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# History of Technology: An Area of Growth in Design Education

Not even the greatest educational sceptic can deny the remarkable growth, in the last decade, of that curious phenomenon the Industrial Museum; curious because not so long ago the very idea was a joke in itself:

'Blank & Co. have gone bankrupt – not surprising, their factory was like a museum ... no wonder production costs were high, the machinery should have been in a museum ...' and so on. Only 20 years back – not long, but outside the lifetime of most of our students – your author was responsible for the design, operation, and maintenance, of a computer installation using thousands of electronic valves, transistors being still a new and unreliable invention; this is already technological history, along with clockwork gramophones and biplanes, and illustrates how all of us already have valid experience in this new field of study.

But what has history to do with today's (or tomorrow's) technologists? Possibly not much, but technologists are only a minor fraction of the nation's population; the majority being subject to the products, successes, failures, and mistakes, of professional technologists; and to the enjoyments, frustrations, and fears of technological society. There is no escape from technological society, in fact attempted escape is practically a punishable offence; but technological society does offer wonderful scope for cultural fulfilment and satisfaction *if the nature of technology is clearly understood.*

Technology appreciation, then, is a matter of some urgency for the majority who will not get a full-scale technological education, as well as being an essential foundation for those who will; for without a clearly understood perspective of the way technology has evolved to its present degree of social importance, the practising technologist may not be adequately equipped to exercise the responsibility to society placed (*by* society, through acceptance or default) in his hands: whilst to the non-technical adult, ignorance of the disciplines and processes of technology, or of the actual consequences of past technological successes and failures, is liable in the future to intensify fears and prejudices towards potentially good technology as much as is indifference, apathy, and passive acceptance of bad and inefficient design. With these factors in mind, technology appreciation might be defined as understanding the evolution and achievements, the disciplines and processes of technologists, without necessarily being a skilled practitioner oneself; with emphasis on what technologists do and have done, since technology itself can be defined as *designing things for the benefit of people* – a process that can only exist in the minds of real people.

Various educational routes to the goal of technology appreciation have been tried: science teaching is not in itself the direct road, although Physics possibly comes nearest, and in this context both the Institute of Physics (1974) and the Association for Science Education have published a statement emphasising the value of 'interdisciplinary approaches to the appreciation of technology . . . through science, or through mathematics, or design, or craftwork, or history, or geography, or any other subjects.[1] The fact is that, although scientific method has some elements in common with the process of design technology, science is essentially analytical whilst technology is concerned with synthesis and innovation; nature as it stands has plenty for the scientific mind to analyse, but, historically, new technologies have depended little on pre-existing science – there has to be a technology before science can begin to analyse it. Then, of course, comes the process of applying scientific analysis to the refinement and ultimate full exploitation of the pre-existing technology: there could not have been a science of thermodynamics without working steam-engines to analyse, nor any theoretical aerodynamics without flying machines to apply it to and experiment with. A further snag about science teaching is that the pupils most in need of qualitative technology appreciation are those least able to cope with the quantitive disciplines of theoretical or practical sciences.

Craft and design teaching is a well-explored route towards technology education, offering experience of innovative design and the acquisition of some basic craft skills; but one should ask if these experiences are perceived by pupils in the context of any historical continuum of technological design and progress, and whether the pupils are necessarily aware of their own drawing upon, or contribution to, technology as a progressively evolving creative process.

Awareness and appreciation of this continuing evolutionary process can only be gained by experience and study of the process itself and of the artefacts it has created, in a historical context. Sadly, though, we find that few historians have the necessary technical knowledge or experience to relate the great achievements of technologists to the social, economic, or political history of the appropriate period; conversely, equally few teachers of craft and design have enough training in academic history to be credibly equipped for offering the practical enrichment that examination-orientated history courses so often need. Hence the history-of-technology teacher is still a new animal, but a growing number of examination syllabuses compete for his attentions.

Price (1968) pointed out that a survey of 10,000 pupils under 16 put history high on the list of 'useless and boring subjects'[2], but that was before the period of major growth in industrial museums and when industrial archaeology was still a fresh concept, although Rix (1967), the originator of the term, was already able to say that 'the beauty of industrial archaeology is that it can be practised anywhere ... in rural areas as well as towns ... here is a subject that is acceptable to the economic historian ... the human geographer ... the liberal studies class ... a subject that can be studied at any level from a part-time hobby to a PhD thesis'.[3] Also Smith (1965) correctly emphasised that industrial archaeology, and hence history of technology 'is ultimately concerned with people rather than things ... machines are of interest only as physical expressions of human behaviour'.[4]

