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THE GIFTED CHILD
and the need for Planners and Leaders

Why have Germany and Russia made such strides in science and technology? Where has America failed? The writer suggests that the explanation lies in the rigorous educational system of Europe in comparison with the softer 'comprehensive' system of the States. S. Africa must demand much higher educational standards.

by S. M. NAUDÉ

FROM this title it might appear that gifted children are thought of especially as future planners and leaders. I should like to include among the planners, researchers and inventors, because they are today the planners and leaders of the technological atom-age in which we live.

From time to time the world has produced exceptionally gifted children like an Einstein, or a Planck in the field of physics. The question immediately arises: why is it that certain countries like Germany, Holland, France and England, for example, have produced so many Nobel prize winners per head of population compared with countries like America? A closer analysis of the Nobel prize winners in physics and chemistry up to 1955 shows that per million of population, Germany has received three times, England two-and-a-half times, and France one-and-a-half times as many Nobel prizes as the United States. Holland, with a population one-sixteenth that of the U.S.A., has received four prizes compared with 22 by the U.S.A.; Switzerland, with only one-fiftieth that of the U.S.A., has received five, and Austria, with one-twentieth, three.

Consider the field of atomic fission. Twelve basic discoveries in physics, chemistry and mathematics have made nuclear energy a reality. Of the twelve, three each have been made by the Germans, the English and French; one each by a Danish and an Italian scientist, but only one by an American. And yet the population of France, Germany, England, Denmark and Italy together is only one-third greater than that of the U.S.A.; the total national wealth is far less than that of the U.S.A., but in this particular measure of national brain-power they were eleven times richer than the United States.

Or again, take the successful development of the atom bomb. America offered the facilities and unlimited funds, but the more important contributions of brain power came from Italy's Fermi and Segré, Denmark's Bohr, Hungary's Teller, Wigner and Szillard, Germany's Hahn, Strassmann, Einstein and Bethe, and England's Cockcroft and Chadwick, to give but a few of the top names. According to Admiral H. G. Rickover of the U.S.A., 60 per cent to 70 per cent of the best American scientists were not born or educated in the U.S.A., and some of their most outstanding scientific contributors to the atom bomb had their education in Europe.

No educational system can guarantee that it can produce geniuses up to a given proportion. But it must make it possible to discover brilliant gifts at an early stage to nourish them and to develop them in keeping with the student's own talents and motives.

To what may we ascribe the relative success of the European scientist in comparison with his American colleague? I think that the solution must be sought in the differing systems of education.

The Continental Systems

Let us examine first the origin of the present continental school systems. The distinguishing characteristic of the continental educational system is that it is efficient and cheap in com-

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parison with the results that are obtained. This is not surprising when we note that it was designed in its basic form by the Prussians after their defeat by Napoleon in 1806. At that time the country lay under the heel of a conqueror, its richest provinces cut off and its treasury empty. A small group of patriotic Germans cleansed their country from top to bottom, including a thorough reform of a backward educational system. They realised that this was the only hope if Prussia was to rise again.

Prussia was one of the first states in Europe to realise that the citizens of a modern state must have at least an elementary education and that its leaders must be sufficiently educated to cope with the problems of the approaching industrialisation. Prussia was one of the first states to make elementary education compulsory and free and to place all education under the control of the State. As the population was poor, school fees had to be kept low and a large part of the cost of education fell on the State. The State was, however, also poor and because of this the Prussians designed a carefully thought-out two-stream system: one stream designed for the mass of the children and the other for those chosen for the higher professions.

The rapid rise of Prussia in the industrial and military fields and the brilliance of the scientific research carried out by its Universities, to which students from all over the world streamed, led to the adoption of its basic educational system by the greater part of Europe. Prussia's lightning victories in 1864, 1866 and 1871 only about sixty years after the defeat by France are everywhere regarded as a victory for the Prussian schools and universities.

