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MINUTES OF THE STRATEGY GROUP

SIXTEENTH MEETING: MONDAY 2nd MARCH 1987

Present: Prime Minister (in the Chair)
Foreign Secretary
Home Secretary
Chancellor of the Exchequer
Party Chairman
Chief Whip

Present by invitation: Secretary of State for Employment
Secretary of State for Education

Also present: Professor Griffiths
Mr Alison
Mr Sherbourne
Mr Harris (secretary)

Apologies: Lord President

Action

1. Forthcoming Events

The Strategy Group considered the handling of forthcoming events and announcements. The issues of arms control, charging for dairy inspections and prescription charges were discussed. The Secretary of State for Education described his proposals to publicise his decisions on Teachers' Pay. The Home Secretary would also make a statement on the Tamils and other 'refugees'. The Secretary of State for Employment would make a statement on unemployment regulations and the Community Programme.

KB The Secretary of State for Education said that he would send a note to the Prime Minister on Student Loans and the line to take on the issue.

The Strategy Group also discussed the membership of the Conservative Party's 'One Nation Forum'.

2. Education

KB The Secretary of State for Education had received a report on the state of school buildings: he would send a note to the Prime Minister about it.

The Secretary of State for Education introduced his paper.

The Strategy Group agreed that the establishment of a national curriculum also required the establishment of a national syllabus. Although it was recognised that there were particular problems with the teaching of History, and although it was necessary to encourage

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Action

in schools respect for the law and for other people, the priority areas for action should be Mathematics, the English Language and General Science. It was agreed that the mechanism for establishing the syllabus must be acceptable and that it should not just depend upon the Secretary of State himself: a dozen of the best Head Teachers might be asked to construct the required syllabus in these subjects. It was also agreed that there must be some results evident in Mathematics and English before the General Election.

KB

The Prime Minister asked the Secretary of State to send her the results of the progress so far made in establishing a syllabus in Mathematics and English.

KB

The Secretary of State for Education said that it was necessary to build upon the 1986 Education Act so as to increase the influence of Head Teachers and parents on Governing Bodies. It was argued that the school Governing Bodies should contain more businessmen: it was noted that some Governing Bodies in some areas would be open to political manipulation. Further consideration was required to establish the contents of the budget for schools, control over which would be delegated to the Head Teacher and Governing Body.

The Secretary of State for Education said that more training for Heads and Governors should be provided. The Foreign Secretary said that, as with the establishment of a national curriculum, it was important to have some examples before the General Election of Governors successfully managing budgets within a framework of proper accounting.

The Strategy Group considered the other proposals in the Secretary of State for Education's paper. The Strategy Group endorsed the Secretary of State's proposals on open enrolment, CTCs, the option of direct funding for schools and the planned expansion to 35,000 by 1989 of the Assisted Places Scheme.

On Higher Education, the Prime Minister and the Secretary of State for Education accepted the need to increase the age participation rate (APR). The Strategy Group also agreed in principle with the Secretary of State for Education's proposals on Polytechnics, the replacement of the UGC and the move to contracts (as a method of funding Polytechnics). It would not be necessary to mention Student Loans in the Manifesto. The Secretary of State for Education stressed that the option being considered by Mr Walden's Committee was for 'top-up' loans, not loans as a replacement for Grants. It was agreed that the expansion of Government funding of scientific research - as opposed to the enhancement of its quality and the use made of it - was not a necessary objective in Higher Education.

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Action

Further consideration would need to be given to the Secretary of State for Education's proposals on Training.

3. Next Meeting

The next Meeting of the Strategy Group will take place on Monday 9th March. Papers from Mr Ridley and Mr Jopling on Farming and the Countryside will be discussed. They and the Chief Secretary to the Treasury will attend.

RH/CR
3.3.87

SIXTEENTH MEETING OF THE STRATEGY GROUP ON MONDAY, 2nd MARCH 1987 at 12 NOON

A G E N D A

1. Forward looking diary for the next two weeks (paper circulated at meeting)

2. Discussion on Education. Paper from Kenneth Baker already circulated to Strategy Group members

Conservative Research Department

32 Smith Square Westminster SW1P 3HH Telephone 01-222 9511

Director: ROBIN HARRIS

Copy Number 1.

PERSONAL & CONFIDENTIAL

PRIME MINISTER

MR BAKER'S PAPER

... I attach a paper by Mr Kenneth Baker for discussion at the next Meeting of the Strategy Group on Monday 2nd March. Copies go to the Members of the Strategy Group and Lord Young.

RH

ROBIN HARRIS

RH/CR
27.2.87

CONFIDENTIAL

Copy Number 1 ...

EDUCATION POLICY

PAPER FOR PRIME MINISTER'S STRATEGY GROUP MEETING, MONDAY 2 MARCH 1987

We will undertake a major series of reforms to improve the educational system of our country. The aim will be to improve the quality of education in all our schools by raising standards.

We will:

- establish a national curriculum. This will lay down the basic subjects which must be taken up to age 16. It will also lay down clear and specific targets of attainment for certain ages. These targets will differ for children of varying ability. It is important to establish this through discussion and consultation with all the parties involved in education - parents, teacher, LEAs and employers.

- build upon our Education Act 1986 to increase the influence of Headteachers and parents on governing bodies. Over the course of a Parliament we want to see the budget for all secondary schools and larger primaries delegated to the Headteacher and the governing body. This will give the school a decisive say in how its resources are spent.

- provide more training for Heads in general and financial management. Schools with delegated budgets will need bursars. We will extend the existing courses for governors to prepare for the election of parent governors in 1988. Through improved teacher training we want to enhance the professional standing of teachers.

- build upon our success in getting computers into schools to improve technological education by spending £900 million over the next 10 years on the latest equipment through the TVEI scheme. The children of today must acquire the skills of tomorrow.

We want to extend the area of parent choice. Since 1980 parents have had a much wider choice particularly at the crucial change to secondary school. We want to extend this in four ways:

1. Move to a system of open enrolment where schools will be required to take in pupils much closer to the school's physical capacity.

2. Establish a pilot network of 20 CTCs providing free education for children living in our towns and cities.

3. Establish a scheme whereby governing bodies with parental support can apply to the Department of Education and Science for direct funding for their schools so that they can remain in the state maintained sector but be independent of the local authority. This will extend the choice of parents, particularly in the towns and cities, in a significant way.

4. Expand the Assisted Places Scheme from its present level of 25,000+ to 35,000+ by 1989. This scheme helps children from poorer homes have acces to independent schools.

HIGHER EDUCATION

Our objectives in this area are to:

1. Increase the age participation rate.
2. Transfer polytechnics out of local education authorities.
3. Replace the University Grants Committee.
4. Reform the student support system.
5. Move to contracts.
6. Expand scientific research.

TRAINING

The training functions of the MSC should be combined with the DES to provide a clearer path for young people post-16 to benefit from the wide range of training and educational courses which are available.

We want to expand the PICKUP scheme for adult training. Currently 400,000 people in work take these courses to update their skills.

KB
Department of Education and Science

27 February 1987

PRIME MINISTER

27 February 1987

Education and the Manifesto

> "We decided at the very outset to make reform as comprehensive as possible and if there were any nettles, to get a good bunch of them in our arms and not be stung by a little one. That policy has proved extremely successful ... because the more nettles you collect the more they sting one another and the less they sting you"
>
> (R A Butler soon after the 1944 Education Act)

We need to consider schools, polytechnics and colleges, universities, the science budget, 16-19 NAFE and management education.

Schools

This is the most important item on education for the Manifesto. The major concerns of the electorate are low academic standards, a lack of discipline within schools and a fear that schools fail to prepare young people with relevant skills for today's world.

Our policy consists of three key parts:

(a) delegating financial responsibility to school level and giving greater freedom to heads;

(b) increasing parental choice, and

(c) introducing national core syllabuses for all subjects, with specified attainment levels and a national system of exams.

You need to press Kenneth Baker however on two key points:

(i) the need for LEAs to be given less discretion over the funding schools, so that money follows the child automatically;

(ii) the need to establish a national core curriculum made up of:-

- specific core syllabuses drawn up by subject specialists
- attainment levels at the ages of 7,11,13,16
- a national system of examinations (not projects) to test knowledge
- publication of the results of tests
- a role for HMI concerned with diagnosing the failure of schools to meet standards

Polytechnics

The White Paper should be published in April and will establish polys as independent national institutions in their own right. This must win approval. Details must be worked out but there is little in the way of initiatives which we need to take.

Universities

This is a far more difficult problem. There are some hopeful signs:

- the cuts of the early 80s have proved a great stimulus to enterprise and efficiency,

- the UGC in 1985-6 did a thorough job of evaluating the quality by research of each department in all four universities and allocating funds accordingly,

- the recent pay proposal, which introduces far more flexibility for university staff, is a move in the right direction,

You must press Kenneth Baker however on the following:-

- the need to introduce student loans (introduced over a period of time)

- abolition of tenure: this must go and he should insist that no new tenures are created,

- student entitlement (vouchers),

He keeps claiming that many Vice-Chancellors now support him. But it is time that he really launched them in public to support him in **specific** ventures.

Science Budget

The only way this can be tackled is by handing out more cash - but this raises fundamental issues regarding the benefits of this kind of search, about which great doubt remains.

16-19 Nafe

This is an area in which we clearly lag behind France, Germany and Japan: documented evidence has been provided by S J Prais of the National Institute. Our attainments, especially in maths, are lower than our competitors and students in France, Germany and Japan stay on much longer than students in this country. I enclose the most recent article comparing England and Japan (but others which could have been included are a comparison with both France and Germany) - please see pages 40-41 and 51-52.

The recommendations for improvements in this country are interesting. They are:

a. the need to develop a much more rigorous set of core syllabuses in the years 6-14 and

b. an appeal to the home (as has recently been carried out in the US) so that parents take greater interest in their childrens' progress.

You might ask Kenneth Baker how he intends to move forward in this area and whether anything should be mentioned in the Manifesto .

