued study by introducing new elements of work-oriented preparation and periods of work-experience, so as 'to bring the schools nearer to working life'; and the 'student unrest' from about 1964 onwards in the USA was
prompted by unease about the relevance of protracted tutelage to contemporary conditions and ultimate job prospects. A similar state of disquiet among post-compulsory enrolments in five representative West European countries was thoroughly documented in a 3-year research programme (6), long before statesmen and planners got down to worrying about 'the transition from school to work'. Those students were more alert to problems of their teachers and elders.

Nevertheless, the 'transition from school to work' did become a major preoccupation, for two reasons: (a) both the academic type of education and the vocational/technical types of training currently available were ill-adjusted to contemporary industrial/technological requirements — let alone those of emerging types of employment; and (b) the international collapse of trade and the re-location of manufacturing industries (within countries, as well as internationally) left many school leavers with little prospect of employment locally or in the types of occupation which they had quasi-automatically assumed would be theirs. In one country after another, and in international agencies such as OECD, the European Communities and the Council of Europe, a large volume of reports appeared on the problems of 'transition'. Many of these were primarily concerned with the problem of growing unemployment, which increased rapidly among all age-groups in industrial countries after 1973 - but most especially among young adults under 25, and above all among people between the ages of about 15 and 20. Young adults in the 15-25 age-group make up some 40% of all the unemployed in industrialised countries, while those under the age of 20 are three times more likely to be unemployed than the 20-25s. Furthermore, the average length of employment (if obtained) is about six months on average in industrialised countries, alternating with unemployment of similar duration, itself very often followed by a changed type of occupation. In low-income countries the employment prospects of school leavers and higher education graduates are even more precarious. Thus, the 'transition from school to work' is extremely uncertain.

Faced with growing unemployment among young adults, many countries have initiated 'youth training programmes' which in many instances are little more than palliatives for unemployment statistics. Sometimes they are well-intended, of course, but in the present state of the job-market Britain's present figure of about half of the trainees finding jobs eventually is about average. Many, however, do not find the jobs for which they have been trained under emergency schemes; and throughout the world at present the jobs which young adults find are being gradually depressed in status and pay because of the glut of young 'employables' — and also because really worth-while jobs now
depend on more advanced and different training. Unemployment is therefore being caused or aggravated by two factors: structural change (including the re-location of industries, take-overs, obsolescence, and being superseded by new industries); and changes of character because the different work being done requires different competences and therefore different forms of schooling. Linked with the latter requirement is the need for constant updating, with adaptability to readjust oneself and one's skills. That all means in-service re-education; and for that, in turn, a different kind of preparation is required during earlier school years.

It is customary among professional educators to focus attention almost exclusively on schools or college of one type or another, and to think of 'youth' or 'young people' as people distinct from ordinary adults. On both these counts they are out of touch with the times. In the first place, many adults whose schooling was foreshortened or inappropriate now need (and wish) to return to education or training at 'young adult' or immediately post-compulsory levels after varying lengths of time away from formal schooling. Among these 'returners' are many whose former employment has been wiped out by take-overs or plain obsolescence; there are also many women who now seek employment and therefore training because their families have grown up and left home, or because their marriages have broken up; and, of course, there are many who need to 'top up' or 'make a fresh start' either because of personal ambition or because they simply must retrain to meet the requirements and opportunities of new technologies.

Therefore the whole field of 'post-compulsory education' - which was a new term (or at least a term with new significance which needed explanation) (7) when my colleagues and I focussed attention on it in 1970-1973 - now appears as a modern theatre of new-style experiments in education at a characteristic level for any adults beyond the level of basic schooling, but before full specialisation for a detailed graduation course or a defined career. One might loosely refer to it as a span of learning and/or training 'from 16 to diploma level'; but in today's and tomorrow's circumstances it is important to recognise that the age of participation matters for less than the level of need served. 'Returners' and those who wish to 'round out' their personal profiles of learning and competence were also served. Indeed, already more than one-fifth of those enrolled in Swedish '16 to 19' provision have been out at work and come back in. Technological/occupational change, changes of mind, and the ever-obvious need to prepare for uncertainty ahead seem to establish 'post-compulsory education' in a central position when plans are laid for future provision.
Already existing structural innovations (such as new-style lycées, the Kolleg in some parts of the Federal Republic of Germany, Norway's gymnas (§), and the 'tertiary colleges' and 'sixth form colleges' in Britain) call for careful consideration, for several reasons: (a) they are separate from ordinary school at a time when new laws, advertisers, and self-awareness have all helped to bring fuller recognition to the over-16s as really young adults, and (by being evidently concerned with educational and personal provision for sexually and socially mature people rather than for 'conditionally relevant' trainees) they have developed a new ethos and appropriate teaching/learning relationships; (b) their increasingly comprehensive character makes it possible to combine different subjects, different levels of study, and different career prospects in ways which were previously impossible; (c) their links (structural or personal) with work experience outside add a new dimension of relevance and experiment; (d) provision is often made for 'returners' to resume study at this level - no matter what their age. The last feature is particularly noticeable if the 'community college' aspect is developed by evening provision, or by deliberate fostering in other ways.

