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CHGO-10
Science in Hong Kong - I

4 Kotewall Road, 4/floor,
Hong Kong.

October 25, 1962.

Mr. R.H. Nolte,
Institute of Current World Affairs,
366 Madison Avenue,
New York 17, N.Y..

Dear Mr. Nolte,

Hong Kong is a place of contrasts. The guide books and travel agents glamorize them and call them the exotic contrasts of East and West. To a certain superficial extent the advertising is right, but the basic contrasts are far from glamorous and they go much deeper than just those between East and West. The sort of contrasts I mean are those between the ultra-modern luxury hotels and apartments and the miserable wooden squatter shacks and over-crowded tenements; between the landlords who have been increasing rents (already skyhigh) at about 20% per year, and the coolie who must work 363 days a year to afford "bedspace" for his family; between the latest IBM equipment, and the abacus with its 1,700 year history; between the modern machine tools and the traditional Chinese carpenter's drill; between those Government apartments which somehow manage to have a 24 hour daily water supply, and the boat people who must queue for their 4 hour daily ration from stand pipes; between the girls making transistor radios, and the women on building sites using shoulder poles to carry huge boulders. The list could go on endlessly, but what it adds up to is the basic contrast between rich and poor, new and old, and East and West. In fact Hong Kong shows many of the characteristics of a rich developed country, while at the same time showing the characteristics of a poor underdeveloped one.

The gap between the rich and poor countries is widely recognized as one of the most important problems in the world today. It is also widely recognized that science and technology have made it technically feasible to close this gap quickly. When we recall that Hong Kong is a Colony with, presumably, all the background and facilities of British science at its disposal, and that it already has some of the characteristics of a rich country, - then we might suppose that Hong Kong should be a good place to study specifically how science is being used to close the gap which so obviously exists here. Certainly I had this in mind when I talked with many of Hong Kong's educators, administrators and scientists, about the role of the natural sciences in Hong Kong. My talks only scratched the surface of what is a complex and fascinating topic, but they did unearth some interesting problems, some of which are peculiar to Hong Kong and others which are germane to all newly developing countries.

In this letter I want to discuss science and education in

Hong Kong. Subsequent letters will explore the relationship between science and industry, and science and government, and in a final letter on this theme, I will try and draw the significant points together and examine what might be done in the future.

SCIENCE AND EDUCATION IN HONG KONG

Science education in any country serves a two-fold purpose. First of all there is the cultural need to provide the modern citizen with a modicum of understanding of the scientific age in which he lives. This is particularly needed in Hong Kong where the majority of the people have no scientific background, and where even some of the most basic lessons of public hygiene have still to be learned. Secondly, a science education is needed to train those who are to do scientific work. In order to see how well these needs are being met in Hong Kong it is first necessary to take a brief look at the education system here.

The Hong Kong Education System

Generally speaking a Hong Kong child begins primary school at the age of six. He then receives six years of instruction, which is mainly given in the Chinese language, until at the age of 12 he either leaves school, or goes on for a secondary education. Secondary education can be had at either an Anglo-Chinese school where English is the language of instruction, or at a Chinese 'middle' school where Chinese is the language of instruction. After five years at the Anglo-Chinese school the student can take the English language School Certificate Examination. If he does well in this he stays on at school for two years more and takes the Hong Kong University Matriculation examinations, and if he does sufficiently well in these, he is eligible to go to Hong Kong University. The student who goes to the Chinese middle school usually takes the Chinese School Certificate examination after six years and then may try to enter one of the post-secondary colleges which teach mainly in Chinese. At both primary and secondary levels there are three types of schools: Government, Government assisted, and profit making private schools. The percentages of students attending the different types of schools is as follows:-

	Primary	Secondary
Government	15%	7%
Government assisted	35%	21%
Private	50%	72%

In practise, conditions vary considerably from the idealized case mentioned above. Figure 1a helps to explain the actual situation. It shows that from age 8 to 11 about 75% of Hong Kong children were receiving some form of primary education at the time of the census in March last year. It also shows that many children did not begin school at the recommended age of six, and that many were still in primary schools beyond the age of twelve. The main reason for the late starting age is that with many families where the mother and father are both working, the six and seven year olds are required to stay at home to look after the younger children