Basic Principles

The basic principles of the system were as follows:

1. That elementary, secondary and university training must be directed exclusively to the development of the intellect of the student to its greatest capacity. All vocational training had to be done in schools which were specially established for this purpose.
2. That the secondary schools must provide a broad, general education in the shortest possible time so that professional studies could begin at not later than 18 years.
3. In order to prepare children by the age of 18 for their professional studies, serious study of foreign languages, higher mathematics, literature, geography and history had to begin not later than the age of 9. At this age more rapid learners were gradually separated from the slow learners.
4. In order to complete this broad, general education within nine years, carefully worked-out courses for every subject, in ever increasing logical sequence year by year, from the simple to the complex, were essential. Optional subjects had, therefore, no place in such a complex and well-balanced programme. It was only at the University level that any choice of subjects was allowed to students.
5. Three basic types of secondary education were slowly developed and provided; the classical, the semi-classical and the mathematical-scientific. Each of the three types provided a broad, general education to enable the student to follow any professional university course. For example, a matriculant from the classical secondary school could train as an engineer by taking additional courses in mathematics and the sciences.
6. Reasonable freedom was allowed in each school so long as national standards were maintained. These standards affected the qualifications of teachers as well as those of the matriculants. Tests of matriculants were applied by authorities outside the schools by means of comprehensive examinations without which no certificates could be awarded.

The European educational system was later made more democratic by the abolition of school fees and by the subsidisation of the education of outstanding pupils and university students by means of bursaries. This system is now widely applied in England, where for example, three-quarters of the students at the University of Oxford receive government bursaries. Russia has gone farthest in this direction by giving outstanding students bursaries and subsistence allowances.

European secondary schools have also junior high schools which prepare pupils at the age of about 15 for sub-professional careers.

The whole system is flexible and can be used for different national aims. It has the greatest advantage that it allows children with diverse

brain capacities to proceed at their own pace in classes which are more or less homogeneous in intellectual demands. While Europe has opened its educational institutions to all children, it has, at the same time, maintained the fundamental requirements of thorough training, a high standard of professional competence among teachers and a solid pursuance of the principle that a secondary school educates, that it develops reasoning powers, and that industrial training and training in social needs must be given elsewhere. Making the schools more democratic has not led to a lowering of academic standards. Examinations eliminate those who cannot benefit from further education.

This was the European system which the Russians imported about 25 years ago and which has enabled them to advance at such a phenomenal rate. By paying the living costs of all gifted students, by spending large sums on buildings and the equipment of wonderful laboratories and libraries and by offering to their children no other way to success than through education, the Russians have succeeded in raising a greater proportion of their students to the university level than is the case in the rest of Europe or America. It is true that there are three times as many students fitted for University training than there are University places with the consequence that the Universities select only the best.

The method is simple. Combine the European educational system with sufficient funds and motivate the children by offering them the highest material rewards for hard study and you can get the same result in any part of the world. China and India have already begun to apply this system.

The English System

The South African school system was formerly based primarily on the earlier English system. Quite a number of our present practices can be traced to that system. After about a hundred years England has at last managed to bring its system into line with that on the continent of Europe. England was ham-strung by the tradition of private schools and control by thousands of local school boards, but finally the English have succeeded in working out a compromise by which the government and the local school authorities work together. The local school boards had, however, to be abolished and have been replaced by a number of district councils. England has been able to overcome step by step the political handicaps towards a sound public education, but it took a century and she was still well behind Germany, for example. Was this perhaps the reason why Britain in spite of her extensive empire and her enormous lead in industrialisation was quickly overtaken by Germany both in the industrial and military fields? Education is far too important to a nation's welfare to remain for long a subject of debate.

Position in U.S.A.

And what is now the position in the U.S.A.? Admiral Rickover said the following on the 6th of December, 1957, at the opening of the Atomic Energy Training School of the American fleet: "We are slowly thinking our way through a thicket of bitter disappointment and humiliating truth to the realisation that a nineteenth century educational philosophy is as hopelessly outdated today as the horse and buggy. Nothing short of a complete reorganisation of American education preceded by a revolutionary reversal of educational aims, can equip us for winning the educational race with the Russians.

