HOW TO STUDY

E. W. MENZEL

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HOW TO STUDY

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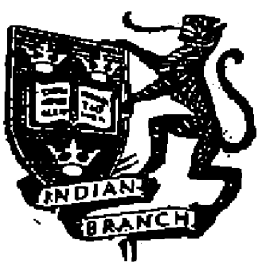

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TO

IDA EMMA

who seems to do about
half my jobs

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INTRODUCTION

THIS book was written with a double purpose: to present a plea for an enlarged conception of education and study, and to give some practical helps for the improvement of the technique of study with this enlarged conception of education in the background. Those who look for cut-and-dried formulæ that assure success in passing examinations will be disappointed. We are concerned here with the truly intellectual and moral growth of the student, and not with the cramming for examinations which does not appreciably serve this end. We are convinced that the narrow view of education which looks upon the passing of the examination as the real goal of education is detrimental to real education.

In order to improve the technique of true intellectual study which contrasts so sharply with the narrow aim of last-minute preparation for an examination, we must teach the teacher as well as the student. Both are in equal need of an enlarged conception of the student's task and purpose. Therefore, this book contains two sections, one directed to the teacher and the other to the pupil.

The author is well aware that very few bona fide students will ever read the part of this book directed to the student, because it is written in English. If it is to reach the student, literature must be written in the student's mother-tongue. What, then, is the purpose of writing a hundred pages in a language which very

few students of this country are able to read during their student days? The purpose is twofold: first, to challenge Indian writers to produce a guide for the help of the student, either through translating what is here given, or better still through writing an independent work in the mother-tongue of the student; secondly, to aid the individual teacher to guide his students in the better methods for studying the particular subject he teaches. Many teachers who take a keen interest in teaching their subject have not as yet devoted much attention to teaching their pupils how to study this particular subject. Teaching as a whole must be more student-centred, and teachers must adopt a broader view of education and study. As soon as this change is effected they will realize that much more is involved in study than just preparation for examinations.

The teacher not only needs stimulation for the adoption of a broader and more psychological view of study but he also needs some aid on approaching the student, to show him how to study more effectively with a view to broadening the range of his learnings and study. It is hoped that the teacher might reach the student with the material of Part II of this book.

Comparatively few high school students have the interests and realization of their needs to stimulate them to use a book on this subject even in their mother-tongue. They need help from the teacher. Students at the college level should be able to profit very definitely from an appropriate study-guide in the mother-tongue, even though help from the teacher is not given them. A few students who know English exceptionally well may be able to benefit from this book in English. Students in training colleges, who use English as a

medium of instruction, should be able to profit from every part of it; therefore, they should go through it very carefully.

This book contains much that is repetitious. The author is well aware of this fact and has not tried to avoid it. This book is not intended as literature but as a teaching aid. The creator of literature must avoid repetitions, but the teacher needs to repeat as often as he finds it necessary or useful. The section directed to the student is to a large extent a repetition of the section directed to the teacher, but is presented from the viewpoint of the student because his problem is different from the teacher's. The chapters directed to the student were written so that each chapter is complete in itself so that a reader who has not read the other chapters of the book can still understand a particular chapter. This approach necessitates a certain amount of restatement of principles given in previous chapters.

The author expresses his gratitude to Ida E. Menzel for typewriting and secretarial work, to the Reverend Otto Artopoeus for assistance in preparing the manuscript and to Miss H. Schaeffer and Mr John W. Narsaiya for helpful criticism.

1 August 1951 E. W. M.

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PART I

TO THE TEACHER

1. How to Study

A STUDENT is one who is supposed to study. Studying is his more or less full-time job, that is, he pretends to do it professionally. Therefore, we should expect him to do it with the skill of a professional. Of course we must make allowance for the fact that most students are still minors in age and are students in training rather than accomplished students. Yet in the average school one finds very little training in the art of study. Only in rare instances does one find a student who approaches his job with any show of professional skill such as one can reasonably expect of a youth of that age. One of the greatest defects of the Indian educational system is the lack of training in effective methods of study.

The author recently watched two carpenters working on contract. They were planing boards. The one had a good plane and the other a very poor one. The one with the poor tool worked harder than the one with the good one. But at the end of the day he had not done half as much work. When I asked him why he did not get a better tool, he answered that the price of tools was very high. A very simple mathematical calculation proved to him that the loss of work in a single week as a result of having an inferior tool amounted to almost the entire cost of a new plane. In other words, he could not afford to work on contract with such an inferior tool. Every day spent with

that tool cost him half of his wages. But a month later he still had the same inefficient, time-wasting instrument and complained that he could not earn enough to make a living. It is easy to see why.

Methods of study are tools. For different types of study different methods of study are required. The tool must vary with the job in hand. Insufficient attention is being paid in Indian schools to the use of the proper methods of study. In fact, little attention is being paid to the tools at all. Some students use methods of work which are not only twice as efficient as those used by other students, but six or even ten times as efficient. Some students are struggling to get along with methods of study which can never result in substantial accomplishment. It is surprising that some students get through an examination at all, considering the poor work-habits they have. The lack of stress on the proper training of a professional student in his professional job is amazing. The one thing a student should be expected to learn is how to study properly, but our schools are filled with so-called students who have had very little experience in real application of their minds to understanding and mastering knowledge.

They are not entirely to blame. The system is to blame far more than they. The teacher is to blame even more than the student, but the teacher again is to a large extent the victim of a system. There are a number of factors which may be regarded as strong contributing causes to the condition of poor study-habits on the part of Indian students.

I. A FOREIGN LANGUAGE MEDIUM. On the whole Indian students have done well in their effort

to master the English language. Some have done very well. But, no matter what his race or nationality, only the exceptional student can ever master a foreign language well enough to do his thinking in that language. Mastery is rarely achieved on the college level and practically never on the high school level unless the foreign language is used almost as much as the mother-tongue, outside of the classroom as well as in it.* Thus the use of a foreign language medium has restricted planning, thinking, and freedom of expression. This could only have a baneful effect on the students' habits of work and study. It has tended to emphasize verbatim reproduction rather than independence and initiative. It promotes rote memory rather than thinking.