FIGURE 1a - % OF ALL CHILDREN AT SCHOOL IN HONG KONG, MARCH 1961

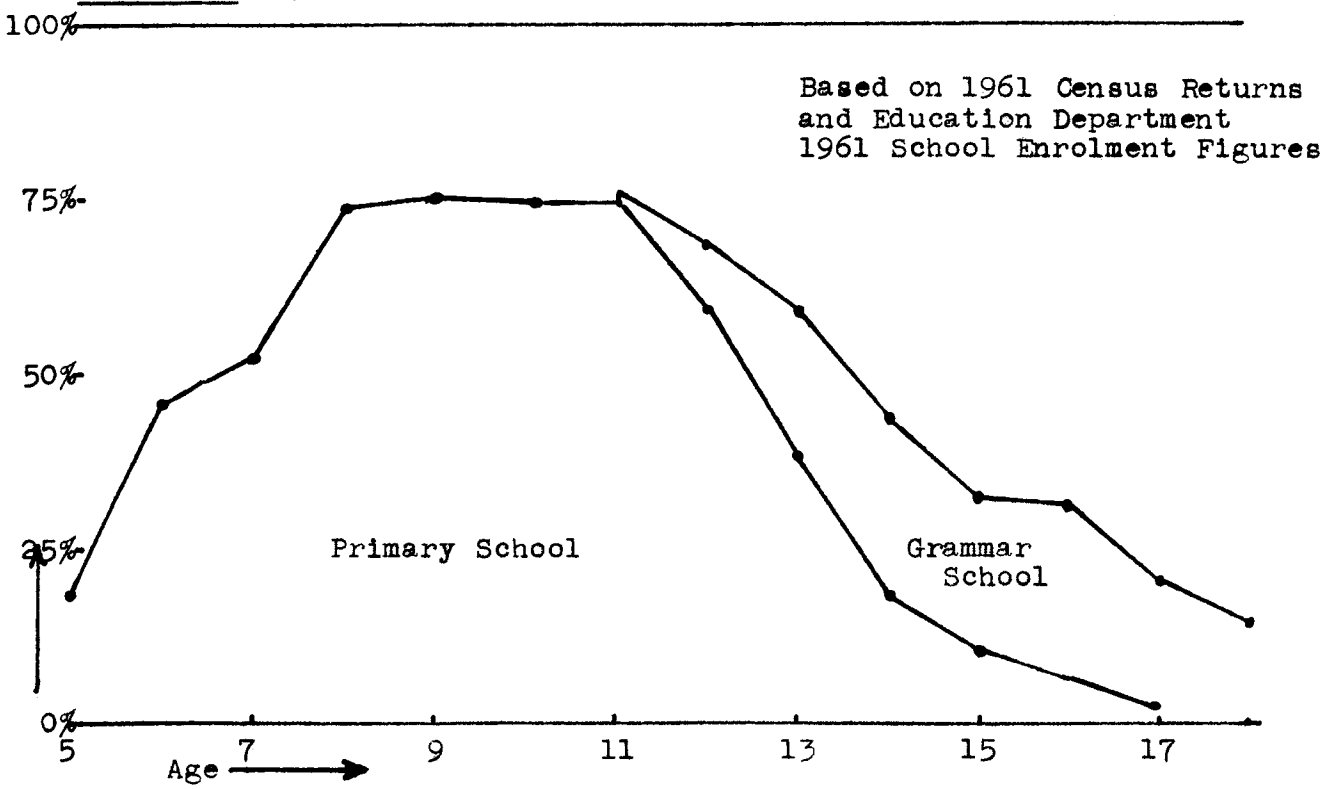
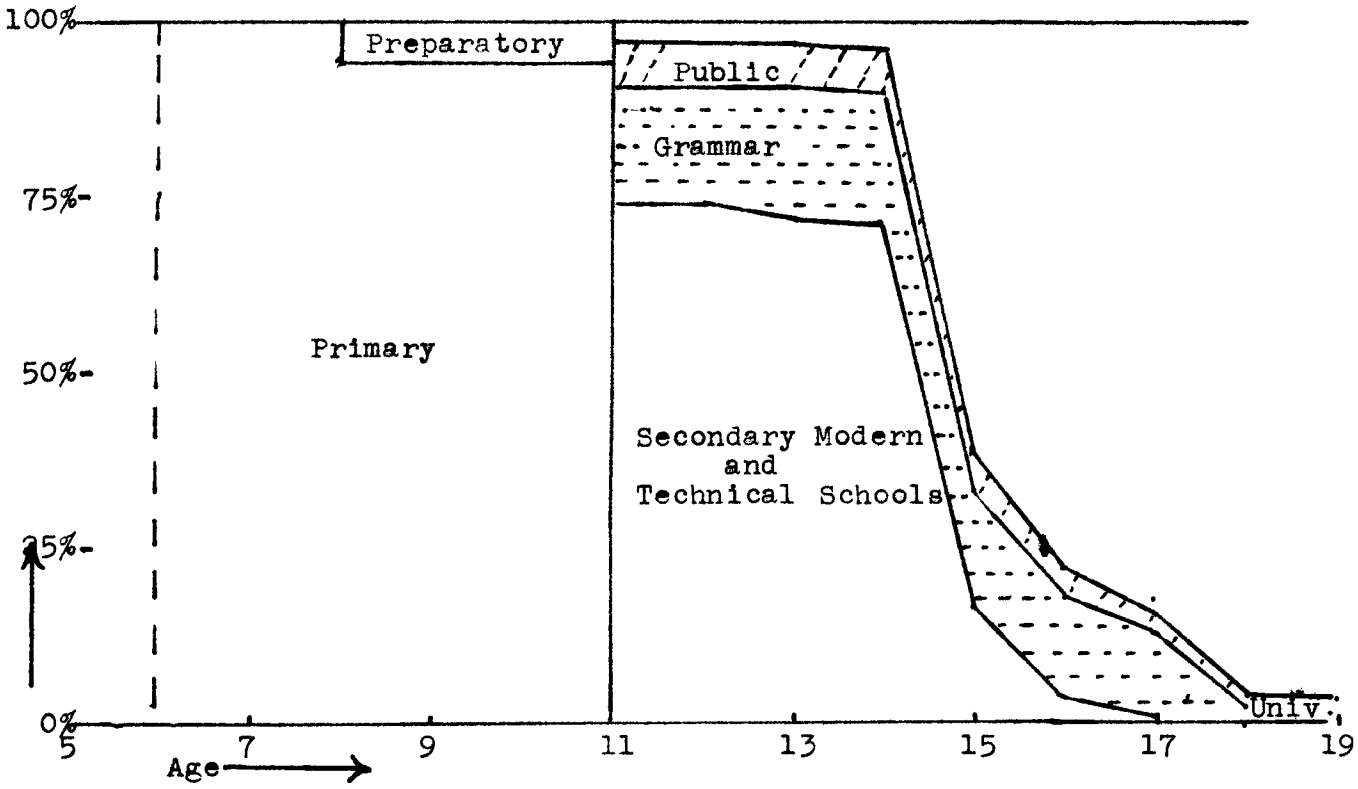