"One of the great defects of our educational system is that it does not respond to changing national needs for specific kinds of professional people. Because of the considerable latitude allowed to the student in selecting subjects, not only in college, but even in high school, he may be so unprepared to study a given profession as virtually to bar him from it unless he has begun deliberately to prepare himself for it in high school. For example, we need a great many physicists *now*. But a youngster who has taken no physics and little mathematics in high school, as is true of most of our high school graduates, and who then takes the usual two years of liberal arts in college is, in effect, precluded from becoming a physicist. And yet in today's rapidly changing technological civilisation it is absolutely essential that the educational system be sufficiently elastic to permit students to shift quickly into study for those professions most needed at any given moment.

"This inelasticity of our school system is the direct result of the sentimental attachment we hold for the concept of a comprehensive school in which all children — stupid, average, talented and bright — march sedately up to the 18th year, absorbing so little real education that it

takes another four years at college before the pre-professional stage of education is completed. In order to make some small allowance for different mental capacities we allow junior and senior high school pupils considerable leeway in selection of subjects. Electives are a necessary consequence of forcing the educational straitjacket of the comprehensive school on *all* children in the name of educational democracy. We thus thrust upon our teenagers decisions which may adversly affect not only their own professional careers, but also the country's ability to obtain the professionals it needs.

"I have long felt that we erred grievously when we set up our own public educational system without first making a thorough study of what at that time were the best foreign educational systems; that is, those of continental Europe. England, whose educational experiences have in many ways paralleled our own showed greater wisdom. Though then the premier nation of the world, she was not too proud to profit from the experiences of small countries like Holland and Switzerland; or potential enemies like France and Germany."

I apologise for this long quotation, but as we in the Transvaal introduced this American system of comprehensive schools in January, 1958, I wanted to give in his own words the judgment of the system in the U.S.A. made by the head of the American fleet's department for Atomic Energy Development for submarines. Elsewhere he has said that in his work in connection with atomic energy he has interviewed thousands of applicants. Only a very small percentage had the necessary background for such training and it was then that he came to the conclusion that there was something radically wrong with the schools to which the training of these young people was entrusted.

Holland as Example

What is comprised in this continental education which Admiral Rickover so admires? I can answer this question best by quoting from my report on my visit to Holland under the cultural relations scheme between Holland and S. Africa:

"Primary school education ends at about 12 years of age. An examination at the end of the primary school decides whether a child is suited for preparation for an academic career or whether the child should follow a curtailed course in a trade school. In the first case the child can follow one of two courses:

1. He may follow the five year course in the Hogere Burger School (H.B.S.) in which the following ten compulsory subjects will be included:

   First Year: Mathematics, Dutch, French, History, Geography and Biology.

   Second Year: The above six subjects plus English.

   Third Year: The above seven subjects plus German and Physics.

   Fourth Year: The above nine subjects plus Chemistry.

   Fifth Year: All ten subjects.

2. Or he may go to the Gymnasium for a six-year course which will include the same ten compulsory subjects as in the H.B.S. plus Latin and Greek.

   First Year: Mathematics, Dutch, French, History, Geography, Biology and Latin.

   Second Year: The above seven subjects plus English and Greek.

   Third Year: The above nine subjects plus German and Physics.

   Fourth Year: The above eleven subjects plus Chemistry.

   Fifth Year: A—No Physics and Chemistry, but more languages (17 hours).

   B—Less languages (6 hours) and more Mathematics and Physics.

   Sixth Year: The same as the fifth year.

There is also a third type of school, the Lyceum for children who cannot decide between the H.B.S. and the Gymnasium. This offers them one or two preparatory years and after that they can make their choice between the H.B.S. and Gymnasium or even a trade or other vocational school.

The children who have attended the H.B.S. or Gymnasium write a school leaving examination at the age of 18 or 19 and then go on to the University. The child is now already one or two years older than the S. African child and

he must now begin to prepare himself for the "candidates examination" in four subjects which he will write after 3 or 3¼ years study. After that comes three years up to the Doctoral examination in one major subject and two minor subjects, and then two or three years for the Doctor's dissertation and final examination. The student is thus 26 to 28 years old before he graduates with a Doctor's degree compared with the S. African student's age of 24 to 25, if he has gone straight through with his studies after matriculation."