2. THE RIGID EXAMINATION SYSTEM. The present examination system has restricted the freedom of both teacher and pupil and forced them to channel their efforts towards the narrow goal of passing an examination, which can hardly be passed without a great deal of cramming. Preparing for the type of examinations that have dominated the curriculum in the past has more often encouraged bluffing before the examiner than development of intelligent, individual study-habits. In recent years examinations have improved, and are not as narrowing in their teaching and study influence as they were, but they still tend to stereotype teaching, and encourage cramming, rather than thought or mastery of the subject.

3. ABSENCE OF ADEQUATE EQUIPMENT. A library is absolutely essential to a rounded-out education. Most secondary schools in India have some show of a library; usually the number of books is very small

and the collection confined largely to a few dust-laden English books far beyond the reading capacity not only of the students but of most teachers as well. Books in the mother-tongue are few and of these only a small percentage deal with interesting subjects, or are attractively printed and bound. Good reference books in libraries are almost unknown. Teaching is generally limited to the contents of a single textbook, which is most often a cut-and-dried affair. Lack of proper laboratory facilities and lack of even the most essential maps, globes, and illustrative materials result in abstract teaching, requiring a minimum of activity on the part of the students, who merely memorize the bare facts stated. Consequently this method has little, if any, value.

In this connexion we might also allude to the teachers' practice of dictating notes, which thereupon become for the pupils not so much the real textbook as a barren résumé of parts of a textbook. Lack of equipment can hardly be blamed for the development of this practice. It probably grew to its present unhealthy proportions because instruction has been through a foreign language medium. This criticism is not directed against the student taking notes—far from it—rather is it directed against the teachers' practice of dictating notes and expecting the students to commit these notes to memory.

4. HISTORICAL ASSOCIATIONS. The old pathshalas and maktabs confined themselves largely to verbatim reproduction of religious texts. Secular studies were more or less regarded with disdain. Secular studies were introduced under the English régime and were made to dominate the syllabus. They were,

however, associated with the language and culture of the foreigners to such an extent that the large mass of people always regarded them as alien to Indian culture.

Education was narrowly scholastic and largely a series of hurdles that had to be negotiated in order to get a post; more specifically it was a series of examinations that had to be passed. The number of such examinations passed determined salary and vocational standing for the rest of one's life. Mere examination-passing was emphasized to the neglect of the educational process. Mere form was sought instead of substance. The product was not a student with his heart in his work, but a competitor for prizes attainable by passing examinations. Such a competing student had not been trained to fit himself for capable service but only to get a job, and the only job which he had any hope of getting in the nineteenth century was that of a clerical menial for the East India Company and the British Empire. In this job he carried out strictly routine tasks whose purpose he usually did not even know. The outlook inspired by such prospects still dominates much of the educational system today. At least its effects are still with us to a very noticeable degree.

5. THE STRICTLY LITERARY OUTLOOK OF TRADITIONAL EDUCATION. Education in most countries suffered from this outlook until very recently. India has been particularly afflicted by it. This is partly due to the fact that the schools of the nineteenth century were, as stated above, preparatory schools for menial clerks. But it is also due to the fact that in this country manual work was considered degrading for a person of education. Education for

vocations other than clerkship, teaching and law was left entirely to apprenticeship in the various trades, and the trade was determined largely by caste. Education was actually regarded as making one unfit for labour of the hands whether skilled or unskilled. This conception of manual labour being degrading to the literate person is now happily dying out, thanks to the teachings of Gandhiji and the independence movement. Also the needs of scientific and industrial development, such as we find in medicine, agriculture, and engineering, as well as in the requirements of pure science, have begun to put an emphasis on the development of the hand as well as of the head. The old, strictly literary education is recognized as being unreal in this very human life with its practical needs of every sort. Education is looked upon as more than just a door opening upon a better job for the individual. It is increasingly looked upon as the nation's effort to fit its citizens for the thousand-and-one tasks which need to be done for the national welfare. These tasks need well-trained persons with skill, imagination and initiative. It is up to the educational system to supply them or stand condemned as a failure and a useless luxury.

The schools have only recently begun to adjust themselves to this new conception of the purpose of education. Curricula are being revised to meet the new need, but as yet very few students realize how revolutionary this revision is to their old habits of work and study, habits which are altogether inadequate in the face of the demands of the new independent India. From this it is clear that a sixth reason for the inadequacy of the present study-habits and methods has been the lack of professional and national incentives. The

opportunities now ahead of an independent India should do much to encourage students to prepare themselves properly for valuable service instead of leaving them content just to get rewarding numbers in the examination. Also it should widen the outlook of the teacher and draw him away from the narrow objective of merely getting his pupils over the examination hurdles and instead make him aim at fitting them for a useful life.

It would be well at this point to consider the definition of the word 'study'. We cannot be satisfied with a single definition but require a variety of definitions if we are to bring out the wide range of activities involved in true study. The following definitions were all taken from a single dictionary (Webster's *Collegiate*):

Application of the mind to books, art, or any subject for the purpose of acquiring knowledge.

Act or process of acquiring by one's own efforts knowledge of a subject.

Any act of attentive consideration.

Earnest and reasoned effort, desire, or thought.

Mental absorption.

Profound thought or perplexity.

A rendering of anything as a result of careful investigation.

To fix the mind closely upon a subject, also to ponder or meditate.

To endeavour with thought and planning.

To be intelligently zealous.

To devise with deliberation.

To read and to examine so as to understand.

Earnest effort to learn.

To examine carefully.

To think out and plan.

Only by taking all or at least a greater part of these definitions and considering them applicable do we get the true breadth and width of the term.

This consideration of definitions gives us a far different conception of study than we usually find in the student who thinks of it primarily as committing the contents of his textbook or notes to memory, or as training himself to carry out activities of a limited scope such as occur in the traditional examination. The reality of the impending examination which brings forty per cent or more of the examinees to grief will always be before the struggling student as long as the present system is maintained. But what most students —and even many of the teachers—fail to realize is, that a student, who has aimed at mastering his subject and is at home in it, is better prepared to pass the examination than the one who has aimed only at passing the examination and has not a true understanding of the subject. The student who goes into the examination gambling that he will get the 'right' questions is not a good but a poor student. The poorer the student, the more he crams for the examination questions without regard to a real understanding of the subject-matter as a whole. The better the student, the better grasp he has of the subject-matter, so that he is able to render a good account of himself no matter what questions happen to be set in the examination paper of that year. Examination reform is urgently needed, but the examination itself is not so much at fault as the fact that the teacher has been training the student, and the student has been training himself, to deal only with certain expected questions. The training is useless if the questions are different from the

ones expected. The student should have been trained to tackle efficiently a wide variety of problems. Cramming creates mechanical students who have to rely on memorizing second-hand material. Good habits of study create thinking students who can handle themselves well in many types of situations.