FIGURE 1b - % OF ALL BOYS AT SCHOOL IN ENGLAND AND WALES (1960)



Based on A. Sampson - "Anatomy of Britain", 1962.

in the family. The large number still at primary school beyond 12 is due to a number of reasons. One is the late starting age, another is lack of places in secondary schools, a third reason is the law which prohibits children from working before 14 years of age, and a fourth is the law which requires any employer to provide apprentice training to employees between 14 and 18. Many employers are loth to do this and only employ people beyond the age of 18. The different ages at which pupils start and finish school results in a strange mixture of ages in any given class, and this leads to its own set of educational problems. Figure 2 illustrates this point with graphs showing the number of children of different ages in the first class at all primary schools, and a similar graph for the children in form 5 at the Anglo-Chinese grammar schools.

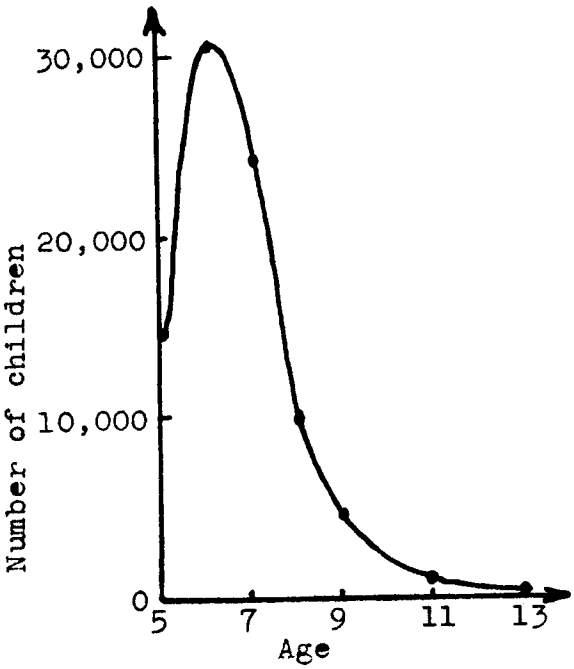


FIGURE 2a - Age range of children in Class 1 at all Primary Schools (1960)

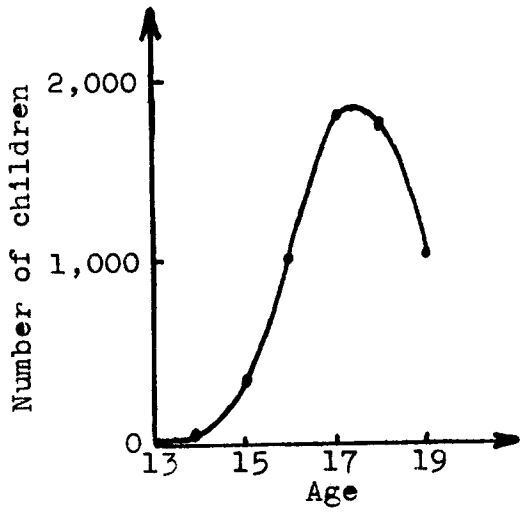


FIGURE 2b - Age range of children in Form 5 of all Anglo-Chinese Secondary Schools (1960).

It is interesting to compare Hong Kong with a developed country, so I have included Figure 1b which shows the percentage of boys at different types of schools* in England and Wales. (I was unable to get hold of the figures for boys and girls.)

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* It is perhaps superfluous to mention that British 'Public' schools are the 133 expensive private schools, plus 64 'Grammar' schools whose principals belong to the exclusive "Headmasters' Conference". Grammar schools come closest to the American High school, and both these and the Public schools provide an academically orientated education. 'Secondary modern' schools are for children of 11-15 years of age and provide a vocationally orientated education.

It is reasonable to make this comparison with the British system since the Hong Kong secondary education very closely follows the British grammar school pattern, having a similar curriculum and a similar type of examination at the end. The main differences in education between Britain and Hong Kong are: 1. There is universal (compulsory) primary education in Britain as compared with a maximum of 75% in Hong Kong. 2. The great bulk of British children between the ages of 11 and 15 receive a 'secondary modern' type of education, whereas in Hong Kong almost all secondary education is of the grammar school type*. 3. In Hong Kong a greater percentage of the children are still at school at age 16 and 17 than in Britain. 4. About 5% of all children have post-secondary education (mainly at universities) in Britain, compared with about 2½% in Hong Kong.

The future plans for education in Hong Kong are a subject of much debate. Figure 3, based on the census returns of last year, shows that the number of children of secondary school age will just about double in the next decade.