Management education

This matter has been placed on the agenda by:

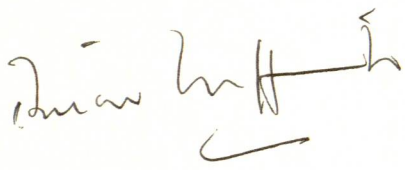
a. The cuts in the budget of London and Manchester Business Schools - our two oldest and most prestigious institutions.

b. A report to be published next month by Charles Hardy (and sponsored by NEDDY, BIM and MSC) which

will argue in favour of a major boost to management education and training at all levels.

David Young has talked of breaking up the MSC and setting up a National Training Agency which tackles this problem.

You might ask Kenneth Baker whether he has ideas in this area.



BRIAN GRIFFITHS

EDUCATING FOR PRODUCTIVITY: COMPARISONS OF JAPANESE AND ENGLISH SCHOOLING AND VOCATIONAL PREPARATION

by S. J. PRAIS

The high technical quality and reliability of Japanese manufactures raises questions of how the training and education of their workforce differs from Britain's. The standards reached by Japanese 15–18 year-olds in their technical and vocational secondary schools—and the number of pupils reaching them—are described in this paper and compared with Britain, as well as the standards reached in mathematics during compulsory schooling till 15. This article follows earlier studies of German and French schooling and vocational preparation (see this Review, August 1983, February and May 1985, and May 1986).

Japan ... can hardly fail to become a teacher ere long.
Alfred Marshall, *Industry and Trade*, 1923.

I. INTRODUCTION

This article examines certain important differences between the ways youngsters are prepared by schooling and training for the world of modern-day work in Japan and in England. Much has been written on the breathtaking pace of Japanese economic progress,[1] and it is thus sufficient here to recall no more than a few summary indicators: the Japanese level of real income per head, which was only about a quarter of that in Britain before the war, overtook Britain in about 1970, and is now about a quarter *higher*;[2] output per employee in Japanese manufacturing industry rose in the 20 years to 1985 by a factor of over four (a cumulative increase of 8 per cent a year), compared with a 60 per cent rise in the UK in that period (2 per cent a year); and there is the astonishing Japanese leadership in world-wide exports of many complex manufactures, especially in cars and sophisticated consumer electronic products.

Much has also been written on the importance attached to education in Japan, where over 95 per cent now stay on in full-time schooling until the age of 18—in contrast to the 32 per cent of the 16–18 year-olds in England in full-time schooling.[3] Yet there remains a need to examine closely how attainments in schooling and the vocational preparation of their workforce compares with this country—particularly in relation to the *average* member of the workforce, rather than the university-trained elite. That is the focus of the present article: the reasons for adopting it are, in brief, fourfold.

First, the progressive introduction of automation in factory and office work in the past two decades has led to a continuing reduction in the demand for unskilled labour accompanied, in industrialised countries such as Britain, by heavy unemployment among the young unskilled; it has added urgency to the raising of educational standards—not just of the few who plan and control production—but more particularly of those involved at the simpler stages of production which are being transferred to automated machinery.

Secondly, our previous comparisons between England and Germany drew attention to a continuing German advantage in preparing the average and below-average pupil for the world of technical work: English education rightly prides itself on the quality of its cream, but German pupils of average and below-average ability when finishing compulsory schooling are—broadly speaking—ahead of their English counterparts in mathematical attainments by the equivalent of a year or two, and have received more intensive pre-vocational preparation. The present article asks whether broadly similar inferences are to be drawn from comparisons between England and Japan.

A third reason for concentrating here on the attainments of the broad cross-section of the workforce is that the differences between Japan and Britain at the top level—those going on to university and other forms of higher education—are not quite as great as sometimes suggested, though a little more complex. In Japan it appears that as many as 36 per cent of the relevant age-group entered universities and other forms of full-time higher education in 1984, compared with 14 per cent in higher education in the UK. But those 'other forms' of higher education in Japan included Junior Colleges and courses which in Britain are undertaken to a large extent under the auspices of professional organisations on a part-time basis. By adopting a broader definition for the UK, and by including part-time professional courses, a total of 31 per cent entering higher education in the UK in 1981–2 was estimated by the Department of Education and Science.[4] Further, while Japan

produces just over twice as many graduated engineers per member of the workforce as Britain, their quality is not quite as high.[5]

Finally, our discussions with Japanese-owned manufacturing plants in Britain have confirmed the need in Britain to increase and improve education and training particularly at *intermediate* vocational levels. In one firm we were shown advanced automatic machines, made in Japan, producing at only 60 per cent of the rate of the same automatic machines in Japan. The problem lay in technical maintenance. There were adequate local supplies of unskilled labour available to the British subsidiary plant, fully as capable of carrying out their tasks as their counterparts in Japan;[6] and there were adequate numbers of engineers of the highest quality; but the shortage lay at the intermediate level—those who were technically trained and willing to carry out routine operating procedures, able to notice in advance when anything might cause trouble, and capable of routine maintenance of their complex machines.

Thus our concern in this article is—not with what is achieved at the best Japanese educational institutions, nor at the training establishments of a few of the largest and most notable Japanese firms who recruit the best graduates—but with the attainments of the typical pupil, who goes on to become a typical member of the workforce. In order to keep within manageable limits a topic having the widest cultural ramifications, we concentrate—as in our previous comparisons with Germany—on:

(a) mathematical attainments at school—since basic mathematical competence provides the foundation required both for the application of modern technology, and for much commercial and office work; and
(b) vocational preparation provided at school, especially for those who—broadly speaking—are in the central or lower half of the ability-range.

II. MATHEMATICAL ATTAINMENTS AT SCHOOL

We begin our assessment of Japanese schooling attainments by re-examining an international study which administered the same agreed sets of mathematical questions to representative samples of 13-year-old pupils in Japan and England. This is followed by a comparison of school-leaving examinations in the two countries, which casts light on differences in curricula. Both these sources point to an extraordinary success by Japanese schools: we therefore next devote some attention to teaching methods and organisation.

The IEA comparisons at ages 13–14

Scientifically-organised international comparisons of mathematical attainments of secondary school pupils were carried out in 1981 among some two dozen countries, and in 1964 among a dozen countries, by the International Association for the Evaluation of Educational Achievement (IEA). At both dates Japan appeared well ahead of England (and, indeed, ahead of almost all other countries). Japan was also well ahead of England in tests of school attainments in science carried out by the IEA in 1970. The seriousness of the disparities emerging from these comparisons have been inadequately noticed by economists; the disparities shown by the earlier comparisons continue to be of important practical consequence today, since pupils who were then at school are now in the central ages of the workforce of each country, have affected economic growth so far, and will continue to affect each country's technical efficiency for some years to come.

Provisional findings of the 1981 survey have been published, but for detailed comparisons at present it is necessary to go back to the 1964 tests. These were based on a set of some 70 internationally-agreed mathematical questions which were put to representative samples of 3,200 pupils in England and 2,050 pupils in Japan, with an average age of 13½ in both countries; the English pupils obtained an average correct score of 19.3, and Japanese pupils an average of 31.2.[7] The tests were carried out at that age because it was the oldest age at which virtually all pupils in countries participating in the survey were still at school.

How many years of additional schooling might it have taken to bring the average English pupil to the Japanese level? An approximate answer can be obtained by referring to a parallel sample of pupils, tested in England as part of that study, who were ten months older on average than the sample mentioned above; they obtained an average score of 23.8, that is 4.5 points higher.[8] At that rate of progress, if it could be maintained, it would take English pupils about two years' extra schooling—that is, till they were nearly 16 years old—before they reached the average score of 13½ year-old Japanese pupils.

This is not of course the end of the story since the Japanese pupils will not have stood still in that interval. Any more complex calculation must bring into account that the Japanese start compulsory schooling over a year later than the English;[9] hence, what Japanese pupils learnt of mathematics in their first *seven* years of schooling (between the ages of 6 and 13) would have required nearly *eleven* years in England (between the ages of 5 and 16). In other words, the Japanese seem to learn their mathematics about 50 per cent faster per annum of schooling; by the time they reach the age of 16 it is thus to be expected that they might be even further ahead.

These are no more than hypothetical calculations, intended to yield a more easily understood indication of the order of magnitude of the gap between the two countries. In reality, low-attaining pupils in English Comprehensive Schools have often become so discouraged by the ages of 14–16 that further schooling along existing lines is no longer a realistic way forward.

Another important feature of the success of the Japanese schooling system is the lower disparity among pupils' attainments than under the English system: the coefficients of variation of the scores were 78 per cent in England, 54 per cent in Japan (similar to Germany's 46 per cent). As a consequence there were fewer very low achievers in Japan; for example, only about 8 per cent of Japanese pupils attained scores below those attained by the lowest quarter of English pupils. England had the largest percentage of very low attainers (those with a score of 5 points or less out of a maximum 70) of the ten countries compared in that study.[10] Amongst pupils who did best in those tests (with a score of 61 points or over) England did relatively well, coming second behind Japan (1.4 per cent of pupils in Japan, 0.7 per cent in England). There is thus an apparent greater relative backwardness amongst low-attainers in England—a conclusion also reached in our previous comparisons with Germany.[11]

Information so far available from the IEA mathematical comparisons of 1981 indicates little change in the relative position of Japan and England. Japanese pupils in 1981 attained an average score of 62 per cent correct answers at an average age of 13 years and 4 months, compared with England's average of 47 per cent at an average age of 14 years and 1 month.[12]

Some simple examples from the 1981 comparisons help to convey the nature of the gap between the countries. Adding two simple fractions, $\frac{2}{5} + \frac{3}{8}$, was correctly answered by 89 per cent of Japanese pupils, but by only 42 per cent of English pupils. A simple algebraic question, find x if $5x + 4 = 4x - 31$, was answered correctly by 58 per cent in Japan and 22 per cent in England.[13]

The greater variability of scores in England in 1981 was as evident as in the previous survey; the coefficient of variation was 46 per cent in England, and 28 per cent in Japan. Marks as low as those obtained by the lowest quarter in Britain were obtained by only approximately the lowest 7 per cent in Japan.[14]

The Japanese tested their pupils both towards the beginning and towards the end of their first year in Lower Secondary Schools (in May 1980 and February 1981) on similar questions; at the end of the year, when the main test was carried out, the number of correct answers had risen by a quarter.[15] At that rate of progress it may be inferred—on the same basis as above—that Japanese pupils had attained the average English score when they were just over a year younger, that is, at an age of about 12 years 3 months. The pupils in the English sample were nine months older at the time of their tests than those in Japan, making a total gap of just under two years. In these terms the relative position of the two countries has hardly changed after an interval of 17 years.