A discussion of the best methods of study can be effectively introduced to students by asking them when study takes place, who studies and what activities show a high degree of study value. The following exercise can be cyclostyled and given to them:

You will find printed on this sheet a list of activities. You are asked to estimate their study value. If you think a certain activity demands much study, then put a figure 3 in front of the statement. If you think it has some value but not much, put a figure 2 in front of it.

If you think it has almost no study value, mark it with a 1.

Carrying water for the garden.

Laying out the paths and fields of the gardens.

Finding out what plants will grow best and how they should be planted and tended.

Gathering the fruits of the garden.

Studying the geography notes which have been dictated to you by the teacher.

Making notes on what your country sells to other countries and what it has to buy for its own use.

Drawing the shape of the moon each day for a month and noting the time it rises.

Learning the names of the principal rivers of Asia.

Making a relief map in sand.

By discussing the study value of a large variety of activities, a clearer idea should be obtained as to what

constitutes effective study; which activities are merely repetitive and offer no opportunities of enlargement of experience or imagination; and which activities contain in them opportunities for mental growth.

2. We Learn by Concentrating

To appreciate the best methods of study we need to understand the ways in which we learn. We are not concerned so much with the psychological laws of learning as with the more elemental tools which are at our disposal. These may be listed under six main headings. We learn by concentration, observation, doing, the use of language, reading and memory.

The aspects of a subject for which a student must intentionally exert himself to learn, can only be learnt by concentration. The amount of time spent in study is less important than the intensity with which we apply our minds to the task or problem.

Concentration need not be painful. In fact, it is one of the most pleasurable of all experiences when interest has been aroused. When one is really absorbed in a problem, time goes by so quickly, that one does not notice it at all. Even mealtime can come and go without hunger making itself felt when the interest has really been stirred. It has been found that we learn something interesting in a fraction of the time and with a fraction of the effort it takes us to learn something which does not command our interest. We can concentrate on a subject without being really interested, but this is always tedious and takes conscious effort. Forcing ourselves to concentrate can be done only for a very limited time, and is exhausting. When there is genuine interest, we can concentrate for long periods

of time and consider it a delightful experience. Interest carries the person along, calling forth the best effort with almost no strain or consciousness of working hard.

A man making a public speech is usually tempted to speak too long because, while speaking, he is concentrating so fully on what he is saying that he does not realize how time is passing. Time seems to fly when we think intensely. Under such tension our mind gathers experience much faster than when less actively employed.

All great thinkers are men and women who can keep their minds focussed for long periods of time and think so intensely that they are almost oblivious to everything apart from the problem commanding their attention. As an illustration two incidents from the life of Thomas Edison, the great inventor, are presented. The first shows how completely Edison could give himself over to study when in search of information connected with the problem he had under consideration.

Edison began his experiments in search of electric light for household use. He not only experimented, he also studied. He read everything he could find in books, papers and notebooks of scientists about light. He studied not only about arc-lights and experiments with electricity, but also about gas light, oil lamps, candles, and everything connected with light-making. He filled more than 200 notebooks with notes collected in his studies. These notebooks contained 40,000 pages written in his own handwriting. He was as great a student as he was an original thinker.[1]

The second incident takes Edison away from his books

[1] From 'The World's Greatest Magician', by E. W. Menzel, *The Treasure Chest*, July 1948, p. 187.

and shows him in the laboratory, where he is trying to find a way to make an electric light.

He had spent more than a year and a lakh of rupees, and there was still no reasonable hope of success.

As he sat and thought, he noticed on his desk a little dish with carbon in it. He had once tried to use carbon to make a filament (as the glowing part of an electric light is called). So had other scientists, but without success. He decided to try again. Carbon is nothing more than lamp-black or soot. The carbon on the work-table was mixed with a little tar to make it stick together. Edison had used this same kind of carbon to make his telephone speaker.

He began to play with the carbon, thinking deeply as he did so. Carbon does not burn easily. It glows long before it melts or burns. If only he could make a kind of wire or a filament out of this!

At last he had an idea. He said to an errand-boy, 'Boy, run to the shop quickly and get me a reel of cotton thread.'

The boy could see that his master had an idea, so he ran quickly. As soon as he returned Edison took the thread, covered it with the black sticky carbon and put it into a mould which he used in making his platinum wires. Then he put the mould with the carbonized thread in the oven to bake. After baking it for several hours he took the thread out of the mould and tried to put it into a light bulb. It broke before he could get it out of the mould. He tried again. Again it broke. And again and again it broke. For two days and nights he and his helpers tried to bake a thread covered with carbon and put it into a light bulb. At last they succeeded. But what could they expect such a delicate little thread to do when they needed to run an electric current through it of such strength that it would instantly melt the hardest metal?

At last the carbonized thread was set in the bulb and the bulb was put into the electric connexion. A beautiful soft light shone before them, a better light than anyone had ever seen in an oil lamp, arc-light, gas lamp or anywhere. The men all held their breath. How long would it shine? Just a fraction of a second like a platinum wire, or for several seconds? It kept on burning.

It kept on burning more than a few minutes. After an hour it was still burning with the same soft light. It was burning after two hours, and after three hours. Some of the men had not left the workshop for two days and nights, but they had no thought of going home now. Some of them got a few hours' sleep on their work-benches but they stayed on in the shop, counting the hours and minutes that the new lamp was continuing to burn.

Suddenly, at the end of forty-five hours, the lamp went out. After the light went out all the men went home. Some of them slept twenty-four hours without waking up.[1]

Whether at work with books or at work with his hands, Edison was capable of the tensest application and maintenance of interest. It was then that his real work was done. His wife did not permit him to be disturbed at such times, even though he forgot to eat and sleep, for she knew that at such times he achieved his greatest successes.