As for the introduction of history of technology into history syllabuses, Holley (1974) finds that, in terms of history teachers' perceptions of relative importance of possible teaching topics, history of technology ranks 12th of 13 items ranging from *political and constitutional history* to *archaeology.*[5] This is hard to correlate with the way that *history of ideas* ranks fifth in time actually spent by teachers in class and fourth in the teachers' ideal syllabus, for history of technology is largely a history of ideas – such as the concept of atmospheric pressure (the basis of the steam engine) or the idea of time in a 24-hour mechanical clock (as opposed to the more primitive notion of a variable 12-hour day plus a corresponding 12-hour night throughout the year). The dismissal of history of technology to minority time (tending to zero), whilst giving high priority to history of ideas, implies that most history teachers have themselves received no teaching in the ideas and methods of technology, even in a historical narrative; and the fact that history teachers' perceptions of their own experience shows that only a minority believe their academic qualifications to be a constraint on teaching, confirms that few have any clear concept of the thought-processes in technological innovation through the period of historical time.

Having mentioned examination syllabuses, let us now examine a few recently published syllabuses and revisions which incorporate distinctive trends towards the introduction or extension of studies in history of technology or technology appreciation.

The Schools Council History 13-16 project has resulted in an Alternative-Ordinary syllabus in History administered by the Southern Universities Joint Board (first examined in 1976), and a teachers text *History Around Us* (Schools Council Publications, 1976). Both text and examination emphasise the importance to national culture of buildings and town plans, and of the industrial methods that influenced building design, town development, manufacturing processes, and rural landscape, at all periods in history. Projects and course-work account for 40 per cent of the examination marks, and there is clearly broad scope for the practically-minded pupil to make a serious study of local crafts and industries, leading to a GCE qualification equivalent in value to that gained from book-learning in a more traditional history course. In addition, such a pupil should gain insight into the processes of technology by the study of *simple* technologies as practised in his locality, particularly if the history teaching is co-ordinated with the learning of craft and technical skills.

The Joint Matriculation Board's Alternative-Ordinary syllabus in *Local History* has its first examination in 1979. Again, the syllabus includes industrial archaeology, building design, and rural landscape patterns, and a project in one of these areas accounts for 50 per cent of the examination marks. The JMB has also introduced (for examination from 1980) an Alternative-Ordinary Syllabus in *Art and Environment* that includes some detailed study of building materials and the evolution of construction methods, and of the historical development of industrial design including mass-production processes and products.

At GCE Advanced level, a recent publication is the Associated Examining Board's new syllabus in *General Studies*, whose core material includes the study of 'man's growing awareness and mastery of earth, sea, and space, as scientist and engineer ... (the) technology of substitutes for natural materials (and) exploitation of energy sources'. The first examination is in 1979 and, evidently, questions on early industry, engines and ships, and on the engineers associated with important innovations, may be expected in subsequent years. A discussion paper on technology appreciation in General Studies has been published by the Standing Conference on Schools Science and Technology (SCSST, 1974) and much of current thinking on the value of history of technology in the General Studies curriculum springs from that paper[6] and from earlier publications by Schools Council Project

Technology, such as the paper by Coggin (1969), who argued (quoting the Dainton Report of 1968) that 'for many young people, science, engineering, and technology, seen out of touch with human and social affairs: yet opting out leaves the field open to those one-sided technologists who are so immersed in their particular field that they are blind to all the implications that are not their immediate concern'.[7]

Areas such as History and General Studies have traditionally been linked with the Arts more than with the Sciences, but here is evidence that teachers in the non-technical sphere are realising the need for some appreciation of the nature and evolution of technology as a social process inseparable from the political and economic progress of nations and communities: in fact there is a growing awareness that history of technology is an essential element in general education at all levels.

Further 'A' level syllabuses in the Craft and Design area, that require substantial studies on the history of technology, include the AEB *Craftwork* (both wood and metal) syllabuses, the JMB *Craft, Design and Practice,* London *Design and Technology;* in each case the syllabus committee has recognised the need for serious, if restricted, historical study of technological evolution and its social implications.

A striking confirmation of the trend may be found in the syllabus recommendations (DES, 1972) for the Ordinary National Diploma in Technology, a 2-year full-time course in Further Education Colleges. Of the 2100 hours recommended for the course, 170 hours (or 8 per cent) is allocated to *Complementary Studies*, about half of this component (including a second-year project) being studies in the historical development and social consequences of technology and industry.[8] Since the OND syllabus is roughly equivalent to 4 'A' level subjects, Complementary Studies may be regarded as about equal (in time allocation) to one-third of an 'A' level course.