Nonetheless, a closer comparison restricted to *questions identical in both the 1964 and 1981* mathematical tests shows a slight advance by Japanese pupils—from 62 to 63 per cent of correct answers; but a fall in the attainments of English pupils—from 50 to 44 per cent of correct answers. England was the *only one of the ten countries* for which these comparisons were possible which showed a fall in average scores in *all* three main components—arithmetic, algebra and geometry.[16] It is possible that the shift in the past 20 years away from traditional mathematics has been greater in England than in Japan and Germany: however that may be, it must be a matter of concern that the overall performance of English pupils is not more distinguished, and that the substantial changes in school curricula in mathematics in England in this period have not borne any obvious fruit when judged by internationally-agreed standards (the reform of the mathematics syllabus is discussed further below).

General examinations at 15–16

To provide a broader perspective it is helpful to compare the public examinations taken at the end of compulsory schooling at ages 15–16 in the two countries. Of course, such examinations differ between the countries, and it is not as straightforward to draw conclusions as from the IEA tests—using identical questions—considered so far. The interest in making these further comparisons is that they cast light on the scope of studies (the breadth of syllabuses) in the two countries, and on the nature of pupils' immediate incentives to succeed; such comparisons can also be more up to date.

The public examinations in Japan corresponding most closely to the English 16+ examinations—the GCE O-level (intended for the top 20–25 per cent of pupils), A/O level (taken by roughly the top 3 per cent of pupils) and CSE (intended for the middle-range of pupils between roughly the 20th and 60th percentiles)—are those taken by Japanese pupils when they transfer from Lower Secondary School (a three-year course for ages 13–15) to Upper Secondary School (a three-year course for ages 16–18). Over 95 per cent of all Japanese pupils now take these

examinations and move on to the Upper Secondary stage of schooling.

Some further details of Japanese schooling arrangements need to be mentioned here to explain the present comparisons. Until the age of 15, schooling in Japan is compulsory and free (private schools up to that age cater for only 3 per cent of pupils). After that age, part of the costs of schooling are met by parents. The proportion paid depends on whether the school is publicly-financed or private; private schools are not entirely private (as that term is understood elsewhere), and receive a government subsidy amounting to about half of teachers' salaries. Costs averaged £700 a year in 1983 in publicly-financed Upper Secondary Schools attended by about two-thirds of all pupils, to £1,500 in private schools (the most expensive private schools charged about double that).[17]

In apparent contrast to Britain, there are no national school-*leaving* examinations in Japan, but there are a variety of *entrance* examinations to Upper Secondary Schools. These examinations serve more or less the same purpose as the English examinations now taken at 16+ (indeed, much of the present English system derives from an earlier broader set of entrance examinations to higher educational institutions). Each of about 50 Japanese Prefectures (comparable to English local education authorities—of which there are about 100) sets examinations for the Prefectural schools in its area, and each private school and the few 'prestige' National schools set their own (the National or 'State' schools are similar, from the point of view of financing, to the earlier English Direct Grant Schools; some of these Japanese National schools are attached to university education departments and are in the nature of 'model' schools).

The Prefectural schools cater for the greatest part of the ability-range, say from the 20th to the 98th percentile, and it was their examinations that were compared in the present exercise. The few National schools, and a few of the private schools (such as our St Paul's or Winchester), cater for the very top of the ability-range; but most private schools cater for pupils in the middle and lower part of the ability-range whose parents are anxious to provide their children with a more costly education than they could obtain from the publicly-financed sector, and for pupils who could not gain admittance to a publicly-financed school.

Approximately 100 such entrance tests in mathematics are published annually by the Obunsha publishing house to help intending candidates; about half of these tests are for Prefectural schools. As part of the Japanese entrance examination to an Upper Secondary School, tests have also to be taken in English—the major foreign language—and in their own language; some schools also set tests in science and social studies.[18]

A comparison with the mathematics tests set in England leads to the following broad conclusions on the uniformity and scope of the syllabus, and its level of difficulty.[19] First, the Japanese tests were of broadly *uniform* scope in their coverage of topics; this was true equally for the Prefectural and most other schools (though the top private and State schools had a more wide-ranging syllabus). This broad uniformity reflects the common curriculum specified for all schools in detail for each year of schooling by the Japanese Ministry of Education. Schools' textbooks have to be chosen from those authorised by the Ministry as covering that curriculum, though schools are entitled to include additional material.

Secondly, the Japanese at that age follow a mathematical curriculum which, as to a good three-quarters, is *similar in scope to that followed in England.* Yet there is a notable difference in that little is to be seen of 'modern' tendencies introduced in many English mathematics courses in the past generation. There is no 'set theory' and topology; nor are matrices and calculus introduced at this age in Japan. This is not to say that Japan was entirely immune from 'modern' tendencies; but after a trial period in the 1970s, most of these innovations were dropped.[20] Perhaps more surprisingly, there is also no trigonometry (this is left to the first year of Upper Secondary School). On the other hand, there is more geometry, and some co-ordinate geometry of the kind usually taken in England in the sixth form. The Japanese papers also include more three-dimensional geometry and elementary probability than is usual here. In many ways, the syllabus covered by these tests is close to that of the German *Realschulen.*[21]

Thirdly, the central focus in *difficulty* of the Japanese questions seemed to be somewhat above our O-level, though the range of abilities tested was wider than that. A few questions (at the beginning of each paper) were directed to a level corresponding to our low CSE grades. However the *typical* question in the Japanese test-papers required that distinctive chain of reasoning which makes mathematics such an excellent training for the mind: early steps in solving a problem need to be correct—and checked by the pupil as correct—before he can have much hope of answering correctly later stages of that problem. Questions on our CSE papers are often content with the recognition of a great range of mathematical symbols and concepts, but require little logical elaboration. Calculators are not allowed in the Japanese tests; similarly, very little use is made of computers in Japanese schools (one is bound to ask whether too

much hope is being placed in British schools on the introduction of computers as a means of raising mathematical competence).[22]

As mentioned, there is a third level of mathematical examination taken at about this age in England known as the Advanced Ordinary or Alternative Ordinary level (A/O level for short) which is passed by about the top 3 per cent of English 16 year-olds. The scope of the A/O syllabus is broader, and the questions on the whole are somewhat more difficult, than in most of the Japanese Prefectural papers. Compared with the entrance examinations for the *top* Japanese State and private schools, the A/O paper covered a broader range of topics, but the questions were less complex and required less mathematical ingenuity than the Japanese questions.

Our conclusion must be that the Prefectural tests which are taken by virtually *all* Japanese pupils are directed on the whole to a higher level of attainment than O-level tests in England which are directed to approximately our top quarter of pupils; but the level is probably not very much higher than that. The average score obtained by Japanese pupils on their mathematical tests for Prefectural schools was 55 per cent in 1981–2.[23] On the other hand, the pass-mark in England on O-level tests, a grade C, is usually set in the region of 50 per cent, and this grade was attained by 30 per cent of all English school-leavers in 1982–3. Thus the *average* Japanese pupil at age 15½ seems to do as well as—and perhaps slightly better than—the top 30th percentile of English pupils who are a year older. To put it another way: to match the Japanese we must bring our average Comprehensive school-leaver up to Grammar School standard, and get him there a year earlier.

Higher Japanese schooling attainments have apparently not absorbed a greater share of national resources than in England (5.0 per cent of GDP in Japan, 5.8 in UK, and 5.2 in Germany). The main factors contributing to controlled costs are probably: larger class-sizes are typically taught by a teacher in Japan (40 as compared with under 30 in England); a restricted curriculum *within* each school, with few optional subjects (but allowing for diversity of curricula *between* schools at later ages); a longer school-year, that is fewer school holidays (243 school-days a year in Japan, compared with 193 in England); and pupils' assistance in ancillary tasks at schools—cleaning classrooms, operating the school library, helping with mid-day meals, and the like.[24] Our central concern here however is with methods of attaining high standards for the broad cross-section of pupils, and this requires us to consider the way teaching is organised to accommodate different ability levels.

The Japanese version of comprehensive schooling

Until the age of 15, that is, during compulsory attendance at Lower Secondary Schools, the official policy is 'comprehensive' schooling, equal for all, following the American pattern. Even at this stage, some schools acquire a reputation for academic success and provide better access to the next stage of education; and there is an element of pressure to get into the best school at age 12. Pupils' priorities in choosing Upper Secondary Schools (at age 15) are based on reputations for excellence: these schools are *explicitly* selective and admit pupils according to pupils' results in the entrance examinations described above.

Schools in each area come to be arranged in an intellectual hierarchy, changing gradually in response to their success in attracting both teachers and pupils of good ability. To pass for admission to a better school at age 15—and so ultimately to a higher position in the socio-economic ranking—is an objective that acts as an explicit incentive (with many steps on the ladder) to schooling attainments at younger ages. Since over 95 per cent of pupils move on to these Upper Secondary Schools, virtually *all* Japanese pupils have an incentive to do that 'little bit better which might make all the difference'. This contrasts with the present English system where 'lower-half pupils' have little by way of incentives of this kind; most do not go on to further education, and for those who do, educational entry-requirements ('pre-requisites') are not strict, are not sufficiently graded, or do not exist at all (on the other hand, English pupils with high attainments have incentives to obtain better O- and A-levels so as to be able to enter courses of their choice at universities that stand higher in the 'pecking order'). It will be remembered that German 'lower-half pupils' have a strong incentive to obtain their appropriate school-leaving certificate in order to be accepted for employment in a skilled trade and for the training that goes with it.