Such application can hardly be expected from high-school or even college students. It comes only with time, experience and growth in interests. The attention of small children in intellectual pursuits can only be held for very short periods of time, usually only a few minutes. It is only as children learn to identify themselves with the subject in hand, or an immediate

[1] From 'The World's Greatest Magician', by E. W. Menzel, *The Treasure Chest*, July 1948, p. 187.

problem, that they begin to work as intensively as they play. It is only when intellectual and cultural activities fill them with as much pleasure as play that they make good progress. Children can be led to find the identification of letters and words an interesting game, and numerical relationships may become as absorbing as arranging brightly coloured stones. But the absorption in such tasks lasts only as long as their endurance to play any game does at that age—and it is not very long.

As children grow up and become mature, their interest can be sustained for longer periods of time on increasingly complex problems. Proper training greatly increases their ability to apply themselves to harder and harder tasks, and with the growth of wider interests it should become less difficult to capture their attention for facts and problems which have educational value.

It takes a clever teacher to keep small children interested in school work. Children are not used to the restraint demanded in a school, to the long hours of sitting and having to pay attention to a subject chosen by the teacher rather than being able to run about and do as they please. They want to be physically active. The teacher's method in the primary classes has to be such as to give them at least some of the activity they naturally crave and to enlist their instincts of curiosity and play as much as possible. In these classes we might say everything depends on the teacher. A good teacher keeps his pupils interested at least a good part of the time. A less capable teacher struggles and strains all day to enforce discipline, and the pupils tire themselves out straining at the harness they are in. The work of the teacher in the lower classes can be

judged largely on the basis of whether he succeeds in keeping his pupils interested in the things he aims to teach. The old-style teacher, who concentrates on bending his pupils to the discipline of having to learn the three R's, may achieve some measure of success; but not the same measure which is achieved by the teacher who has convinced his pupils that books can be very interesting, that there is a certain fascination in manipulating figures accurately, that a good command of the language is very useful, and that everywhere about us there are things and persons and forces important to our happiness.

In the higher classes, the amount of learning the pupils do should depend less on the teacher devising ways to keep them interested and more on the pupils realizing the importance of the work and devoting their best energies towards their own progress. A student who is not truly interested in his own progress can never be successful. If he is exceptionally bright he may still pass his examinations, and even do so with a high mark, but he will still be learning only a fraction of what he might have learnt had he had a real interest. Mediocre boys and girls will get through by a narrow margin, if at all, when lacking such interest. It is too much to expect that middle-school pupils should have so much enthusiasm for their studies that they would rather come to school than have a holiday, or that they should feel regret when the school bell releases them from the confines of the schoolroom. The desire to be out and active, laughing and playing, and in their own free time to do what pleases them, is by no means a dead instinct at this tender age—nor should it be. Children should never quite get over the

desire for activity and play. But at the same time, middle-school pupils are quite far enough advanced in life to see the usefulness of a good proportion of the skills and knowledge which the school is attempting to teach them, and they should have found real pleasure, at least occasionally, in the use of these tools.

All students, including those at the college and university stage, sometimes grow tired of being in the classroom and fail to find certain subjects interesting. But it is essential that they find at least some of their work interesting enough to derive real pleasure from it. You cannot force yourself to the discipline of concentrating often enough to be really helpful unless you find yourself, at least sometimes, concentrating unconsciously. Even in the middle school, and certainly in the high school, you can expect students to take pleasure in their work, although you cannot expect it all of the time.

The student who sits in the class day after day, but takes no active interest, will learn very little. Children who skip school and are frequently absent, often without the knowledge of their parents, are wasting their own time and also the time of the teacher and of their fellow-pupils. Those who put off studying until the examination is almost due are profiting little from their work in that particular class.

The old theory of education was that education is primarily a discipline, something one has to subject oneself to. Discipline is irksome. The modern theory is that education is a co-operative enterprise between pupil, teacher, the educational system and society in general, to fit the pupil for intelligent and useful life in society. Some things were taught under the old

system, but not nearly as much can be taught that way as when the pupil finds his schooling not merely a duty but something that fits him for his future role in life.

A certain amount of discipline will always be necessary in the process of becoming educated. Naturally there are many things we would rather do than the task we need to do for our own good. It is the same difference that we find between work and play. No one can hold down a full-time job without sometimes having to force himself to stay at his job when he would rather be doing something else. But unfortunate is the worker who finds no pleasure in his work at any time and has to drive himself all of the time. That makes the simplest task drudgery. Happiest in life are those people who are able to do just what they like to do and make a living doing it. At times even they would like to do something else, but a sense of duty, devotion and loyalty to the task, and pride in doing a job well and faithfully, tide them over these spells and help them to do even the disagreeable parts of their work without too much displeasure. Every job has its less interesting and even disagreeable moments, but in the light of the needs of the whole job, these should not make the job as a whole disagreeable.

No student will get far who cannot discipline himself to stick to his studies when the going is hard and interest has flagged. Being a student is serious work, although interest can often make it as pleasurable as play. But such high moments of pleasure cannot be expected at all times.

We often have to apply ourselves painfully to do a necessary job. We would rather put it off or avoid

it. And yet after we really get started, we find that the engine begins to pick up speed, and soon we are travelling along easily because suddenly we have become absorbed. We do not notice this until we have finished or have gone along for some time, for the nature of being interested or absorbed is that we forget ourselves, and the job in hand draws us on. Suddenly we wake up and realize that our minds have had fun in working out a puzzle. Students who are never thus carried away by their studies are fighting a losing battle and will find themselves sliding downhill just as soon as their will-power tires a bit. You cannot acquire an education by will-power and hard work alone. Somehow, somewhere, interest and enthusiasm must seize you and give you momentum to accomplish your work. The student who experiences these times of interest and pleasure most often is the one who can, other factors being equal, be expected to get the farthest. It may take real will-power on the part of the student to leave his football or pleasant conversation with friends, or even mere idling, in order to get to work. But if he has learned to concentrate, once he gets started the challenge of his work should carry him on, except on those exceptional days which come to everyone when one simply cannot seem to get one's mind on the subject. If proper habits of concentration have been formed, such difficult days should not come very often.