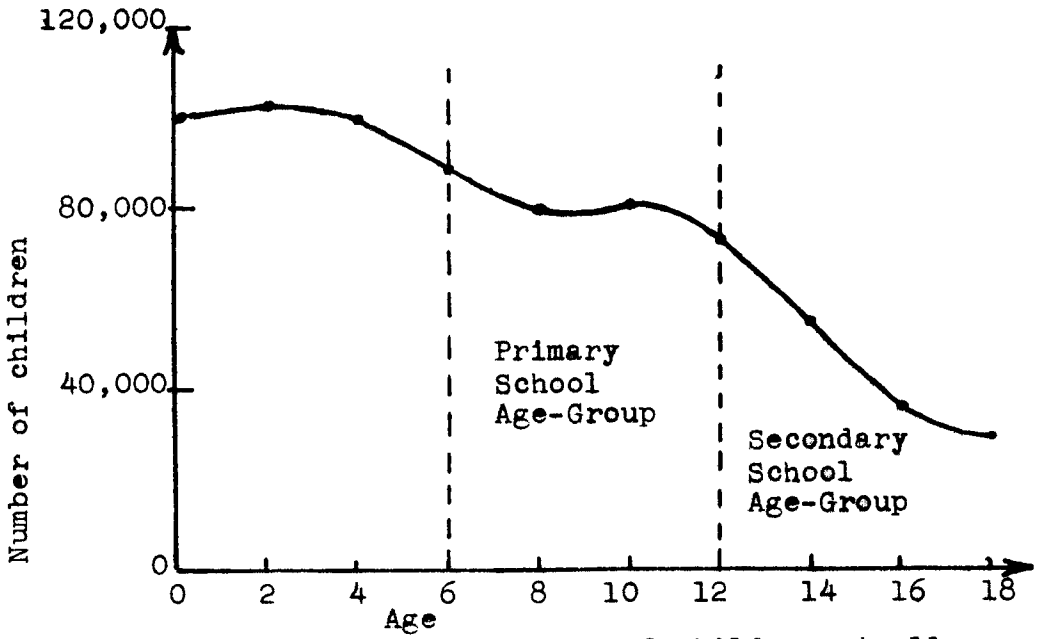

FIGURE 3 - Total number of children at all ages in Hong Kong, March 1961.

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* Hong Kong began a 'secondary modern' system in 1960. Two well-equipped schools were built, - but the experiment seems to have been a flop. The headmaster of one leading Hong Kong grammar school told me, "The Government are actually advertizing for students to go to these schools, but parents want their children to go to grammar schools and have a chance to sit for the School Certificate Exam.. I know of one family paying $70 H.K. a month out of a pay packet of $250 H.K. to send their boy to a second rate private school rather than let him go to the secondary modern."

The Government has said that their policy is to encourage primary education for all, (new schools are opening at the rate of 1 every 4½ days) but the percentage of those receiving secondary education will have to drop to about 14%. The secondary modern system does not seem to have been a success, and so the Government has suggested that two more primary classes should be added, extending the "official" leaving age to 14. Many teachers think that the 14% with secondary education is much too low a number, and some said they would never be satisfied until there was a grammar school education for all.

Earlier I mentioned the post-secondary colleges. These are a number of colleges with widely varying backgrounds and academic standards which were founded as a result of the influx of intellectual refugees in the 1947-50 period. In 1961 there were 3,864 students enrolled at these colleges. The most exciting thing on the post-secondary horizon is the possible creation of a new university in Hong Kong formed by uniting the three leading colleges (Chung Chi, New Asia, and United) in a federal type structure. Chinese would be the principal language of instruction. A commission headed by J.S. Fulton, Vice Chancellor of the University of Sussex, spent six weeks in the Colony during July and August of this year enquiring into the problems of university status. Their report is expected in November.

Some General Problems Pertaining to Science and Education in Hong Kong

Before describing the special achievements and problems at each of the different education levels, I want to mention three problems which I found permeated all levels and which are perhaps the most fundamental of the science education problems in Hong Kong. They can be summarized in three statements - the problem is to decide to what extent they are true:- (i) It is impossible to teach science in the Chinese language. (ii) It is impossible for most students to fully grasp science when it is taught in a foreign language (English). (iii) The Chinese students in Hong Kong have wonderful memories but most of them are incapable of creative scientific thought.

At the moment, science is taught in English at all the Anglo-Chinese schools, at the University, at the Technical College, and in most science subjects in the Chinese post-secondary colleges. It has recently become an urgent matter to decide whether either of the first two statements is true because the Fulton Commission, in studying the problems associated with the creation of a new Chinese university, has been considering whether science should or could be taught in Chinese. Many of the science teachers I talked to thought that it was quite impossible to teach science in Chinese. They argued that technical terms were frequently too complex to be translated into Chinese, that there were too few textbooks in Chinese and that the Chinese language does not lend itself to expressing the more abstract concepts of science. A surprizing number of the teachers who hold this view are Chinese. At least, I was surprised until I realized that these are the Chinese who themselves learned their science using English. They are unfamiliar

with the standardized terminologies which have been adopted in China, and if they were called upon to teach in Chinese they would have to learn a new terminology. I strongly disagree with their viewpoint. After studying scientific Chinese for two years I sincerely believe that any science, even at the most advanced level, can be expressed perfectly well in Chinese. I have purchased two Chinese geophysics textbooks in Hong Kong which explain some of the most complex concepts in potential theory and theoretical seismology at least as well, and in some cases better, than the best English language texts on these subjects. One was written by a Chinese professor, and the other was the translation of a Russian textbook. As in any other language, the clarity depends upon the ability of the writer. I would perhaps agree that it is easier for a poor writer to write "unclear Chinese" than "unclear English". The argument which stresses the greater range of available textbooks and published papers in English is more valid, and maybe sufficient reason for advocating the teaching of science at university level in English. But it is just not true to say that science cannot be taught adequately in Chinese. There is ample proof that it can be - just across the border on the China Mainland.