No Loss of Standards

It might be expected that the standard in each of the ten of twelve matriculation subjects must be much lower than in S. Africa, where we demand only six or seven subjects for matriculation. From my own experience when I was a student in Germany, and came into contact with the first year German student who had followed more or less the same course as his Dutch colleague, I can assure you that a much higher standard is reached by matriculants on the continent. A fellow physics student in Berlin read Greek tragedies in the original text for relaxation. My daughter is at present a scientific assistant in the physics laboratory of the University of Groningen. One of her first jobs was to prepare physics experiments for first year students. She wrote that to her surprise the first experiment was one that she had not done in the whole course of her three year training in physics in S. Africa. She had to read further into the theory of the experiment.

This high standard is reached because the continental education system separates the gifted children from the less gifted by the age of twelve, and then subjects them to higher standards in academic high schools. In addition, children in Holland go to school for the half day on Saturdays and each school day is half an hour longer than ours. The pupil is also on the average one year older at matriculation than the S. African pupil.

In a special study of gifted children that Dr. Hollingworth carried out in the State schools in the State of New York, he found that children with an I.Q. of 135 could complete the prescribed curriculum in from one-quarter to one-half the time required by the average pupil. An investigation by Prof. Terman of the U.S.A. showed that the majority of gifted children could have been two to three years further on in their school career had they been correctly placed. The danger is that the gifted child who is held back because he must mark time while the average child catches up, loses interest at school and what is going on in it. The child becomes frustrated. Perhaps this is the reason why S. African teachers of considerable experience have found that it isn't the exceptionally gifted child with an I.Q. over 135 who does well at school, but rather the child with an I.Q. of about 120.

The tragedy is that the intellectually outstanding child in S. Africa receives less attention today than the average or even the physically or mentally backward child. I would be the last to say that we must not make special provision for these unfortunate children, but at the same time I must ask emphatically: Can we not do the same for our gifted children? These are the people on whom the future of Western civilisation in our country depends. There are not many of them. According to American figures only about 15 per cent to 20 per cent of American children have an I.Q. of 115 or above. This is also by chance the percentage of children in Europe who are able to pass the admission examinations to academic secondary schools. In America only 1½ per cent to 2 per cent have an I.Q. over 135. These are regarded as brilliant children.

In discussions with teachers I have been told that this is now exactly what is envisaged with the comprehensive school. The plan is to place children with I.Q. over 110 into separate classes and to prepare them for an academic career. If these children were now to be obliged to take the basic academic subjects like six or seven of the ten or twelve which are compulsory in Holland for admission to University, the danger would not be so great, but unfortunately we have only two compulsory subjects, the two official languages, English and Afrikaans.

Electives

Admiral Rickover writes as follows on the choice of subjects in the U.S.A.:

> "In addition to the common core of obligatory courses our high schools offer a wide choice of elective subjects from which each child may pick those he prefers. Among the electives there are the tough academic subjects which constitute the college preparatory

programme — Mathematics, Algebra, Geometry, Trigonometry, Physics, Chemistry, Biology, foreign languages; there are the vocational subjects which make less demand on the intellect or will power, since little homework is required — domestic science for the girls, and various trade skills for the boys; finally there are the subjects of a recreational nature or those which in a vague sort of way aim to train children in co-operative and helpful living . . .

"All except the academic subjects are of the kind which we might term 'know-how'. That is, they have nothing to do with the school's primary task, which is to teach young minds to think and to train them in the elementary tools of learning. This is a task which can be performed only by the school. Vocational recreational, or life-adjustment training can be and should be obtained elsewhere. Our teacher shortage would be greatly lessened if we relieved them of all responsibilities except those of teaching the minds of the children and developing their bodies through physical exercise.

"Nowhere else in the world are curricula in secondary schools so largely elective as in America. Very few children have so earnest a love for learning — such intellectual fortitude — as to pass up the chance to coast through school on the easy subject. Unless they are wisely guided by their parents and teachers, they will tend to choose the easiest and most pleasant school subjects.

"It is the children from the better homes where entrance into college is taken for granted who take the college preparatory course at high school. But the talented children who come from poor homes often lack the parental example and urging to take this more difficult course. Classes are too large and teachers too burdened with extraneous responsibilities heaped upon them by the community to have time for the kind of counselling which discovers the talented children from poor homes and encourages them to take the tougher courses."