From what has been said, it should be clear that concentration requires ability on the part of the student to work by himself. He should train himself to work and should not be drilled by the teacher too much. Concentration means self-application and self-directed work. A group can also try to concentrate on a

particular problem, but this can be successful only when the individuals concentrate either independently or as a group. There has been much too strong a tendency in India to have students working always under a teacher. The work a pupil does outside the classroom is usually of more importance than that which he does in the classroom. Unfortunately, it is so often assumed that the pupil will do little, if anything, outside the classroom. Absorbing interest cannot develop until the student goes off by himself and does his own work in his own way, being free and eager to do something beyond that which is demanded of him by his teacher.

True interest and real concentration always result in the student doing more than is required of him. He may even neglect some things that were demanded of him because he followed a pathway not identical with the one laid out by the syllabus. Provided that he does not neglect the required things too much this diversion is all to the good. We do not want everyone to work exactly alike and feed on exactly the same intellectual fodder. The inclinations of no two people are exactly alike, and real interest will lead us to follow our own inclinations for at least part of the time. Progressive and creative education avoids trying to cast all students in the same mould and encourages each to work in his own way. One does not have to adopt the Dalton plan in order to have pupils working as individuals. Merely leaving pupils to exercise their own initiative, by giving them assignments for which they are personally responsible and which compel them to forage for information for themselves, without detailed guidance, forces them to concentrate and helps them to develop habits of concentration.

The practice of making a student sit with a private tutor and rehash with him the subjects he is taking in school is utterly ruinous to the student's prospects of developing habits of self-help and concentration. What he needs is not a drill-master, but the chance to get off by himself and to work at his problems in his own way. Only in rare cases, and then only for a short time to remove a special difficulty, is a private tutor helpful. Usually the main difficulty with the weak student is that he does not know how to study by himself. He needs to be taught how and what to study. But private tutors will not teach this. If they did they would become unnecessary after a short while, and they have little intention of surrendering their income in this way.

Concentration and interest must not be confused with ambition to become a matriculate or a B.A., or with the desire to pass an examination. There are many students who are desperately keen to finish high school or college but who are very poor students nevertheless. More often than not these are older students who have failed their classes more than once. At best their work is poor even though many of them finally manage to pass the examinations. You will find that in spite of their great ambition to succeed, they are not really interested in their work. Their studies are always a burden to them, though they may spend most of their time and energy on them. Such students should be doing something else. They lack the particular kind of intelligence which such school work requires, and are never seized with the type of interest which enables them to concentrate and learn effectively. They are fighting an uphill fight.

Some students regularly do very little work during the first three-quarters of the year and then get to work in the last quarter in order to pass their examinations. Unfortunately many teachers feel the same way about their teaching. Examination-fear results in little useful learning. The best learning and teaching can be done only in the early parts of the year, when the goal is an understanding of the subject rather than a preparation for the examination. Examination-fear or even ambition to gain a high mark is quite different from interest in the subject itself. Such students may pass their examinations, but they receive only a small part of the benefits that students of their intelligence could be getting. They are learning only the minimum, and not that which causes them really to think and digest. It makes them superficial in knowledge and shallow in judgement.

SUMMARY

It is not the time we spend in studying, but the amount of concentration, that results in good learning. It is not the amount of drill work or memorizing that gives us understanding, but the amount of undivided attention. To concentrate or give attention is difficult and fatiguing unless we develop interest. Having interest, we learn more easily, pleasantly, and faster, for we concentrate automatically and painlessly and for long periods.

Study demands a disciplining of ourselves to concentrate even when we feel no inclination to do so. But discipline alone will not get enough concentration out of us to result in good work. Unless interest is engendered, the most strenuous efforts are largely in

vain. A student need not be interested in everything he is required to learn, but he must be interested in a fair share of his subjects in order to use his opportunities to good advantage. A student with little interest is hardly worth teaching. Interest must always be genuine interest and not just a desire to reap the rewards of degrees.

The ability to concentrate is partly a natural gift and partly a matter of training. The educational system in India in the past has not done much to give this training or to build up and encourage those interests which alone will stimulate the faculty of concentration and active attention. There can be no intelligent study without the ability to develop concentration. Methods of training to study must be directed to increase the ability to concentrate.

3. We Learn by Observation

Observation is not only through the eye but also through the senses of hearing, taste, touch, and smell. A child's first learning is through the senses.

A certain amount of learning in this way comes to every normal human being whether he wills it or not. It comes long before we are conscious human beings. In fact, the earliest years of our life make the heaviest demands on our senses. Not that children actually perceive more than older people, but they work many times as hard trying to perceive, although they perceive only a small part of what older people are seeing, hearing, touching, tasting and smelling.

No two pairs of eyes see exactly the same things. No two pairs of ears hear the same things. What is perceived by the senses depends not only upon the keenness of the senses but also upon the experience of the person.

The senses need to be trained in order to do their work properly. Part of this training goes on in our everyday living but a great deal is left for the school to accomplish. When the senses are neglected, education is not well-rounded; it fails as much in its task as when the student, as a result of faulty teaching and study, fails in mathematics. But sense-training is rarely tested in the examination, and therefore students and teachers underestimate its importance.

The writer well remembers his first day in the

zoology laboratory. We were each given a microscope and a small flatworm about one-eighth of an inch long, to examine under the microscope. It looked very large. It gave the impression of being as large as a small crocodile. We were told to make a rough drawing of what we saw. We all succeeded in drawing the general shape. But that was all. When we started to put in details we had them all wrong. The teacher, who was a good teacher, left us to our own devices. But we had to submit our drawings to him for approval. Time after time he said to us kindly but firmly, 'No, that isn't what you see. Look again. Put down whatever you see, but *only* what you see.'

Since a flatworm is transparent, its inner organs and their workings are plainly visible. That is, they are plainly visible to someone who knows what he is looking at. But to us who knew nothing about the anatomy or physiology of the body of the flatworm, there was only an indistinct mass visible. We were left to our own devices for two hours. All we found out was that what we claimed to see was not what our teacher wanted us to see.