The second problem is related to the first - can the concepts of science be grasped when they are taught in what, to the Chinese, is a foreign language? There is little doubt that for the best students the answer is 'Yes', but how about the average school child? I asked Mr. Tom Lewis, Senior Science Master at one of the Anglo-Chinese schools, what he thought about this. He wasn't sure how much difficulty was due to lack of understanding and how much to the inability to express themselves. "But" he said, "If an English boy wrote the same answers in examinations as some of the Chinese boys, I would call them wrong. With the Chinese, I'm never sure whether they don't know the answer, or know and can't express themselves correctly." Mr. Locock, Headmaster of one of the best Anglo-Chinese grammar schools, believed that the main difficulty was that of expression. He thought that probably the best answer was to use a mixed language, part English and part Chinese, when teaching science. This problem is more pertinent to the schools than to the universities, since by the time a student reaches a university, his English language ability is usually adequate.

The third problem was mentioned by both secondary and post-secondary teachers, and it is a problem which affects all students, not just those learning science. Tom Lewis summed up the concensus opinion when he said "The Chinese students have a remarkable memory - in an examination they can turn back my lecture notes almost word for word, but give them a problem which they haven't seen before and there's hardly one of them who knows how to tackle it. They won't ask questions in class, and sometimes I feel it is a deadening experience teaching them." A University professor told me that in a Third Year optional course on the History of Science, only 8 out of 42 students continued when they found that it was a seminar course and they were required to discuss and give their own opinions. Time and again I was told that the Chinese student doesn't seem to have any real interest in the subject - he's only interested in passing examinations. One of the few people to give a dissenting

opinion was Mr. Burt, Principal of the Hong Kong Technical College. He said he found no difference in the creative ability between European and Chinese students. He believed that any lack of discussion between teachers and students was due to the students difficulty in expressing themselves in English - but when I suggested that it might then be better to teach technicians in Chinese, he vehemently protested - "Impossible!"

What do the Chinese students say about all this? I asked one of Mr. Burt's students for his opinions. He had arrived recently from Shanghai and agreed with me that it is nonsense to say that it is impossible to learn a technical subject in Chinese - he'd been doing just that for two years at a university in Shanghai before he came to Hong Kong. He admitted that no one in his class at the Technical College would ask questions and said the reason he doesn't like to is because he does not want to be considered a "Teh shu ren" - a special person, one who stands out in a crowd.

If the concensus opinion is right, and the average Hong Kong Chinese are less capable of original thought than other people, then it becomes important to find out why. A UNESCO study has shown that there is no evidence to support the thesis that there is any innate difference in intelligence between the races, and Lee and Yang proved - by winning the Nobel Prize in physics - that Chinese brains are capable of being amongst the most original in the world. I believe there are two reasons for the Hong Kong situation. One is the traditional Chinese scholastic system which emphasized rote learning of the classics as the true education. Even learning Chinese characters is a process which requires only memory work. (I sometimes feel my two years of language study has been a stultifying experience). Thus by tradition and early training the Chinese are taught the importance of memory work. But I think the main reason for the Hong Kong situation is the vicious battle for the survival of the fittest. Education is the passport to a decent job, and in Hong Kong this passport is quite literally a piece of paper. It is the School Certificate or Matriculation at the end of secondary school and a degree or equivalent at the end of the post-secondary education. The mere possession of this piece of paper can mean the difference of a factor of four in starting salary. There is also the increased social status attached to a good education. But there are just too few schools in Hong Kong to meet this almost fanatical demand for education, and only one child in every four can go to a secondary school. Not only that, but the competition is so great that a student needs to pass each year's examinations to be assured of a place the following year. This means that the chief aim becomes to pass examinations. Because of this the teachers cram the students - and the whole education process becomes that of teaching and learning how to pass examinations. "There is just no time to inculcate a love of a subject" said one teacher, "And no time to think."

Whatever the reasons, it is not a healthy state of affairs, a practising scientist not only needs to know facts, he also needs to have a creative mind, and the present education system does not seem to be meeting this need.

Science and education at the different education levels

(a) Science and the Primary School

Since most children only have a primary education any science education they are to receive must be included in the primary curriculum. Formal science courses are not taught in Hong Kong's primary schools, although nature study lessons are given and some attention is paid to the importance of personal and public hygiene. I don't profess to know whether the amount taught is sufficient or optimum - but at least it is a start.