Remarkably enough, the whole class in a typical Japanese Lower Secondary School is taught together, without streaming, and follows systematically one of the officially-authorised textbooks. Pupils are expected to attempt the many problems printed in their textbooks; a certain quota of pages in the text is covered each week. 'Japanese education is textbook centred' (as Professor Anderson put it);[25] in English Comprehensive Schools, on the other hand, the teacher often prides himself on *not* using textbooks, and relies on many individually—and laboriously—produced duplicated sets of problems and other teaching material. Japanese textbooks are attractively set out with graded exercises, including additional exercises for

slower pupils and more difficult exercises for faster pupils. The proportion of the school timetable devoted to mathematics is not very different in the two countries, but more mathematical homework is set in Japan.[26]

The practical reality of mixed-ability teaching in Japan needs to be considered in more detail to understand how such high standards are attained, and with relatively less variability amongst pupils than in England. First, one or two weaker pupils in a class may receive 'remedial' teaching to help them keep up, but this is usually *outside* normal school hours or during school holidays. Secondly, in addition to attending their Prefectural day school, many pupils attend a private supplementary school (*Juku*) in the evening or on Sunday morning; the average fees in 1985 were about £30 a month. Typically attendance is for 2–3 evenings a week, and for three hours an evening till 8 or 9 p.m.;[27] here they receive additional practice—to be able to solve problems more consistently—or they follow more advanced textbooks in parallel to the texts studied at day school but containing more complex problems. These supplementary schools are specialised according to pupils' needs and their prospects of passing entrance tests for the various Upper Secondary Schools; that is to say, they are 'selective schools', some catering for 'remedial' education, some for 'high-flyers', and many for those in the middle who hope to do that little bit better. (Those attending the best private schools during the day do not usually attend evening schools; the need for supplementary education is felt mainly by those at Prefectural schools.)

According to an official survey in 1985, some 45 per cent of all Lower Secondary School pupils attended such evening classes. The practice begins even before that in primary schools, in the upper forms (ages 10–11) of which 35 per cent attended such classes, rising to 54 per cent in the last year of Lower Secondary School (that is, at age 15, before taking examinations for the Upper Schools). The practice is growing, and is more prevalent in larger towns; in Tokyo up to 75 per cent of 10–12 year-olds were taking such classes, according to an earlier private survey. In addition to, or in place of, *Juku*, some parents engage private tutors; and some arrange private classes after school in piano, dancing and the like which, according to the official survey, were taken by up to 70 per cent of 9–10 year-olds.[28]

Thus, while there is no grouping by ability in the *compulsory* day school up to the age of 15—and no doubt many social advantages flow from this—in reality there is a great difference between the school-day of the academically-inclined part of the population, and the school-day of the remainder. The strong parental motivation that supports these supplementary classes goes a long way towards explaining how such a large proportion of pupils are able to attain such very high standards by the age of 15. It is said that brighter pupils take their supplementary evening classes with more seriousness than they take their day school.[29]

This 'double schooling' system—consisting of a compulsory day school plus widespread optional evening classes—as it has evolved in Japan seems a very uneasy compromise: it embodies a form of streaming behind a veil of 'comprehensiveness'. It requires a length of school-day that is not entirely unknown in this country (for example, at some boarding schools supervised 'prep' may finish after eight in the evening and, until ten years ago, 'early school' at Eton began at 7.15 a.m.), but it is not a system that carries any very obvious lessons for general emulation here (should, or could, anything be done to persuade teachers to give lessons outside school-hours to those pupils in need of them?).

On the other hand, it needs emphasis that the high standards attained in Japanese schools at young ages is evidently *not* attained there solely by mixed-ability teaching in comprehensive schools during normal school-hours. High standards, in those circumstances, depend on a clearly-agreed set of syllabuses for each year of schooling, an extraordinary devotion by teachers, parents and pupils to the ideals of educational excellence from an early age, as well as a considerable supplement of selective private education.

Mathematical schooling in Japan after the age of 15

As mentioned, full-time schooling in Japan continues to age 18 at Upper Secondary Schools on a non-compulsory and fee-paying basis for over 95 per cent of the age-group; this is in great contrast to England where only 32 per cent of 16–18 year-olds remained at full-time school in 1980–1. Japanese Upper Secondary Schools vary considerably in their curricula. Those known as *General* Schools cater for approximately two thirds of the age-group, and provide a broad curriculum as on the European continent—in distinction to the sixth-form specialisation on three subjects customary in England. Almost all the remaining third of all pupils go on to a variety of *Vocational* Secondary Schools catering for technical, commercial and other specialisations.

For the first two years at all Upper Secondary Schools in Japan, that is until age 17, mathematics is usually studied by all pupils for 4–6 periods a week. It is then continued for a further year by all pupils at General Upper Secondary Schools, and also by

pupils following technical courses at Vocational Upper Secondary Schools (details of the syllabuses are given in the following section). At this stage it needs only to be emphasised that, not only do almost all Japanese pupils continue with what we call 'sixth form' schooling, but they carry on studying mathematics for a further two or three years, having started from a level of mathematical knowledge distinctly ahead of that in England.[30] The gap in mathematical knowledge at the end of full-time schooling between the countries was succinctly put by a mathematical specialist, visiting Japan on behalf of the British Council in 1983, in this way: 90 per cent of all Japanese pupils do some calculus before they leave school, compared with only 15 per cent in the UK.[31]

III. VOCATIONAL SECONDARY SCHOOLS

This section describes vocational secondary schooling in Japan: this is a Cinderella-like subject, given adequate attention neither by Anglo-American writers—who have been more impressed by the development of university education and seem often unaware of the important role of vocational secondary schooling—nor by Japanese academic writers, who proceed as if vocational secondary schooling may be taken for granted and are more interested in the development of general schooling. Our concern here however is with methods of raising the technical competence of the workforce as a whole, and particularly (as explained in the Introduction) with those below university level, where England needs urgently to consider alternative paths of development. We shall need to outline the types of schools and courses available in Japan, the range of pupils catered for, the standards reached, and how the numbers attaining those standards compare with England.

The variety of vocational schooling available to Japanese pupils is such that only the main features of the system can be described in the space available. Aside from full-time *Vocational Upper Secondary Schools* providing three-year courses for 15–18 year olds on which we concentrate here—there are:

— *Technical Colleges* providing five-year courses for 16–20 year olds aiming at higher levels;
— *Special Training Schools* providing specialised vocational courses lasting a year or longer, intended mainly for those who have completed General (i.e. non-vocational) Upper Secondary Schools; and
— *other training institutions* providing shorter specialised qualifications and retraining (some sponsored by the Ministry of Health and Welfare or by the Ministry of Labour, rather than the Ministry of Education).

Proposals have also been under discussion recently to establish technical secondary schools that will provide six-year courses for the age-range 12–18, combining the present Lower and Upper Secondary Schools; their object would be to permit technical education to begin at an earlier age, and also provide greater continuity of instruction.[32]

At present the three-year Vocational Upper Secondary Schools are numerically the most important (for example, the Special Training Schools cater for 40 per cent, and the five-year Technical Colleges for only 4 per cent, of the number of pupils in Vocational Upper Secondary Schools.[33] Following the abolition of secondary technical schools in Britain, as part of the move to comprehensive schooling twenty years ago, there is now no body of educational institutions here that parallels these Japanese Vocational Secondary Schools; voices have increasingly been heard in Britain calling for the re-establishment of technical secondary schools, and specific proposals for the establishment of a score of such schools by 1990 were announced by the Government in October 1986.

Pupils who complete technical courses at *Vocational* Upper Secondary Schools in Japan are prepared for a variety of more-or-less skilled jobs in industry, intermediate between that of operator and that of engineer or manager—though the best have risen to that top level;[34] they may work on setting up and maintaining large-scale manufacturing assembly lines, 'equip and regulate the machinery prior to its actual operation', or in central research laboratories.[35] With a rising proportion of pupils going to university, the prospects of advancement to the highest levels of those taking employment immediately after Vocational Secondary Schools may not in the future be as promising as in the past. But a difference between large and small firms has here to be noted. University graduates tend to seek employment in the largest firms, where they look towards a role in the established hierarchy with a prospect of 'life-time employment'. Those from Vocational Secondary Schools, on the other hand, play a greater part—and are likely to continue to do so—amongst the mass of technically competent small firms that are such an important feature of the Japanese industrial scene. These small firms often act as sub-contractors, making components (or sub-assemblies) for larger firms.[36]

As explained further below, Upper Secondary Schools—whether Vocational Schools or General Schools—select their entrants according to ability as displayed in entrance examinations: some schools in each category cater for pupils of average ability, and others for those above or below the average. It is consequently not surprising to find that firms some-

times say they prefer to recruit persons coming from a General School catering for those of high ability, rather than someone from a Vocational School catering for pupils of lower ability. Each firm knows the quality of the schools in its neighbourhood and its own particular production requirements; it recruits accordingly, and provides appropriate on-the-job training. Smaller firms are limited in the specialised training they can provide within the firm, and inevitably rely to a greater extent on the technical education and training provided by Vocational Schools, which are our concern here. Once youngsters are in employment, there is greater reliance on *on*-the-job training (rather than *off*-the-job training, now much favoured in England); on-the-job training is regarded as the 'most cost-effective approach' in their 'relatively poor country'.[37] It is probably more effective than in this country because, as a British trade-union official noted on visiting a factory in Japan similar to his own in England, Japanese training within firms is able to build on the previously 'high level of technical training at school for 16–18 year-olds'.[38]

Ability range

Some 1.4 million pupils—just over a quarter of the relevant age group—were enrolled in 1984 in Japanese Vocational Upper Secondary Schools, and were following three-year courses starting at an average age of 15½. The great majority were at Technical and Commercial Schools (490,000 and 560,000 respectively)—the former attended almost entirely by boys and the latter mostly by girls; the remaining pupils were at schools specialising in agriculture, fisheries, home economics and health (including nursing). As part of the trend towards more university education, numbers of pupils at Vocational Schools have been falling by about 1 per cent a year in the past two decades, while those at General Schools—a higher proportion of whom go on to universities—have been rising by some 3 per cent a year. Irrespective of the possible long-term consequences of these trends for the technical competence of the workforce (a risk of over-qualification on the theoretical side, and under-qualification on the practical side), it remains important for our comparisons here that over a quarter of all youngsters attended full-time Vocational Secondary Schools in 1984, and will obviously continue for many decades to form a highly important skilled constituent of the workforce.