In the next period in the laboratory the teacher showed us finished sketches of flatworms and directed us to examine these sketches carefully and then look at the specimens under the microscope once more. Of course, we were again directed to make drawings of what we saw. Our drawings were made with our eyes on the textbook sketches far more than on the live specimens. Again our teacher told us, 'That is not what you see.' He politely informed us that we were copying from the sketches and not observing our specimens. Our specimens were a different species

from those represented in the sketches. In addition, the sketches gave certain details which could not be seen without the use of dyes to colour parts of the worm, or without microscopes with considerably greater magnification than those we were using. We had put these details into our drawings, although it was impossible for us to see them. This was one of the best lessons in honesty I have ever had, and also one of the best lessons in the control of the imagination. We had to learn not to let ourselves see what we expected to see, because it was shown in the textbook, but which in reality was not visible to us.

The practised eye of a doctor sees details in every human body, and in the movements of the body, which the non-medical person does not see. In comparison with what a botanist sees on a plant, the rest of us are three-quarters blind. One look into the starlit sky tells the astronomer the time of night, the season of the year, and the latitude, and reminds him of hundreds of other facts about far stars, near stars, hot stars, cold stars, the centre of the universe, and conditions on the planets. The building up of our experiences and understanding is to a very high degree dependent on how we employ our five senses. The more we have seen and heard the more we are reminded of. Yet the average teacher rarely relates the method of study to a practical use of our senses.

Hearing permits of as much development as seeing. I was once in a room with about a dozen men and women, all of whom spoke English. A stranger who had never heard of or seen any of us was introduced. We were all surprised to see how he correctly placed all of us according to the lands of our birth. He

immediately identified one as having come from Scotland, another from the vicinity of London, another from Germany, even though the latter spoke English more fluently than he could speak German. Others were identified as having come from the south-eastern part of the United States of America, another from Texas, a third American from the city of Brooklyn, and a fourth from the neighbourhood of Chicago. An Irishman was told what part of Ireland he came from. All this was deducible from our speech, by a practised ear.

It is needless to say that proper speech can be learned only by proper hearing. A musician needs to distinguish between thousands of sounds. A mechanic diagnoses many of the mechanical faults of a piece of machinery from sound, and a doctor tells the condition of heart and lungs largely by sound. One can identify birds and insects, aeroplanes and motor cars by the ear.

Primitive man preserved his life in the jungle by being on the alert to hear approaching danger. He acquired his food by listening for sounds of animals that might become his prey. A deaf man or a blind man was badly handicapped in the struggle for existence. Good sight and good hearing are just as valuable to man today as in those days when he walked through the jungle or sat still with eyes and ears ever on the alert for possible prey.

In one way the senses are more valuable to modern man, for they tell him thousands of things that primitive man never even dreamed of. There is a certain amount of ear-training in the schools, in language work, and in music, but on the whole the student has not been encouraged to explore the world of sound for

the sake of determining what differences in sound can reveal to us of the person or the object making the sound.

Man has not paid much attention to the development of his powers of smell. Man has not depended on smell to the extent that many animals have. A dog trusts his sense of smell more than his sense of sight. So do many of the forest-dwelling animals. We have not yet been able to describe and standardize terms for the naming of smells. The chemist is concerned more than most professional people with the development of the sense of smell. The sense of taste is also put to less use than the other senses except when we eat. Then we use it to decide what food we like and what we do not like. Or is it the sense of smell that leads us to do this? That is still a psychologist's debate.

The sense of touch is used by blind people far more than by the rest of us. Helen Keller, who became blind and deaf when a small girl, learned to appreciate music by feeling the vibrations of a musical instrument or the vibrations of a singer's throat. She can often tell what people are saying by keeping her fingers on the muscles of their throat. Lacking sight and hearing, the other senses are developed abnormally. This shows the possibilities of the training of each of our senses.

What our senses really mean to us in the learning process is well illustrated through the example of Helen Keller who was handicapped in having only three of the senses. Though deaf she learned to understand language and even to speak. Though blind she learned to read and write. It is worth while to remind ourselves of the main facts of her life:

Helen Keller was born in Tuscumbia, Alabama, U.S.A.,

on 27 June 1880. When she was nearly two years old she had an attack of scarlet fever and became blind, deaf and dumb. At the age when she would ordinarily have been learning the names of objects around her, her mind was imprisoned in darkness and silence.

She could learn of the world about her only by means of her senses of smell, taste, touch and motion. She used a very few simple signs to express her thoughts, but she was not very successful. Whenever she could not make her mother understand her, she would weep for a long time. As she grew older, the desire to express herself and to explain her wishes grew stronger and stronger, and when she failed she would give way to terrible outbursts of anger.

Her parents felt very sorry for her, but they did not know what to do. In a book by Charles Dickens they read about the success of Dr Howe of the Perkins Institute, Boston, in educating the blind deaf-mute, Laura Bridgman. They asked the Principal of that school to send them a teacher for Helen, and he sent Miss Anne Sullivan, who had herself been a pupil of Laura Bridgman. Miss Sullivan had as a child been blind but had partly regained her sight.

The twenty-year-old teacher had a difficult task with her self-willed, naughty pupil. Although Helen was now a child of six she still had an undeveloped mind. When rebuked she would throw herself on the floor, kicking and screaming for half an hour at a time. She did not know what obedience was.

Her parents were so sorry for her pitiable condition that they could not force her to do anything against her wishes. They gave in to her on every occasion. Miss Sullivan knew that Helen must first learn to obey, and she began lovingly and patiently to teach her. Within a fortnight she was able to write:

'My heart is very happy to know that a miracle has

happened. The light of understanding has shone on my pupil's mind. A change has taken place. The wild creature of two weeks ago has been turned into a gentle child. She is sitting by me as I write, her face calm and happy. The little savage has learned the first lesson in obedience. It remains my task to direct and mould the beautiful intelligence which is beginning to stir in the child's soul.'

Helen soon learned to spell words. Her teacher gave her a doll and slowly spelt d-o-l-l by tapping with her finger on the palm of Helen's hand. Afterwards Helen imitated the tapping until she could make the letters correctly, but it was parrot-like imitation. She had no idea that it was a word. It was mere play to her.