(b) Science and the Secondary Schools

During the first two years in Hong Kong secondary schools the students continue the nature study type of science, but for the next three years many of them receive a more formal education in mathematics, physics, chemistry and biology. The School Science Inspector of the Government Education Department told me that, generally speaking, laboratory equipment was very good in Government schools, good in Government assisted schools and variable but mostly poor, in private schools. Certainly the Government schools I visited were better equipped than my own school had been in England 15 years ago. But both Government and Government assisted science teachers said that it was becoming increasingly difficult to get money for science equipment.

To illustrate the percentage of students studying science at secondary schools I plotted the histograms in Figure 4.

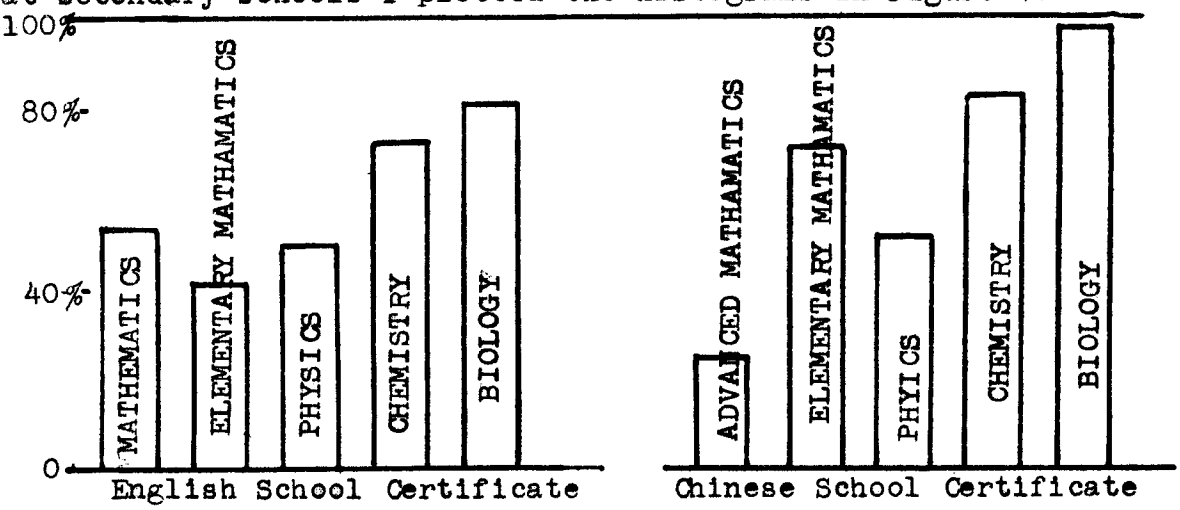

FIGURE 4 - Percentage of all students taking science subjects in School Certificate Examination 1961.

They are based on the total number of students who took the School Certificate Examination in 1961 and the number taking the different science subjects in these exams. They show that rather more than half of Hong Kong's secondary students (i.e. about 12% of all Hong Kong children in this age group) received a formal science education in several science subjects. They also show the popularity of chemistry and biology and illustrate the amazing fact that 98% of

students at the Chinese middle schools had studied biology. To try to get some idea of the 'wastage' of science students I plotted the diagram shown in Figure 5. It traces the fortunes of the group of students who sat for their English School Certificate in physics in 1956, and shows the hurdles which had to be crossed before a very few of them got their University Degree in 1961. It is not the complete story - some students went abroad for further education (although for Hong Kong this is often a loss because many of them do not come back) and others went to a post-secondary college and some went into engineering - nevertheless the 'wastage' is considerable. I use the word 'wastage' here quite deliberately because as far as I can find out, and I must admit that it is very difficult to get any sound statistics on this, very few of those people who didn't get a degree were able to make professional use of their scientific training. This is not to argue that the students didn't profit by their training, but I do feel that Hong Kong is not directly benefiting by it.