If, then, we recognize that post-compulsory education is really the first phase of adult or lifelong education, that it often implies a 'fresh start', that it always entails fresh teaching/learning relationships, we see that it is pivotal in two ways: it turns our attention positively to the long vista of recurrent education of every kind, with multi-media support in a great variety of learning contexts; it also points to the futility of trying to pack a portmanteau of knowledge and skills for life during the basic years of school. Instead, basic preparation must be given for continuous learning, continual reappraisal, and continuous participation in the responsible process of adding to knowledge and judgment instead of merely receiving what is handed out.

Especially (but not only) in this connection, it is important to consider the extent to which 'noneducation' agencies participate in recurrent training/retraining. Many of the initiatives of 'youth training schemes' already mentioned have brought Ministries of Industry or Employment (rather than Education) into large-scale and potent intervention in the 'Education' field - and not only for those beyond compulsory school attendance. In fact, some dissatisfaction with the prevalence of 'academic' or 'bookish' programmes in upper-secondary classes has caused many teachers as well as pupils to welcome more work-related studies and 'real life' presentation into the schools of many countries, particularly for the over-16s. However that may be, there are many implications for varied and long-term experiments in the follow-on from compulsory schooling. Different styles of teaching/learning, with input from the media and computer-assisted delivery in
particular, combined with new ideas about the best ways of providing for adult and recurrent education as and when needed (in alternative locations and with 'intermittent' or discontinuous timing) now call into question the 'school-type' norms for any educational communication to young adults - and, of course, older adults. Whereas earlier studies of the educational needs of 'youth' seemed to focus on a supposedly transitional stage, or on 'young people' who did not quite fit existing scholastic and social expectations, it is now clear that 'young adults' represent the normal if not normative educational situation of the majority of mankind. In the past, most educational prescriptions concentrated heavily on the supposedly innate abilities and permanent competences of the minority; but we are now in a situation where the average young adult is in full-time post-compulsory education and/or training in industrialized countries. Nowadays, even specific training must take on a 'provisional' character because of inevitable technological changes. It requires a more educative element than previously so as to facilitate adaptation to change. Many of our plans for the future (which must take account of the fact that the newly industrialising countries may be starting now in closer consonance with the requirements of rapid technological and social change than the existing proto-technology of education has ever envisaged) will therefore benefit if we learn from the perceptions and experience of young adults who are on the very frontiers of a 'third technological/educational era' (9).

Space does not allow detailed examination of some outstanding changes in today's technological/occupational reorientation; but the crudest and most important indication is plain. As long ago as 1926 A.N. Whitehead in Science and the modern world said: 'The fixed person for fixed duties, who in older societies was such a godsend, in the future will be a public danger'. Quite apart from the 'half-life' and obsolescence of already acquired professional expertise already referred to, we now have to remember that there are many people among and around us who have the potential for the new roles and new sciences or technologies which the future will demand, but who so far are retained by present technology in a state of latency or incompleteness. Why should technicians not aspire to become top scientists or technologists? Why should nurses and paramedical personnel not proceed further? Why should those with social and human skills urgently needed not be enabled to enrich them with supportive studies - and not only in Open Universities or open colleges but by a multi-media array of opportunities? The technological network of opportunities in a 'communications society' - and the demands of the occupational revolution going on under our eyes - make such reconsiderations essential.
For similar reasons existing courses for higher education and training are now 'modular' and open for access according to personal readiness, although most established systems of professional qualification and most university systems continue to resist the obvious implications. We should be prepared in many walks of life to accept the idea of 'two-tier' or 'multiple-stage' qualifications - both to suit personal states of readiness or convenience, and also to serve technological/occupational requirements as they emerge. Whereas in the past the 'continuous' and sequential model of learning had prevailed (often simply as a means of excluding large numbers of aspirants from jealously guarded professions and institutions by eliminatory examinations) tomorrow's occupational patterns will require successive recruitment, multi-level entry, and recurrent education for all. Education for uncertainty (10), or for a continually moving frontier relationship with learning, is already becoming characteristic of a 'communications society' in which all learn and all teach in some measure all the time. Our youngest children will inherit such a world. Young adults are already on its doorstep. Some are already undergoing new kinds of education or training adjusted to it. In any case, questions of education and recurrent education for technological and occupational change - and the social implications of these things - are central to realistic policy-making for education everywhere.

Notes

1. Education for Uncertainty: an inaugural lecture in the Faculty of Education at the University of London, King's College, 1976, p.11.
2. OECD Observer, No.131, November 1984, p.3.
5. See E.J. King, Comparative Studies and Educational Decision, 1968, especially chapter one, 'Is there a science of educational prediction?'.
9. The "Third technological/educational phase" is explained and analysed in my Other schools and ours, 5th edition, 1979, pp. 42 and following.
10. See the publications referred to in notes 1 and 4, above.