One day when someone was drawing water, Miss Sullivan placed Helen's had under the spout. As the cool stream fell over one hand, she spelt w-a-t-e-r into the other. Suddenly Helen understood that things have names. She knew what language means. Her soul was awakened. There were difficulties still but they could be overcome. The next day she ran from room to room touching this object and that and asking their names. She was greatly excited and very, very happy. She was like a prisoner released from captivity.

From that time the little girl made rapid progress. Miss Sullivan took her to the fields and gardens and taught her by means of finger signs, the names of the flowers and animals.

Helen was very clever. She soon began to read books printed in raised type and to write letters. At the age of eleven years she could solve problems in difficult fractions.

Helen greatly desired to speak 'with her mouth', as she said, but was discouraged by her friends and relatives. She persisted, however, and her teacher, who had made a study of lip-reading, began to teach her. The first small sentence which she uttered was, 'It is warm'.

It was uphill work, but the thought that her little pupil would be able to understand her when she could talk, urged her on. After finishing high school, Helen entered college and in four years passed with honours. Every day Miss Sullivan sat beside her in the class and tapped into her hand the lectures as they were given. At night she read the textbook homework and 'told' it to Helen in the same way.

Goodenough [1] claims that we learn to perceive much as we learn to walk. In a normal human being the sense organs are eager to be active, just as there is an urge in the legs of a growing child to get busy walking. The sense organs are probably as sharp at one year of age as they will ever be, but the child has too little knowledge to enable it to perceive detail. A few people who have been born blind, and in their adulthood had their sight opened up to them through surgery, have described their first experiences. These are helpful to us to see how we acquired our powers of perception. We received ours in infancy and therefore do not know how we acquired their use. The adults who had their sight restored claim that during the first days of their sight they could discern almost no details. Objects and persons appeared like lumpy, indefinite shapes, whose contour changed as their seeing experience increased. These objects always appeared as totalities, with little or no suggestion of their parts in the beginning. Only after considerable experience in seeing did the details begin to emerge and the outlines of the objects become definite and stable.

[1] Goodenough, F. L., *Developmental Psychology* (Appleton Century Co., London), pp. 341ff.

Goodenough [1] further claims that what we perceive depends upon what we know, or think we know. Our previous knowledge enables us very quickly to perceive that which we already know. If we have wrong details in mind we are extremely likely to imagine we perceive details which are not there, and what we do not know about will probably be entirely overlooked. It takes a very careful and conscientious person not to perceive things as he thinks they ought to be, instead of the way they actually are. This accounts for the fact that, a dozen people who have every intention of telling the truth, will still give very conflicting reports about the same object or the same happening. It is not only the proverbial blind men who give very conflicting accounts on what the elephant is like, but also those who have eyes, but are not practised in seeing the essential details. People with good eyes are not likely to confuse the shape of an elephant the way the blind men did, but when it comes to describing details they can be just as badly mistaken. An artist cannot draw the human body in a life-like way until he knows something of anatomy. He may look very carefully at the human body as he draws it, and take pains to draw just what he sees, but the muscles will appear unnatural nevertheless because he has insufficient knowledge of muscles and how they function.

It should thus become apparent why it is necessary to pay attention to improving the accuracy of the senses at the same time as we try to increase knowledge. With insufficient knowledge our sense impressions are entirely inadequate and very often erroneous. With wrong observations our knowledge will be partial and

[1] op. cit., p. 343.

faulty. When we were children we saw, and heard, and felt, and tasted like children do. These impressions need constant revision as our knowledge and thinking progress. We have to re-see, re-hear, re-touch, and re-taste in order to brush away wrong impressions and fill in the gaps. We have perceived only a fraction of what is perceivable, and we have perceived a good deal that actually isn't there. One needs to spend hours with a telescope or with a microscope searching out the little baffling details of an object, and one needs to study what has been seen by others before one can adequately understand how crude our old sense impressions are, and how much more there is to be seen than we see in the usual casual way. When I started to read the natural history books by Jean Henri Fabre, I was impressed with the fact that here was a man without laboratory equipment of any kind who could see more in a grasshopper or firefly than all generations of men before him. The progress of science is largely due to the fact that men at last began to apply their senses carefully and systematically, and to build instruments through which the powers of the senses can be greatly intensified. The various 'scopes', amplifiers, etc., have increased our powers of perception tremendously, but mechanical aids, no matter how efficient, by no means remove the necessity for very careful application and training of the senses.

Of the five senses, that of sight is the most valuable to the educator, for that which is seen is more apt to claim attention and be retained in the memory. The eye perceives many relationships and details which are not discernible by the other senses. This explains the strong emphasis on audio-visual aids in the progressive

school; aids which are considerably more visual than audio. However no one of the senses is to be considered the educating sense in isolation. The best learning results from a combination of various senses together with application of the thinking process. The mind is as essential as the organs of sense in keen observation.

The purpose of writing this chapter is to plead for a broader conception of study and education to include the training of all avenues of learning. The experiences of the five senses are foundational to all our experiences. The senses improve greatly in their power of suggestibility through use in tasks of every kind. There is hardly a field of human endeavour that cannot be further enriched by those who have learned to see, and hear, and smell, and touch, and taste more carefully than their fellow men are doing. When study is thought to be largely a matter of trying to absorb the material found in books, it lacks the freshness that can come only from original observation of things as they are. Descriptions by other people, even if they are authorities on their subjects, cannot compensate for the lack of direct experience through our own senses.

It is when our senses are actively seeing and hearing what we have not particularly noticed before that the questions, 'why?' and 'when?' and 'how?' and 'what?' and 'why not?' arise. These questions are the beginning of thinking and concentrating on a subject. It is the senses which stir the curiosity. Without curiosity there is little intellectual activity. Book knowledge always acquires a flavour of staleness when not accompanied by fresh observation. Observing is a most essential part of study. Books tell of real things

only to those who observe the real things so habitually as to 'see' with the mind's eye in its original freshness what the book tells about. It is small wonder that study becomes dull when the senses which started us on the road to learning are seldom exercised in our education.