Vocational schools tend to be seen everywhere as catering for those of lower academic ability; but in Japan the dividing lines in terms of ability-ranges between Vocational and General Schools are far from rigid. This appears most clearly by looking at the proportion of pupils achieving above-average scores at entrance examinations (taken at age 15, as described in the preceding section) for the various kinds of Upper Secondary Schools; the available figures relate to one Prefecture (taken from a special study by the National Institute of Educational Research in Tokyo—no nationwide distributions are available but these figures are thought to be not untypical).[39] They show that 39 per cent of pupils sitting examinations for Technical Schools attained scores above the median for all school-leavers; that is to say, those entering Technical Schools covered a fair spread of abilities—only those at the very top were under-represented. It is thus clearly wrong to think of Technical School pupils in Japan as coming principally from the lower half of the ability-range. The intake into Commercial Schools came from a slightly lower section of the ability-range than those entering Technical Schools; even so, 31 per cent were from the top half of the range for all pupils. The General Schools, on the other hand, while on average catering for pupils of higher ability, also admit pupils having almost the very lowest scores: some 11 per cent of their examinees were in the lowest quarter of the range of scores.[40]

Individual schools, and individual departments in such schools, select their intake according to scores attained at these examinations by a process of successive 'creaming'; admissions to individual schools and departments thus cover a narrower range of scores than indicated by these figures. In other words, some Vocational Schools and some General Schools cater specifically for those of high ability; equally, there are some Vocational Schools and some General Schools that cater specifically for weaker brethren.

Two or three pupils, out of a class of forty, may reach unsatisfactory marks at tests during the first two school years, and have to repeat individual subjects (or perhaps repeat the whole class); and one or two may leave because they find the course too difficult, or do not attend sufficiently regularly. But the great majority of pupils entering Japanese Vocational Schools stay on to complete their three-year full-time courses; in 1982, for example, graduates of Technical Schools represented 91 per cent of those starting three years earlier, and in Commercial Schools the proportion was 94 per cent. At General Upper Secondary Schools the proportion was even a little higher, at 96 per cent. The proportions just quoted relate to pupils on full-time courses; a very small proportion—some 3 per cent—are on evening courses at Vocational Secondary Schools, and something like a third of these pupils leave before completing their courses. The latter is much closer to the proportions usually found in Britain.

Types of Vocational School and their curricula

Japanese Vocational Schools are highly specialised according to the selection of courses taught; amongst those categorised as *Technical* Schools (as distinct from Commercial, Agricultural, Health, etc. Schools), the following half-dozen are the most important specialisations: machinery (or mechanical engineering), electricity, electronics, architecture, civil engineering, industrial chemistry. The first two —machinery and electricity courses—account for about half of all Technical School pupils. There are very few optional subjects on each course. Electronic and electrical courses usually cater for pupils with the highest marks at the entrance examination; courses in 'Sanitation Engineering' (which includes plumbing, air-conditioning, water supply and drainage) are less demanding in their entrance requirements.

The average Technical School has some 700 pupils, divided into a half-dozen parallel classes ('homerooms'); classes are large by English standards, usually consisting of 40 pupils. On average there are some 80 teachers in each school (many are part-time teachers as in technical schools elsewhere). Commercial Schools tend to be slightly smaller, with 550 pupils on average. Japanese Vocational Schools are thus roughly similar in size to English secondary schools. Further Education Colleges in England, which cater for those aged over 16, cover a broader range of subjects than does the typical specialised Japanese Vocational Secondary School, and are much larger in total enrolments, with a preponderance of part-time pupils (on average, over 2,000 day or evening part-time pupils are enrolled on 'non-advanced' courses, i.e. those below university level); the number of full-time pupils, and 'sandwich-course' pupils, is similar to that in Japan.[41]

The published syllabuses, and the approved textbooks for the main Japanese vocational courses that we have scrutinised (with the help of experts in specific subjects), indicate that the details of what is taught at these Japanese schools would not in any way be unfamiliar to those teaching specific courses at the corresponding English colleges. The contrast with England—to put it in a nutshell—lies in this: the typical Japanese pupil pursues a broader curriculum of *general* subjects together with his practical vocational education; the theoretical basis of practical applications is given greater emphasis (so providing a foundation for possible higher studies); and, most important, larger numbers of pupils (per head of the workforce) are involved.

Based on the syllabuses and textbooks for three of the main courses of study at Vocational Secondary Schools—machinery, electricity, and commercial studies—the following summary comparisons can be made with England.[42] In all Japanese Vocational Secondary Schools, instruction in *general subjects* accounts for half the school-day (a little more than half in the first year, a little less in the third year). Included in this part of the curriculum are the familiar school subjects—language, history, geography, mathematics, science, art, physical education. A foreign language, English, is taken for two years at Technical Schools, and for all three years at the Commercial Schools (this follows instruction in English given in Lower Secondary Schools; between 400 and 700 new English words are to be learnt each year in the Vocational School). Mathematics and science occupy an average of one school-period a day for the three years of the course in Technical Schools, and for the first two years in Commercial Schools (at General Upper Secondary Schools, about two periods a day are devoted to these subjects throughout). This follows obligatory mathematics and science throughout the Lower Secondary School averaging 1½ periods a day. The contrast with the curriculum of the English Comprehensive School—where a foreign language, mathematics and science are usually all optional subjects from the age of 14 (the fourth form)—does not need underlining; the breadth of the Japanese curriculum is similar to that found in upper secondary classes in Germany[43] and France.

The standard of mathematics varies according to type of vocational course. Pupils at Commercial Schools cover in their first year topics such as simultaneous equations in two variables of first and second degree, trigonometry up to sine and cosine theorems, co-ordinate geometry up to equations of straight lines and circles; those taking mathematics in their second year are introduced to infinite series (exponential and trigonometric functions) and the elements of calculus. Pupils specialising in business applications of information processing are introduced to statistics and probability: calculations of means and standard deviations, permutations and combinations, binomial theorem, normal distribution, and the basis of statistical inference (population and sample). Those on mechanical and electrical courses take Industrial Mathematics (a syllabus approved in 1982) which includes—at a basic level—infinite series, differentiation, integration by parts (simple cases), and simple differential equations. Again, nothing mentioned here is in any way out of the ordinary to a teacher of mathematics in England; but it has to be noticed, as we shall also see in more detail in relation to vocational subjects, that this level of mathematical instruction goes beyond the reach of those normally taking business studies or Craft-level technical courses in England, and some of it would go beyond that expected at Technician (National Diploma) level.

The other (approximately) half of the day which is devoted to *vocational subjects* relies partly on desk studies based on textbooks, and partly on practical or experimental work at school or in business firms. For pupils on industrial courses, more than half of the total time devoted to vocational subjects is required to be spent on technical drawings, experiments and practical work. A school workshop for mechanical engineers, for example, might include as many as 20 lathes, and a variety of milling machines (vertical, horizontal and numerically-controlled). The 40 pupils in a typical class are usually divided into three or four separate groups for practical work in the workshop. Part of the time allocated to practical work may involve work experience in industry (similarly, pupils attending schools specialising in 'home economics' are expected to spend part of their practical time in helping, for example, at hospitals or child-care institutions, or in cooking in factory canteens).[44]

Comparisons with England

In assessing—in terms familiar to the English reader—the standard aimed at by these Japanese vocational courses, a preliminary word is required on the two main levels of recognised vocational qualifications in England, and the more-or-less corresponding levels in France and Germany.

(i) *The 'Craft level'*: In industrial occupations the Craft level is usually reached in England at age 19–20, on completing a three-year part-time course after the end of compulsory full-time schooling; the corresponding German qualification (the *Berufschulabschluss*) is usually taken at 19; and the corresponding French qualification (the *Certificat d'aptitude professionnelle*—or CAP) may be taken with the help of part-time schooling at 19 or, more usually, as early as 17 at a full-time vocational secondary school (*Lycee d'enseignement professionnel*). Practical experience generally forms the largest element in European qualifications at this level where studies at college are combined with employment.

(ii) *The 'Technician level'*: A higher level of vocational qualification available in England for those following *Technician* courses leads to a National Diploma (previously known as the Ordinary National Diploma), or a National Certificate; study for the Diploma is usually on a full-time two-year course at ages 16–18, while studies for the Certificate are on a part-time course of narrower coverage requiring three or four years. For these qualifications more time is devoted to desk-work in the form of technical drawing and technical calculations, rather than on the practical elements that characterise Craft courses (more-or-less corresponding qualifications are available in Europe, such as the *Bac de technicien* in France).

Many more candidates usually obtain vocational qualifications at a lower level than at a higher level; in mechanical subjects in Britain in 1984, for example, about twice as many passed at Craft level (City and Guilds course, part II) as obtained a Technician's National Certificate in related subjects; and National *Certificates* were awarded to over twice as many candidates as received the more highly respected Technician's National *Diploma*.

Bearing in mind that these Japanese courses are three-year full-time courses, it might be expected that the standard aimed at should be closer to our Technician than to our Craft level, and certainly well above the standard of 'vocational' courses available at our Comprehensive Secondary Schools. That indeed was the judgement reached (as mentioned, with the help of experts in individual subjects) from a scrutiny of the material covered in specimen textbooks for the four courses of study mentioned. Because of the broad scope of the Japanese curricula our National Diploma with its greater number of required courses—rather than the National Certificate—appears as the nearer equivalent.

Commentators on Japanese education stress that the object of all their schools, including their Vocational Schools, is to provide a broad curriculum and develop *general* abilities, and the task of industry is to provide training in operational *specifics*. As appears from the syllabuses and textbooks, the instruction provided in their Technical and Commercial Schools is however quite as specific, and as close to practical reality, as in comparable English, French or German courses. To give a few examples: the *machinery* course covers the many standard types of milling cutters in immense detail, and the precise contours of the many standard types of gear wheels; the *electricity* course deals with multitudinous types of insulators available for carrying high-tension cables; the *commercial* course deals with trial balances and methods of depreciation.[45]

Before completing a course at these Vocational Schools, pupils may take highly specific industrially-recognised trade tests, externally-set by the Ministry of Labour or Ministry of Trade and Industry, such as: Registered Boiler Technician, Gas Welding Technician, Senior Electric Technician (Third Class, i.e. the beginning grade in this occupation), Bookkeeping Licence (First to Third Class), Licensed Information Processing Technician (Second Category, i.e. the lower grade).[46] Preparation for these tests may involve additional instruction by school-teachers outside normal school-hours, during lunch-breaks or in the holidays. Such certificates are seen as helpful in finding jobs.