The Comprehensive School

What Admiral Rickover states here confirms my suspicions that the comprehensive school holds great dangers for our country. Those of us who have studied in America realise that differentiated education in the comprehensive school is America's greatest stumbling block today in her cold war with Russia. My son is studying in the U.S.A. According to him students have to work exceptionally hard in their post-graduate engineering course to reach a standard comparable with that in European universities. When I put this fact to a Dutch Professor in the technical high school in Delft, his remark was: "Yes, but the children in the U.S.A. play the fool so much and learn so little in school that they have to make up the leeway by doubly hard work at the University."

To quote Admiral Richover again: "One half of our children who are endowed with the ability to enter college or university do not do so. For every high school graduate who eventually earns a Doctoral degree there are 25 others who have the mental capacity to achieve that degree but do not. If our schools had succeeded in inspiring love of learning in these children, they would have become professional men and women and we would not be faced today with a deficiency of manpower."

The kind of school that a community has depends on what a community is prepared to pay for it. If we value the material needs of the child more highly than the development of his mind and intelligence, we must expect that our schools will not be able to produce the professional men and women competent to maintain our culture and civilisation.

As I have already said, I do not believe that the comprehensive school is the solution to our problems. How can anything which has been tried out in America and found wanting, as Admiral Rickover and others have emphasised over and over again, be a success in South Africa? It is a pity that an experiment which has already failed should be tried out again on our children. I am afraid that this isn't the first time that American theories and experiments have been tried out in our country with tragic consequences. I think, for example, about our primary schools. The old idea that children should thoroughly master the three Rs. has given way to the new idea that everything must be made as easy as possible for the child and that there must never be any drill work. The consequence of this is that the children's spelling is wretched and that they arrive in the high school with a poor knowledge of grammar which is so necessary for the learning of foreign languages.

Teacher Training Wrong

I am afraid too that the training of our teachers has also taken too much from the Americans. Students who have already completed a degree course regard the diploma course in Education as soul-destroying and nothing more than a waste of time. I think it is high time that the training of teachers should be thoroughly investigated in order to find out what improvements can be made. In addition to a thorough knowledge of the subject matter it is also necessary that the teacher must be inspired with enthusiasm and idealism which will stimulate his pupils and inspire them to aim high. I get the impression, however, that our teaching courses don't succeed in giving the young teachers these essential requirements when they enter the field of education.

The American public has realised that their educational system has landed them in a morass. They are unable to get themselves out of it because education has been entrusted to the individual states and even to cities. All kinds of methods are being sought today to discover and to bring to the fore the gifted child.

Among other things a committee of the Senate has been appointed to report to the Senate. The committee called on outstanding scholars and scientists to give evidence. According to the Washington Post of 31st January, 1958, Prof. Edward Teller one of the physicists imported by America from Hungary, and who had a lot to do with the development of the hydrogen bomb, said that most of the blame for "the present lack of interest in science and mathematics must be placed on the system of education. First, the high school teacher, though thoroughly trained in how to teach, is poorly trained in subject matter. If the teacher does not know and enjoy his subject, the student won't like it either. Secondly, in the elementary school classes in which pupils have only one teacher, the teacher usually knows nothing about science at all. If a child has any interest in science, it is extinguished by the time he graduates to the high school." He also said "talent is not an innate quality. It is the result of interest and consecration. Talent is something like falling in love. Once interested, you do surprising things for it, voluntarily."

In addition a great industry has set up the Westinghouse Science Talent Search in which 25,000 matriculants compete for attractive bursaries to take them to University. It is interesting to read what one of the finalists, Paul J. Devine, said in answer to a question a newspaper put to him. The question was "What goes into making a young scientist?" His answer was "A desire to read, a curiosity and sometimes a bothersome itch to find that nebulous thing called truth. The first time I remember being interested in science was when I read an article in the encyclopedia about astronomy." Do we encourage our children sufficiently to read and to find out the truth for themselves? Do we do sufficient in South Africa to discover talent and to encourage it? Do we not make much more in South Africa of the young athlete or rugby player who shines on the sports field than we do of the student who has achieved six distinctions in the matric examination? The name of a Toweel or of a von Vollenhoven appears more often in heavy type at the head of a column in our newspapers than that of Dr. B. F. J. Schonland who has achieved international fame by becoming head of the Atomic Energy Research Establishment at Harwell in England. Ask a physical science class who knows who von Vollenhoven or Toweel is and who Schonland is and I am convinced that the sportsmen will win.