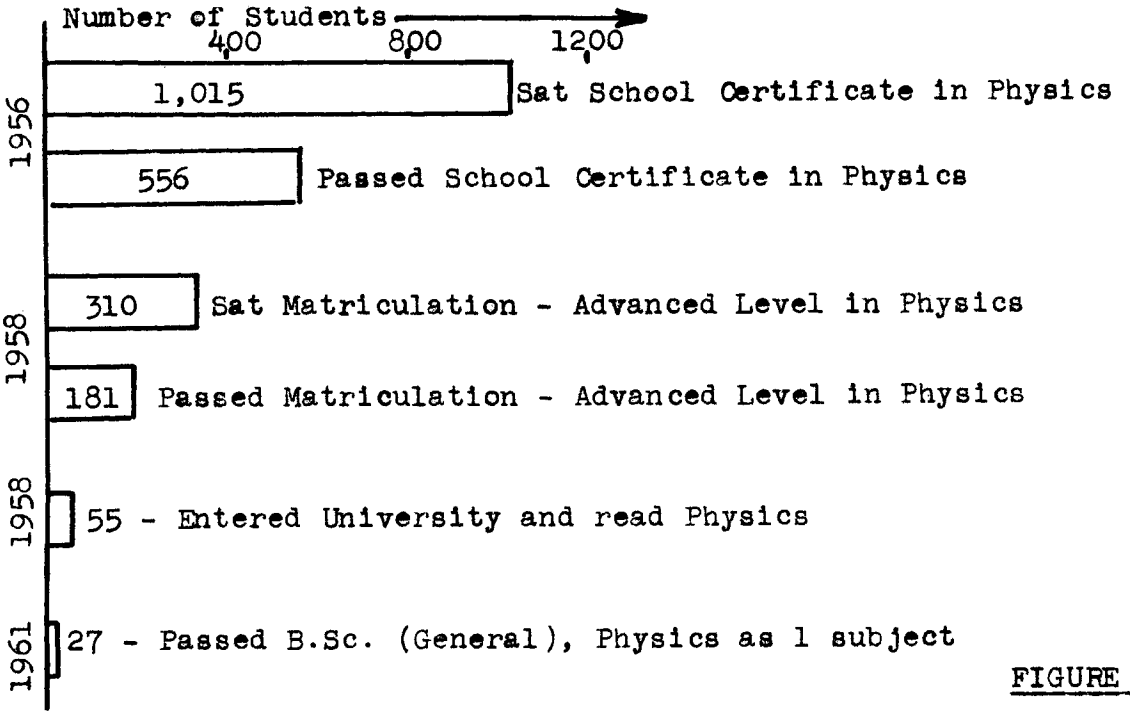

FIGURE 5

Since the science curricula are so similar, it is instructive to look a little closer at the comparison between Hong Kong secondary schools and the combined British public and grammar schools. I have plotted the data already given in Figure 1 in a different way in Figure 6. It reveals the rather startling fact that Hong Kong is giving a considerably greater percentage of its children of ages 16 and 17 a secondary education than is Britain. Actually the reason for it is clear enough. If the Hong Kong curve is shifted 1½ years to the left it almost exactly overlies the British curve. This 1½ year differential is probably due to starting school late, and also to the bi-lingual nature of the education. Particularly at first, education given in a foreign language must go slower than education given in a native language. The result is that the average age of a Hong Kong student taking

School Certificate is 17 or 18 (see Figure 2b) as compared to 15 or 16 in Britain. It does mean however, that the Hong Kong student is maturer when he first learns his science (and other subjects) and is perhaps receptive to a more theoretical approach.

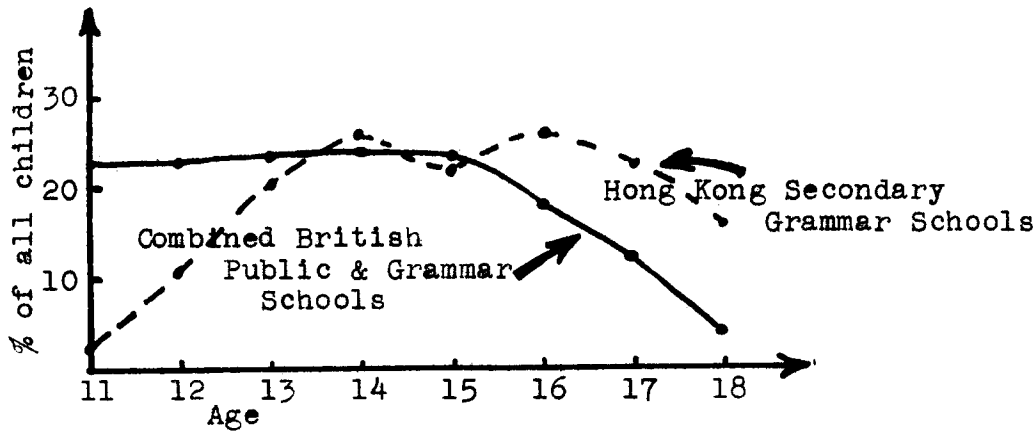

FIGURE 6 - % of all children at Grammar and Public Schools in Britain and Hong Kong.

(c) Science and the Technical College

The Technical College began its 1961-62 session with 747 full time students and 7,321 students in part time day and evening classes. It provides education for two groups of students. First of all it trains technicians and secondly it prepares the best students for engineering qualifications. The Principal, Mr. Burt, is a practical man who runs the College with efficiency and a humane and personal interest in his students. He belongs to the group who have little patience with university research in Hong Kong, and wholeheartedly believes that what Hong Kong needs from science is trained technicians, - "Men who can get out on the factory floor and do a job of work" he said. He even believes that those of his students who go on for professional qualifications are largely wasting their time. "There just are not the kind of jobs in Hong Kong for fully qualified engineers - in fact most of those with professional qualifications end up as salesmen selling engineering equipment." His college is well equipped with all kinds of modern machinery. (I noticed several units of an electrical coil winding apparatus which had been made in Shanghai which apparently were obtained more cheaply and much more promptly than similar equipment from England.) It seems that many people support Mr. Burt's view that Hong Kong needs technicians rather than trained scientists, since the Technical College receives liberal support from Government, industry and overseas donors.

(d) Science and the Post-Secondary Colleges

Of the post-secondary colleges, only Chung Chi has a flourishing science faculty. The Asia Foundation has played a useful part in helping several of the other colleges to start science courses. It has contributed money for laboratories and has also

payed the way for visiting lecturers from the States. Apart from a minor project on mushrooms at Chung Chi, none have done scientific research.