But the breadth of technological over-view given to the Japanese pupil at these Vocational Schools is probably the more important feature, leading to flexibility and adaptability in a world of rapidly advancing technology. The machinery course involves competence in (for example) technical drawing, measuring the hardness of steel, basic fitting techniques, and work on automatic lathes. In England these would more usually each form the separate expertise of those who had undertaken separate specialist courses. Similarly, the typical Japanese course on business studies includes typing, double-entry bookkeeping to intermediate professional standard, commercial law, marketing, and basic electronic data processing; a mix as broad as this—treated at the level of practical detail provided in these courses—is not typical of commercial courses in England.

Numbers attaining comparable levels of qualification

The full contrast between the countries emerges when the numbers of students taking such courses are compared, as in table 1. This sets out the numbers completing such courses in Japan and England in a year at the beginning of this decade. Allowing for the roughly-double size of the Japanese workforce, and taking these numbers at face value for the moment, we see that:

- in mechanical courses, the Japanese system prepares (per member of the workforce) just over twice as many to their level of competence as reach our Craft level in Britain, and just over three times as many as reach our BTEC (Ordinary) National level, taking Certificates and Diplomas together;
- in electrical and electronic courses, they produce twice as many as reach our Craft level, and three times as many as attain BTEC National Certificates and Diplomas;
- in business studies, the Japanese produce roughly six times as many as attain National Certificates and Diplomas.

A stricter comparison, taking our BTEC National Diplomas alone (that is, excluding those on the narrower courses leading to BTEC National Certificates), would show the Japanese system as producing 10–20 times as many at Technician level per head of the workforce as here in the above courses.

Most courses on data-processing and computer science are taken in Japan, not at Vocational Secondary Schools (at ages 15–18), but at Special Training Schools; these courses are at a more advanced level, and are taken by slightly older pupils (aged 18–20). These schools produce 2–3 times as many graduates per head of the workforce in Japan as here obtain the equivalent of a Higher National Diploma or Certificate in computer studies.

Table 1. Numbers completing vocational secondary school courses in Japan 1982, and attaining main vocational qualifications in Britain 1983–4

	Japan, 1982	Britain, 1983–4		
	Vocational secondary schools	C & G Craft	BTEC National Certificate	BTEC National Diploma
Mechanical	50,400[a]	9,900[b]	5,100[c]	1,900[d]
Electrical and electronic	41,000[e]	10,000[f]	6,300[g]	1,030[g]
Business studies	175,000[h]	—	7,400[i]	6,500[i]

Sources: *Japan Statistical Year Books*; *School Basic Surveys*; *City and Guilds Examination Statistics, 1983–84* (home candidates); *BTEC Awards 1983–84*.
(a) Estimated from students enrolled on machinery courses in 1982 (less an allowance for drop-outs based on rate for all technical subjects).
(b) City and Guilds part II, courses 205–6, 210–18, 225.
(c) Mechanical and production engineering, industrial measurement and control, plant engineering, fabrication and welding, general engineering etc.
(d) As (*c*), plus technology (engineering).
(e) Electricity, electronics and information technology; estimated as for (*a*) above.
(f) City and Guilds part II, courses 221, 224, 232–6, 271.
(g) Includes also communications engineering and computer technology.
(h) Excluding students of information processing (5,300 students), and including students specialising in clerical work and accounting; estimated as for (*a*) above.
(i) Business and finance.

It helps to set these policy differences in perspective if we notice that at the very lowest school-leaving qualification—at CSE level—very considerable numbers of pupils in England attain passes in vocationally-related subjects. For example, 52,000 attained a graded result in CSE metalworking in 1984 (a similar number did so in woodworking, but there is probably a considerable overlap in the candidates involved); and 37,000 passed in CSE commerce. Thus, in England a *foundation* is undoubtedly laid during compulsory schooling ages for vocational education for, in total, very roughly the number of pupils that attend the corresponding Vocational Schools in Japan: the difference is that Japanese pupils stay on at Vocational Schools for another three years to reach very much higher standards.

Looked at more critically, it is necessary to note that the Japanese figures relate to students who have 'graduated vocational high school': in order to 'graduate' in Japan it is required only that students' 'achievements are judged to be satisfactory', the judgement being—for the most part—that of the school rather than of an external examining body. In consequence there is considerable variability in attainments, as is widely understood by employers. On the other hand, these schools are attended voluntarily after completing compulsory schooling, and are fee-paying; pupils therefore are under serious incentive to ensure that their attainments will eventually be 'judged as satisfactory'.[47]

A second—and related—reservation is that actual teaching will not necessarily be as deep nor as broad in all schools as indicated by authorised textbooks; the latter are intended to provide not solely for minimum needs, but also for the needs of the more demanding schools and the more demanding pupils. Some topics may be no more than touched upon in schools catering for weaker pupils, or where local industrial needs differ.

Reservations of this sort are of course not unfamiliar in other countries. In England there is little doubt that many pupils focus on selected parts of the syllabus, and are able only to 'scrape' a pass at an external examination; it also appears that the process of internal assessment introduced in recent years for BTEC awards has led to greater variability in standards, and different parts of the syllabus are given very different degrees of emphasis in different colleges.

IV. SUMMARY AND DISCUSSION

Industrial progress and higher productivity obviously depend on many things: from the present comparisons we see that Japan's extraordinary industrial success is strongly based on (a) foundations laid during compulsory schooling, till the age of 15, by way of substantially higher attainments in mathematics by average pupils than in Britain (Japanese pupils' attainments in science are also higher); and (b) these higher standards make possible more advanced vocational preparation—up to Technician level—at full-time Secondary Technical and Commercial Schools, at ages 16–18, for at least three times as many as attain that level here. Virtually all aged 16–18 in Japan continue to study mathematics and sciences, as part of non-compulsory full-time schooling, even if not on technical or scientific courses.

Any training given subsequently in the course of employment in Japan is able to build on those foundations laid during full-time schooling; training within industry can thus be more specialised, more effective and more worthwhile to the employer. To ask British employers to carry out the same amount and same kind of training as in Japan—as British official agencies sometimes suggest—betrays a misunderstanding of the preparation provided at Japanese schools.

The weaknesses of the British education system as they appear in these comparisons with Japan are similar to those highlighted in our previous comparisons with Germany. Mathematical attainments at German schools by average and below-average pupils are significantly ahead of Britain; and vocational preparation at German schools is undertaken in a more substantial way, being an acknowledged main aim of schooling (especially in the *Hauptschule* and *Realschule*), rather than—as often regarded in England—an adjunct barely compatible with the overriding cultural aims of a civilised education.

In one important respect Japan achieves its high vocational standards by following a route that is different from Germany: it provides *full*-time vocational schooling for the kind of pupil who in Germany would be an apprentice at work following a *part*-time course of study at a vocational school. There are consequential differences in what is learnt, with more practical working skills being put into the hands of the typical German 18 year-old who has successfully passed his vocational examinations, in contrast to the broader scope of theoretical work (and technical drawing) at Japanese Vocational Secondary Schools. The French system, as it has evolved, provides a European example in which vocational education is largely provided within the full-time secondary schooling system, and having now the explicit intention to bring the quality and quantity of those with vocational qualifications closer to the Japanese model (the *Bac professionnel* is of special interest).

Present policies in Britain are heavily directed towards the expansion of the part-time route via the Youth Training Scheme. The extension of that scheme to two years (from its original one year) is to be welcomed, in the hope that it may lead to an increase in the numbers—so far small—attaining a serious level of vocational qualification. But the example of Japan suggests that the full-time route to vocational qualifications should also be much extended: depending on their capabilities, some pupils may benefit from the greater practical element inherent in part-time courses, while others may benefit more from the broader scope possible in full-time vocational courses. At present there are two lines of development. The TVEI (Technical and Vocational Education Initiative) scheme, intended to increase the vocational content of full-time schooling for 14–18 year-olds, is as yet only emerging from its pilot phase; on the other hand, there are the proposed City Technology Colleges for 11–18 year-olds—but even by 1990 it is envisaged that there will be only 20 of these colleges spread over the whole country. Both of these ventures are thus hardly more than acorns out of which great oaks may—or may not—grow. Much remains to be done if they are to parallel Japanese attainments in vocational preparation.

The urgency of raising *general* schooling attainments at early schooling ages in Britain cannot be over-emphasised; a higher starting point in general subjects is necessary if vocational studies at all

levels (including YTS, TVEI, BTEC) are to be pursued here as successfully as in other industrially-progressive countries. The comparisons of mathematical attainments presented in section II above serve to indicate, at least broadly, the nature of the objective: the average English school-leaver's attainments in mathematics are a CSE pass (grade 4), while the average Japanese pupil attains the equivalent of a good GCE O-level pass, and does so when he is a year younger. Almost all Japanese pupils then continue with their mathematical studies in their Senior Secondary Schools. The broad cross-section of school-leavers in Japan is thus educated to a significantly higher level than in England; it is as if good Grammar School standards, rather than average Comprehensive School standards, were attained by the school-leaver of average ability.

The home environment in Japan seems to play an important part in supporting and promoting schooling attainments. One is bound to wonder whether public policy in Britain ought now to place greater emphasis on those features of a 'good home' that help children's attainments. Perhaps an information campaign would be appropriate similar to that of the US government which recently drew parents' attention to research on a number of straightforward matters within parents' control: for example, the advantages of providing pupils with a special place at home for studying, sticking to routine times for meals and homework, and monitoring TV.[48]

To set average Japanese schooling attainments as a target for average English school-leavers may not seem at first glance to be impossible; but I suspect most experienced teachers of upper-age classes at English Comprehensive Schools would today regard it as unrealistic. The reason must be sought—at least in part—in the organisation of instruction given at younger ages; on this some important lessons may be drawn from Japan, as also from other countries. In England it is only towards the end of compulsory schooling that any form of national standard affects what is taught; this is done—not through prescribed syllabuses or textbooks—but indirectly through the medium of general school-leaving examinations, the CSE and GCE; the new GCSE does not change this. These examinations influence teaching mainly at the top of the school at ages 14–16. What is taught in schools at younger ages is very much in the hands of individual teachers, without co-ordinated guidance as to syllabus and standards to be attained, nor any control as to what a teacher actually teaches and what pupils actually learn.