Advisory Council Needed

I want to add immediately that I don't want to blame the teacher for the present state of affairs. Nor the present government nor the provincial councils. It is the system of education that we have to day that is wrong and which is a heritage of the last 50 or 100 years. I would strongly plead for an Education Council to advise the Minister of Education, Arts and Science directly, and that the first task of the Council would be to investigate the kind of educational system which South Africa needs. Education is the foundation of our Western civilisation and if that is wrong our land and our people will suffer. Steps must be taken in the first place to ensure that there are enough teachers of the right quality trained and that the salaries and status of teachers will be such that the best talent in the population will feel attracted to teaching and devote their lives to it.

The present system by which the gifted teacher can only move to a higher post when there is a vacancy and by which he can often be promoted from a high school where he is teaching mathematics to a principalship or even a vice-principal-

ship of a primary school merely to get a higher salary must be changed. There are already so few teachers with a scientific training that we just cannot afford to lose in this way men and women who have such a training.

At the end of the primary school course children ought to write a nation-wide test. This test would determine whether the child was fitted to follow a more academic course at high school. If the child is not fitted for this, provision must be made for him to learn a trade and above all he must be taught to take a pride in such an occupation. A piece of plaster work or wood work for example is surely something that a man can be proud of just as much as of a piece of research. The child must be taught to find enjoyment and to take pride in a piece of handwork however small it may be which he has completed to the best of his ability. I am thus not against differentiated education for the child who is not admitted to the academic classes.

The gifted child must be led towards the academic classes. He must have the best teachers and financial handicaps must be removed. Recently I heard of gifted children with a high intelligence and exceptional school achievement who were placed in the C stream in a certain school as they could not go beyond Std. VIII because of home circumstances. Talent is so scarce that we cannot afford to lose even one of such children. I am quite convinced that the parents of such children would not stand in the way if it were explained to them what a rosy future awaited their child if he went on with his education and later went to University. There are fortunately sufficient bursaries for students who have done well in matriculation to enable them to go on to university.

Courses

The academic classes should take as far as possible six or seven basic subjects, namely Afrikaans, English, Mathematics, Physics and Chemistry, History and Latin or German. These would give the children the necessary background and general training so that they could decide after matriculation whether they should study arts or science at University and also which direction they should follow in the natural sciences. It must be explained to parents that it is not necessary, for example, for a girl to study domestic science at school if she wishes to study it later at University. It is far more important that she should study mathematics, biology, physics and chemistry at school because these are the basic subjects which she will have to take at University in following a domestic science course.

My big objection to the present South African school system from the primary to the secondary school is that far too much is done for the child and far too little encouragement is given him to do things for himself and to learn to think. According to the President of Amherst College in the United States, education isn't something which is done for or to the pupil or student. Education is what the child or student does for himself in the development of his own powers and talents. Teachers can help; so can the course which he follows and the atmosphere in which he works. But in the end the whole problem is entirely the problem of the pupil or the student. If he wishes to become an educated man, he must apply his best powers to the hard, unpleasant and often discouraging task of disciplining his own intellect to the point where it becomes an effective mechanism with the sure knowledge that the developed intellect is the strongest weapon in the whole world.

We in South Africa must impress on our children and students more and more that we are surrounded by millions of Bantu who are beginning to realise this truth and who are taking every opportunity to learn and study. The white man's white skin will not save him from going under, but only the higher development of his brain and character. For this reason it is especially important that we should give our gifted children guidance and offer them the opportunity of reaching the highest rung in life. They are indeed the future researchers, inventors, planners and leaders, who will have to find a solution to the great problems which face our country, and on whom the future of our white civilisation itself in this southern part of Africa will depend.

(This article was originally delivered as a speech to the Transvaalonderwyskongres on the 8th April 1958. The English version was approved by Dr. Naudé and published by Symposium because we felt that its contents deserved the widest notice possible.)