Over lunch recently, in the traditionally colonial Hong Kong Club, I talked with Mr. L.G. Morgan, Advisor to the Government on the proposed new university, about the role of science in this university. It was from him that I first learned of the controversy about whether science should be taught in English or Chinese. But what seems likely to be one of the biggest difficulties is the reluctance of the three colleges to unite and form a single science faculty. Despite their strong desire for university status, each wants to have its own staff and even its own laboratories. Mr. Morgan agreed that this was not good sense. It would mean triplication of facilities, extra staff and would result in greatly increased costs. He speculated on what the Fulton Commission would recommend in its report. "Maybe it will agree to separate laboratories and staff for the first two years," he said, "But I think it will recommend a joint third year and joint facilities for research work". Actually I don't see how even this would succeed. The only way to create a strong science faculty is for the colleges to unite right from the start. The Commission has already announced that it will recommend some form of university status, but we must wait a few more weeks to find out just what that form will be.

(e) Science and the University

A Science Faculty was not started at the University until just before the War, in 1939. Now there are five departments, Mathematics, Physics, Chemistry, Zoology and Botany, with a total enrolment last year of 230 students. The Arts Faculty still stubbornly clings to the Department of Geography and Geology, despite recent attempts by some of the scientists to lure Geology into its logical position with the other sciences. There is a three year undergraduate course leading to a General Honours Bachelors Degree, and a fourth year in some departments leading to a Special Honours Bachelors Degree. This is the system of most British 'redbrick' universities.

It is generally accepted that any university worth its salt should have two functions, one is to teach students and the other is to do research. The fact that British universities recognize the Hong Kong degree as equivalent to a British degree indicates that Hong Kong University is adequately teaching the facts of science, but what about the second function of a university? In all the science departments some research is in progress, all have a few students reading for Masters and Doctors degrees, but financial support is pitifully small. In 1960-61 the total research money for the whole University, administered by the University Research Grants Committee, was $41,500 ($7,300 U.S.). It is true that some departments, particularly those in the Medical and Engineering Faculties, received extra money from private foundations, but it is also true that several exciting research projects were unable to get off the ground because of the lack of "a modest amount" of research money.

The bottleneck is the Hong Kong Government which is not convinced that research is a necessary function of Hong Kong University. One Government educator said to me, "What contribution has any of the research done at the University made to Hong Kong? Take Muscle Receptors, for example, (a branch of research for which the Zoology Department has received international recognition), now what on earth good is that?!" The top Government officials are more discreet, they pay lip service to research but won't follow through with the funds. As one science professor said, "I wouldn't mind so much if they (Government) weren't so damned 'British' and polite about it! 'Oh!' They say ... 'Such and such research is very interesting - of course we must support it - excellent idea - what's that? - needs money? - Oh, I'm dreadfully sorry ....'".

The type and place of research in a university is not a problem which is unique to Hong Kong, it is a problem which faces all the poorer countries. The British physicist and Nobel Laureate, Professor P.M.S. Blackett, has argued that the poor countries cannot afford the luxury of basic research, and that they should only do applied research which has a direct bearing on the country's economy. None of the science professors at Hong Kong University agreed with this view. Most of them repeated the usual arguments: That only workers on the frontiers of knowledge can communicate the excitement and true value of science to students; teaching devoid of research becomes bare bones and dull; only if there is support for research will the best staff be attracted to Hong Kong; and that if a community has a university then it is part of the university's job to contribute to the world store-house of knowledge, no self-respecting community can only take - it must also give.

Possibly the best compromize on this question of research at Hong Kong University was propounded by Professor W.D. Chesterman, Professor of Physics, in his inaugural lecture last year, when he said:

"The choice of research subjects in physics for an isolated university such as Hong Kong is a difficult one, for it is necessary to fulfill certain criteria. It is wise to choose as the main research subjects <u>those which can only be done in Hong Kong</u>. The work should if possible have a unique quality related to the environment in which the university exists. Thus the students who take part in the programmes can feel that the work they do is related to the needs of the society in which they live, the society which provides for them their university education. Such unique quality does not necessarily mean that the work should be applied physics."

Yet despite two years of continued fighting, he has been unable to get the H.K. $200,000 he needs to get started on his major research project.

Two years ago an "International Conference on Science in the Advancement of New States" was held at Rehovoth, Israel. It was a conference where some of the political leaders of the new

African and Asian countries met with some of the scientific leaders of the more developed countries to discuss how science could best help the new countries. Summing up the meeting, Abba Eban, President of Israel's Weizmann Institute, said:

"The central crux, I think, is the educational problem. The advanced states have the men who understand modern science and technology, who can absorb it and who can transmit it into the veins and arteries of their societies. Some of the younger states do not. The new states will not begin to catch up until they have scientific personnel who are, as it were, the catalytic agents - the receptacles essential for the absorption of the new science and new technology. This I think is the central conclusion of the Conference".

Edward Shils, Professor of Sociology at the University of Chicago, said at the same conference that one of the fundamental problems facing governments of the new states was how "Government aid to research and training can best foster creativity, inventiveness and adaptiveness."

Hong Kong is not a new state, but many of the problems which it faces are the same as those of the new states, and both Abba Eban's and Professor Shils' comments are pertinent.

I have tried to show in this letter that Hong Kong educators are succeeding in teaching a lot of students a lot of science; but I seriously doubt that they are succeeding in teaching those students to be either "creative, inventive or adaptive".

Yours sincerely,

Geoff. Oldham

C.H.G. Oldham.

Received in New York October 29, 1962.