The widely-known problems of co-ordinating curricula and standards on pupils' transition from primary to secondary school (at 11+) are simply the visible tip of an iceberg, indicative of the wider unnecessary real costs (lost learning time, discouragement of pupils, etc.) resulting from the present approach. In Japan, despite the many difficulties of its system of comprehensive schooling (and an unfortunate substantial and growing reliance on supplementary private evening classes), head-teachers and school inspectors combine their experience to agree on the essential elements of syllabuses; these are formally accepted as the basis for teaching, and serve as the basis for approved textbooks designed for each year of schooling. Similar co-ordination of syllabuses is a fundamental feature of the French and German schooling systems. There is little doubt that it leads to more focused and more effective teaching—perhaps not obviously for the best pupils taught by the best teachers—but for the broad cross-section of pupils taught by the broad cross-section of teachers. The need for a move in this direction in England received recognition by the Secretary of State for Education and Science, Mr Kenneth Baker, in statements in December 1986; implementation was however to be deferred for some years.

In short, the example set by Japanese industrial success, and its rapid pace, raises serious questions as to whether general educational targets in Britain—especially in mathematics and science—are set high enough; whether there is sufficient full-time vocational schooling; and, perhaps more immediately relevant, whether policies to improve these matters are being pursued with sufficient urgency having regard to the steady growth of industry abroad, and the competition it provides to home industry.

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So that the results of the present study may benefit from the comments of both economists and educationalists, a parallel version is being published in *Compare: A Journal of Comparative Education* (Institute of Education, University of London); I am grateful to the Editors of both journals for their agreement.

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NOTES

(1) See the excellent compendium *Asia's New Giant: How the Japanese Economy Works*, eds H. Patrick and H. Rosovsky, Brookings, 1976, esp. the chapters by N. Glazer on social and cultural factors, and by W. Galenson on the labour market.

(2) Using the World Bank's purchasing-power-parity exchange-rates. For pre-war comparisons on alternative bases, see Colin Clark, *The Conditions of Economic Progress*, Macmillan, 3rd edn, 1957, ch.2.

(3) For a detailed description of Japanese education, the reader may refer to Professor R.S. Anderson's study sponsored by the US Department of Health, Education and Welfare: *Education in Japan: A Century of Modern Development*, US GPO, 1975, p.412. Comparisons with England, of course, are not covered there; nor is there adequate emphasis on the role of the supplementary evening classes, described below. A recent article by Professor Leonard Cantor provides a convenient brief introduction to Japanese vocational education and training institutions, as seen through the eyes of an expert on British vocational preparation, but does not attempt a comparative evaluation ('Vocational education and training: the Japanese approach', *Comparative Education*, vol.21, no.1, 1985, pp.67–76); it contains many helpful references to comparisons between US and Japanese schooling and training systems. The most recent issue of *Comparative Education* (vol.22, no.1, 1986) is devoted to education in Japan, and deals with broader issues than are our concern here; the comments of the editor, Professor E.J. King, on the problems of Japanese schooling, are however very relevant (in his article there on 'Japan's education in comparative perspective', pp.73–82). Fuller accounts of Japanese vocational education, but again without comparative evaluations, have been given by S. Umetani, *Education and Vocational Training in Japan*, Institute of Asian Studies, Hamburg, 1980, and by K. Inoue, *The Education and Training of Industrial Manpower, Japan*, World Bank Staff Working Papers no.729, 1985.

(4) DES, *Statistical Bulletin* 9/84, table 2, relating to new entrants to higher education (table 4, relating to graduates, was amended for the UK totals after publication to include other forms of higher education). The well-known study published by NEDO, *Competence and Competition*, 1984, table 6.2, p.82, noted that only 18 per cent of the age-group in the UK in 1981 attained higher educational qualifications, compared with 37 per cent in Japan in 1979; but this was concerned with a narrower group of qualifications than included in the DES table 2 just mentioned.

(5) P.R. Rawle, *The Training and Education of Engineers in Japan*, mimeo, London Business School, 1983, esp. p.32.

(6) A greater 'ambidextrousness' of female operators in the UK than in Japan was reported as one reason for the success of Japanese affiliated electronic firms in this country (in the survey by Professor J.H. Dunning, *Japanese Participation in UK Industry*, Croome Helm, 1986, p.99, n.10). It is those Japanese firms that are 'labour intensive' that set up affiliates here—meaning, intensive in *unskilled* labour, rather than in those technical skills which are more readily available in Germany or Holland (*ibid.*, pp.52 and 63, n.28).

(7) T. Husen (ed.), *International Study of Achievement in Mathematics*, Almquist & Wiksell, Stockholm, 1967, vol.I, p.270 (average ages); vol.II, p.22 (scores). The low average percentage of marks reflects, not an inability to carry out the tests quickly enough, but rather (a) the need to make provisions in the design of the tests to elucidate the proportions in each country who did particularly well, and (b) the diversity of national curricula. The samples compared here are those labelled as 'Population 1a' in that study, and related to pupils in their thirteenth year of age. In our previous comparisons between Germany and England we were obliged to rely on 'Population 1b', which related to all pupils in the class in which the *majority* were aged 13, since Germany did not participate on the alternative basis. Certain non-negligible problems arose in the application of these definitions, and were discussed in Appendix B of our previous paper ('Schooling standards in Britain and Germany', by S.J. Prais and Karin Wagner, *National Institute Economic Review*, no.112, May 1985). The Japanese samples appear to have been identical for 'Populations 1a and 1b'; this reflects the assumption that Japanese pupils advance from one class to another purely on the basis of their age. I am told that this is not precisely true and that a pupil may be required to repeat a class if absence (due to illness or injury) is a relevant factor.

(8) Population 1b (see preceding footnote), and Husen, *ibid.*, vol.I, p.271 and vol.II, p.23.

(9) The median age of starting school at the time of that survey was 5 years and 2 months in England, 6 years and 6 months in Japan (*ibid.*, vol.I, p.227).

(10) Husen, *op. cit.*, vol.I, p.22.

(11) This comparison is based on 'Population 1a' of the IEA study relating to samples of pupils who were all 13 years old. The alternative 'Population 1b' (relating to pupils from classes in which the *majority* of pupils were 13 years old) consolingly showed England as having the greatest proportion of top scorers: 2.4 per cent had 61 points or more, compared with 1.4 per cent in Japan. The position at the bottom of the range in 'Population 1b' is barely changed, with 19 per cent of English pupils having 5 or fewer points and 7.6 per cent in Japan. The difficulty with a comparison on the basis of 'Population 1b' is that the

English sample was about a year older than the Japanese sample. The good results of the top performers in the Dutch sample in 'Population 1a' have been ignored here because the sample was small (429 pupils), and differed markedly from their 'Population 1b'.

[12] Based on a weighted average of the five sub-scores of 137 questions as given in a preliminary report of the 1981 survey by R.W. Phillips, 'Cross national research in mathematics education', in T.N. Postlethwaite (ed.), *International Education Research: Papers in Honor of Torsten Husen*, Pergamon, Oxford, 1986, p.82.

[13] It needs to be emphasised that the questions are usually based on ticking one of five possible answers, and no 'correction for guessing' has been applied in the scores quoted here. England's low marks are thus in reality worse than they appear; for example, in the final question quoted in the text here, in which 22 per cent of English pupils gave the correct answer, it must be remembered that a strategy of ticking at random would have yielded 20 per cent correct. Hence the benefits of teaching in England in this type of problem are visible only in something like a mere 2 per cent of pupils!

[14] Interpolated from the summary in chart 8.3 of the paper by Professor N. Postlethwite (President of the IEA) on 'The bottom half in lower secondary schooling', in *Education and Economic Performance*, ed. G.D.N. Worswick, Gower, 1985, p.96. This chart is based on a maximum mark of 40 relating to the core items in these tests; the coefficients of variation are also on this basis.

[15] See (Japan) National Institute for Educational Research, *Mathematical Achievements of Secondary School Students* (in Japanese), Tokyo, 1982; pp.36-8 give the results for the 60 questions, of which I have taken a simple average.

[16] R.A. Garden, 'The second IEA mathematics study', *Comparative Educational Review* (forthcoming), see table 8. I have here quoted a simple average of the scores in arithmetic, algebra and geometry.

[17] Fees for individual schools are given by Obunsha (see next fn.), pp.22-4; for average expenditures by parents on education, see *Japan Statistical Year Book 1985*, p.668. See also T.P. Rohlen, *Japan's High Schools*, U. Cal., 1983, p.23, n.8.

[18] *Examination Papers for Entrance to Senior High Schools* (in Japanese), Obunsha, 1984. This source provides statistical summaries of the main features of these schools. Such is the popular interest in these examinations that those Japanese newspapers corresponding to the English 'quality press' publish each year, as an exciting news item, a copy of the examinations set for the main Upper Secondary Schools. A short account of these examinations has recently been given by Yutaka Togashi, 'Japanese High School entrance examinations and scholastic achievement', *Evaluation in Education*, vol.9., no.3 (1985), pp.221-42. For an English translation of a specimen examination in mathematics for one Prefecture (Osata), see Appendix A of National Institute Discussion Paper no.121, by the present author (on which this article is based).

[19] The English papers considered here were those set by the University of London (GCE O-level syllabus B, and Alternative Mathematics), and by the London Regional Examining Board (CSE).

[20] See Toshio Sawada, 'Elementary algebra in Lower Secondary Schools in Japan', in *Comparative Studies of Mathematical Curricula: Changes and Stability 1960-1980*, ed. H.-G. Steiner, Institut für Didaktik der Mathematik der Universität Bielefeld, 1980, p.426 *et seq.*

[21] See S.J. Prais and K. Wagner, 'Schooling standards in England and Germany: some summary comparisons bearing on economic performance', *National Institute Economic Review*, no.112, May 1985, p.61.

[22] The lack of computers in Japanese schools was attributed to their aim of providing 'a grammar school education' by a senior HMI Inspector specialising in mathematical education who visited Japanese schools in 1983 (T. Fletcher, HMI, Report to the British Council).