The urgency, for engineering students, of education in the social values of good and bad technology, was recognised before the current expansion in history of technology; Moon (1970), in a study for the Engineering Industry Training Board, found that 'the effects on society of the design or operation of equipment and of the effects on posterity do not form a special part of the engineer's moral outlook or of his accepted responsibilities'. Responses to a questionnaire sent to a 2 per cent sample of chartered Engineers also revealed that '40 per cent of respondents did not have a personal philosophy of engineering. The majority had not been motivated by education to consider the social and moral problems of engineering' and that engineers had 'little thought as to whether a thing is worth doing'.[9] As Mayall (1970) has pointed out, 'the 19th century engineer had no doubts about his intentions in designing products. Thomas Tredgold gave him all the Hippocratic objectives he needed in the words "to direct the great sources of power in nature to the use and convenience of man".'[10] This, of course, is the objective of engineering as defined by the Institution of Civil Engineers soon after its foundation by Thomas Telford's young designers, and its implications and consequences may equally be appreciated and interpreted in the works of Brindley, Smeaton, Rennie, the Stephensons, and the Brunels, to name only a few.

Complementary Studies, in Further Education Colleges, will normally be tackled by the Liberal Studies department; in schools, we may expect History syllabuses to be taught in the History department, and General Studies by a variety of teachers from several disciplines. No single group of teachers has the monopoly in History of Technology: any teacher of Arts, Sciences, or Technical Studies, who has the initial interest and motivation, can learn the subject and teach it from the standpoint of his own discipline. The Open University course *Technology for Teachers* (1976) neatly summarises the opportunities for history of technology in its Unit 14: 'There are four ways in which technology can be included in the school curriculum.

1. It can be taught as a single subject
2. It can be used as a unifying influence across several existing subjects
3. It can be included in a general studies programme
4. It can be used as enrichment material in one or more existing subjects'[11].

This paper attempts to show that history of technology as a legitimate field of study can contribute to majority education in all four of the ways proposed above; for minority interest, technology can also be extended into craft-based, science-based, and art-based, specialist syllabuses.

The advantage of a history-of-technology approach is that early technology – its methods and products, its structures and mechanisms – is simple and directly comprehensible, and serves as a fascinating and stimulating introduction (for those who wish to learn more) to the more complicated and less obvious processes and mechanisms in present-day machines that sometimes frighten even those of us trained in the business.

It is significant that, in the Postgraduate Certificate in Education course at Keele University, History of Technology is chosen annually by approximately 20 per cent of the students in direct competition with ten other options; and in the post-experience course leading to the Diploma for Advanced Studies in Education (DASE) with special reference to General Studies, nearly half the students have chosen History of Technology in preference to three other option courses. History undergraduates at Keele, who are also following the concurrent Certificate in Education course, spend a generous proportion of their time in the Education Department on history of technology and on teaching methods and resources in this field; and higher-degree students in the Department have worked with the education and interpretation branches of industrial museums as well as doing original research in history of technology. Students in all the above courses have produced teaching resource-material for publication (reference 12), some of which has stimulated practising teachers to attend further short courses on the subject held in the University.

Sales of the Keele teaching units in history of technology[12], together with the flood of books and pamphlets on industrial archaeology and local industries, published or reprinted from historic originals since 1970, demonstrate the intensity of interest in history of technology. Both the volume of scholarly research and the publication of examination syllabuses have made history of technology a respectable field of study at any level; there is ample evidence of interest and motivation amongst both pupils and teachers, and it is suggested that, for the majority of pupils, studies in this field might pave the route either to a career in some socially beneficial technology or to a conscientious understanding of the methods and products of professional technologists.

Further papers in this journal will outline the aims, objectives, and content, of courses in history of technology in the Keele Department of Education; and will review the use of resources for learning history of technology in a local-studies context – including the efficient educational use of industrial museums.


**References**

1. Institute of Physics – School Science and Technology – Physics Education, Vol. 9, No. 1 (1974) pages 3-4.
2. Price, M. – History in Danger – History, Vol. 53, No. 179 (1968) page 342.
3. Rix, M. – Industrial Archaeology – Historical Association (1967) page 19.
4. Smith, D. – Industrial Archaeology of the East Midlands – David and Charles (1965) page 191.
5. Holley, B.J. – 'A' level Syllabus studies: History and Physics – Schools Council (1974) tables 2.2, 2.4, 5.3.
6. Standing Conference on Schools Science and Technology – School Technology Forum Report No. 5 (1974).
7. Coggin, P. – Education Technology and Society – Project Technology Bulletin 7 (1969), reprinted in: School Technology Vol. 2 – English Universities Press (1971).
8. Department of Education and Science – Notes for Guidance: OND in Technology (Engineering) 1972.
9. Moon, J.A. – Social Values and the Engineer – Further Education, Vol. 2, No. 1 (1970) page 19.
10. Mayall, W.H. – Engineering and Industrial Design – The Engineering Designer (October 1970) page 9.
11. Open University – Technology for Teachers: a post-experience and second-level course (PET. 271) Unit 14 (1976) pages 11-14.
12. Keele University, Institute and Department of Education teaching units:
1. Thomas Telford
2. Children in Industry
3. The Darbys and the Coalbrookdale Company
4. (In preparation) James Brindley.


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