[23] Togashi, *op. cit.*, p.233. In the same issue of that journal, mathematics scores are quoted for three sample (anonymous) Prefectures, the average being 54 per cent for entrants to General Upper Secondary Schools and 43 per cent for Vocational Upper Secondary Schools. (I am grateful to the authors for clarifying in correspondence that the published marks for Prefectures A and C are out of a total of 60 and 50 respectively, and I have here made the appropriate adjustments to the published averages; see A. Akagi, S. Nagano and M. Yamamoto, 'Achievements in consumer mathematics among Japanese Technical High School students—a comparison with NAEP data', *Evaluation in Education*, 1985, table 3.5, p.255.) Pass-marks, based on the average of the 4–5 subjects examined, are published for a selection of private schools in Obunsha, *op. cit.*, pp.24–5 (third column of table). The private school with the highest academic reputation, Nada in Kobe, is described in detail by Rohlen (*op. cit.*, pp.18–28); it demanded a minimum pass-mark of 73 per cent. Less-demanding private schools were content to accept pupils with marks of 20 per cent. Marking may be more severe in Japan than in England (for example, a reluctance to award half-marks for correct method but wrong answer); this would imply that Japanese attainments were somewhat higher still than suggested in the text here.

[24] Costs of schooling are quoted from a recent OECD study, *Social Expenditure 1970-1990: Problems of Growth and Control*, OECD, Paris, 1985, pp.36,38-9. Class sizes and days per year in school are quoted from the IEA studies. Students' help in schools is described by W.R. Cummings, *Education and Equality in Japan*, Princeton UP, 1980, p.8. The available evidence suggests that the number of hours actually spent in mathematics classes is probably higher in Japan; but there remains a need for a detailed analysis of the time-table which allows for school-periods missed because of sports-days, preparation for school-plays, and the like.

[25] *Op. cit.*, p.285. The implied contrast is with the 'child-centred' attitude to teaching that dominated American schooling practice in the previous half-century (but now under criticism there by the 'back to the basics' movement). If Japanese teachers require additional problems for their class, they are usually able to make use of supplementary published manuals containing problems that are related to the authorised textbooks.

[26] Based on the IEA report by Garden, *op. cit.*, table 6.

[27] A recent popular description quotes a large-scale Tokyo *Juku* at which 12 year-olds attended from 4.50 to 8.50 p.m., with a 20-minute break for supper, every Monday to Friday (*Japan Pictorial*, vol.7, no.3, 1984, p.25). The remarkably broad study of Japanese culture and education by Glazer (*op. cit.*) regrettably does not discuss the role of the *Juku*, and thus does not give an entirely fair account of the educational system and its problems.

[28] The results of the 1985 official survey were reported in *Asahi Shimbun*, 8 April 1986; a previous survey in 1976 was

reported in the *Statistical Abstract* for 1980. Rohlen, *op. cit.*, p.104, gives references to the other surveys mentioned above which give higher percentages. See also W.K. Cummings, *op. cit.*, pp.212–5. These surveys were carried out by post, with a response rate of 57 per cent reported for 1985; it seems possible that parents with children at *Juku* would be more likely to respond, and some upward bias may be present.

[29] In the *Juku* mentioned earlier, a fifth of the pupils are the children of teachers at Prefectural schools 'who know at first hand that effective study at Japanese Prefectural schools is impossible'. The same article mentions that some mothers do the homework set by the day-school for their children, so that their children should be free to devote their time in the evening to *Juku*: even if verging on the anecdotal, it is a significant anecdote that Japanese mothers regard themselves—as they are taught in their homecare classes at school—as having reponsibility for their children's educational progress. The important role of the home is made explicit in the recent US Department of Education booklet addressed to parents and schools; the initial dozen pages are devoted to what the *home* can do to raise children's educational successes (*What Works: Research about Teaching and Learning*, US Department of Education, 1986). In England, on the other hand, education is regarded as being within the province of the school: it is difficult to imagine the DES addressing parents in a similar way on the role of the home in education.

[30] For the benefit of non-English readers it needs to be explained that those English pupils staying on in school till 16–18 follow highly specialised courses; those not on science courses will usually not attend any mathematics classes at all.

[31] B.J. Wilson, *Japan: Mathematics Education*, duplicated report to The British Council, October 1983, p.3.

[32] See the *First Report* of the Provisional Council on Educational Reform (English translation, Tokyo, June 1985). The *Second Report* (a summmary of which was published in English in April 1986) does not indicate any clear decision on six-year secondary schools.

[33] A broad account of vocational training institutions in Japan has been given by Shunichiro Umetani, *Education and Vocational Training in Japan*, Institut für Asienkunde, Hamburg, 1980, p.108; for our purposes, that is in drawing contrasts with England, that monograph unfortunately gives too little attention to Japanese Vocational Upper Secondary Schools. Appendix C of National Institute Discussion Paper no.121 gives further information on Special Training Schools. Had resources permitted, the present study would have included a fuller comparison of the standards reached in these schools in view of their large number of pupils; apart from computing studies and data processing, these schools are however of more importance for nursing, dressmaking, book-keeping—that is for the traditional female occupations—than for engineering skills.

[34] In one of the Japanese factories that we visited in England, half of the local top Japanese management were from Technical Secondary Schools.

[35] Akagi, *op. cit.*, p.254; P. Hetherington, in a report on the Nissan car plant near Tokyo, *The Guardian*, 5 March 1986.

[36] Small firms are much more important in Japanese manufacturing than in Britain: half of all employees in Japanese manufacturing were in establishments with less than 80 employees in 1982, compared with half in local units of under 280 employees in UK manufacturing in 1983. Professor Kazuo Koike of Kyoto University has written extensively on the formation of worker skills in small Japanese firms (see, for example, an article with that title in *Japanese Economic Studies*, vol.XI, no.4, Summer 1983, pp.3–57, and the references there).

[37] J. Lorriman, 'Ichibana—the Japanese approach to engineering education', *Electronics and Power,* August 1983, p.575.

[38] Productivity levels in that Japanese factory were 'at least twice as high' as in the similar British factory. The comment on schooling was by Mr G. Grant, Convenor of the Amalgamated Union of Engineering Workers; see Process Plant EDC, *The Challenge from Abroad*, NEDO, 1982, pp.4,5,10. The amount of training taking place in the course of employment is always difficult to evaluate because of the ambiguity of 'on-the-job training'; it is particularly difficult to assess in Japan because the system of publicly-recognised vocational qualifications of the kind familiar in Europe is less important there. Large firms often have their own grading system, and small firms seem to make only limited use of publicly-recognised trade tests. The numbers published as qualifying each year in the latter are much lower than the numbers leaving Vocational Secondary Schools. See T. Ishikawa, *Vocational Training*, Japan Institute of Labour, Tokyo, 1981, esp. pp.16–7.

[39] My thanks are due to Dr Aiwa Akagi of the Tokyo Institute for supplying these unpublished figures; the statistics relate to 'Prefecture C' referred to on p.255 of the article by Akagi *et. al.* The scores mentioned here relate to the average for *all* examined subjects; the proportion of pupils with above-average scores in *mathematics* tended to be slightly higher for pupils entering Technical Schools, but the differences are not great.

[40] Rohlen (pp.28–33) describes a technical evening school which had many unsatisfactory features—low attainments and poor discipline. The reader needs however to keep very much in mind that this school catered 'for the lowest two per cent (in terms of academic ability)'; the majority of Technical Schools are not of this standard. The Commercial School he describes is unfortunately also not typical, as it catered for pupils from the lowest third of the ability range. On the other hand, among the General Schools he describes is one that has the reputation of having the highest standards in the country. The reader consequently gains a misleading impression of the gap between the average Vocational and the average General School.

[41] The details on sizes of schools are taken from the *Japanese Statistical Yearbook 1984*; Akagi *et al.*, pp.253,258; and DES, *Statistical Bulletin*, 11/85.

[42] Further details of the vocational subjects in these courses of study are given in Appendix B of National Institute Discussion Paper no.121. Specimen timetables ('credits' required) in 1973–4 for General Schools and selected courses in Vocational Schools were given by Anderson, *op. cit.*, pp.150–3. Only small changes have taken place subsequently; see *Basic Facts and Figures about the Education System in Japan*, National Institute for Educational Research, Tokyo, 1983, pp.27–33, and Hisao Suzuki, *Outline of Vocational Education in Japan*, Ministry of Education, Science and Culture, 1980, pp.32 *et seq.* According to the regulations for the *Course of Study for Upper Secondary Schools in Japan* (amended 1978, effective 1982, English version published by the Ministry of Education, Japan, 1983) mathematics is a stipulated requirement only in the first year of Upper Secondary Schools; in practice, however, it appears from the specimen timetables just mentioned that most courses retain mathematics for the first two years.

[43] For more detail see our previous comparisons with Germany (Prais and Wagner, 1983, pp.56–60).

[44] See *Course of Study for Upper Secondary Schools in Japan*, *op. cit.*, pp.10,99,137. The Technical School referred to in this paragraph— as having 20 lathes, etc.—conveniently publishes a *School Handbook* in English (Tokyo Metropolitan Kuramae Technical High School, 1986).

[45] The *information processing* course, in addition to computer programming in COBOL, deals with the elements of inventory control and linear programming as part of a final year course on 'Mathematics for Management' (*Course of Study for Upper Secondary Schools in Japan*, *op. cit.*, p.146).

[46] Suzuki, *op. cit.*, pp.37–8,53. The course in technical drawing is subject in many schools to an external examination set by the Association of Technical High School Headmasters. In the better schools about half of all pupils leave with supplementary specific certificates; but in most schools the proportion seems to be much lower.

[47] *Course of Study for Upper Secondary Schools in Japan*, *op. cit.*, p.12. The career prospects of two thirds of a sample of pupils attending Japanese Technical Schools were thought by them to be improved by attending these schools, rather than by attending General Secondary Schools (M.J. Bowman, *Educational Choice and Labour Markets in Japan*, U. Chicago, 1981, p.243).

[48] See *What Works: Research about Teaching and Learning,* US Department of Education, 1986, p.7.