Sir Isaac Newton had seen apples fall to the ground many times and had seen other objects fall millions of times. So had practically everyone else leading a normal life. But one day, having seen a falling object (perhaps an apple, perhaps not), the 'why' was stirred in his mind so intensely that he could not help concentrating on the question again and again over a period of years. Finally he came out with his statement of the law of gravity which is one of the glorious intellectual achievements of all time. It revolutionized physical science and natural philosophy.

A short quotation from the life of Edison illustrates what the observation of little things may lead to.

One day Edison called one of his best friends and helpers, named Kreusi, and gave him a crude little drawing. He said to Kreusi, 'I would like to have you make the little instrument which you see in the drawing.'

Kreusi asked, 'What is it?'

Edison said, 'Perhaps it is a talking machine.' Kreusi smiled. It did not look like a talking machine or anything else. And whoever heard of a machine that talks? The telephone does not talk unless someone talks into it. Edison must be joking.

Of course, Kreusi made the little machine although he did not have the least idea what it was for. But the drawing told him exactly how to make it. We still have copies of this crude little drawing.

When Kreusi finished the model, he brought it to Edison. Some of the other workmen were standing about and they were all curious as to what it might be. When Edison said, 'a talking machine' they all laughed and began to joke. Edison often made fun with them and they thought he was doing it now.

The inventor wrapped a little tin foil, like the tin foil slabs of chocolate are wrapped in, around a little cylinder on the machine. Then he placed a metal arm holding a needle on the tin foil so that only the needle touched the foil, and began to turn the cylinder by means of a handle. Then he did the strangest thing. He began to shout into a telephone mouthpiece which he connected to the instrument:

> Mary had a little lamb,
> Its fleece was white as snow,
> And everywhere that Mary went
> The lamb was sure to go.

This is a little rhyme that every child in America learns. The men thought that this was so foolish that they laughed and joked more than ever. When the cylinder turned around, the needle made a groove in the tin foil. When Edison finished the rhyme he changed around the parts of the machine and put the needle in the beginning of the groove which the needle had made, so that when he turned the cylinder around again, the needle would pass round in the same groove it had made the first time the cylinder had been turned by means of the handle.

As soon as the handle began to turn, everyone was surprised and listened carefully. A thin squeaky voice said, 'Mary had a little lamb', etc. They immediately recognized the voice as that of Edison. Every word could be clearly heard. This was the first time that any man had spoken and heard his words repeated to him in his own

voice except in an echo. A machine had been made that really talked, saying again what had been spoken a short time before.

People asked Edison how he happened to get the idea which led him to try to invent the talking machine. He said, 'One day while I was singing into a telephone the vibration of my singing pushed a needle into my finger. I could feel the needle vibrating. I felt sure the needle vibrated to the sound of my singing. Later I reasoned with myself that if I could send the needle over the same path again it should make the same vibrations and reproduce the same sound.' So he attached a needle to a mouthpiece of a telephone and ran the needle over a piece of paper. He shouted 'Hello' into the mouthpiece. When he ran the needle over the same scratch the needle had made in the paper when he shouted, he could very faintly hear it say, 'Hello'. So he made a drawing of a machine that should work better than the needle on the telephone mouthpiece, and used tin foil instead of paper. This worked much better than he expected.

How can the teacher set about training students to observe more acutely? There are innumerable ways. The following are merely a few suggestions.

1. Drawing is a very good subject to train students to record exactly what they see. The student must not only observe carefully how the object to be drawn is composed, but also what its appearance is from a particular position. Mere copy drawing does not give this training. Drawing must be from life.

2. Laboratory, and practical work afford excellent opportunity for directing the senses towards those phenomena which have significance to the scientist, and also to the seemingly insignificant. One can never tell what will be significant tomorrow. Science begins with

observation and requires further observed data at every point of its development. The mere reproduction of textbook matter, or of notes, is not the teaching of science, but the memorization of hearsay. The making of a scientist is the making of a trained observer who can transfer the import of what he has seen, heard, smelled, tasted and felt to a wide variety of situations. There is no more intensive training of the eye than when we sit behind a microscope, or telescope, and try to draw what we see.

3. Manual and mechanical training involving not only training of the hand, but training of the eye (and perhaps other sense organs) as well. It builds up practical experience so that problems of all sorts can be more clearly visualized and solutions suggested.

4. The next chapter, ' We Learn By Doing ', points out that we learn through activities rather than through committing to memory. While engaged in activities of many sorts we are constantly required to observe. This means employing the senses. The greater the emphasis on original observation, the more effective the learning.

5. Field trips are of inestimable value. You cannot learn about geography by sitting in classrooms. You need to see soil, streams, heavenly bodies, market places, industries, transportation systems, people at work and play, the effect of climate, landmarks, and physical features. It is generally assumed that pupils have seen these. They have seen them only superficially. The teacher needs to sharpen their eyes and wits by pointing out the geographically significant. Only when they have a rich fund of such experience can arguments and inferences and illustrations begin to take

effect on their thinking, and not until then. There is more geography, civics, science and human nature to be taught outside the classroom than in the classroom. It is only as outside experience and memories of outside experience are brought into the classroom that eyes and ears begin to open properly.

6. It stands to reason that first hand observation is better than pictures. And yet pictures, drawings, epidiascope slides, the cinema, museums, demonstrations, object lessons, all enlarge the experience if there is enough first-hand experience to make that which is pictured life-like to the imagination of the pupil. Pictures are meaningful when they recall something that has been actually seen. What was actually seen may be only a small part of that portrayed in the picture but, it nevertheless enables the imaginative person to visualize a greater object portrayed in the picture.

7. There is need of much simple nature study. Not everyone can take a course in formal botany, zoology, astronomy, geology, physics, or psychology. And yet no one should be allowed to go through school without being familiar with the more common forms of the flora and fauna of the country, as well as the habits of animals and human beings, the changes wrought by seasons and weather conditions, and the working of physical law. These may be known in a very non-technical way but they should be known. Boy scout and girl guide programmes are excellent in promoting such observation, especially the proficiency badge programmes.

8. Sports are very good for the development of keenness of eye, and responsiveness to other sensory

stimuli. They require the athlete to be a good judge of speed and distance, and to be alert to the movement of a ball or other object and to the movements of other contestants. In general we might say that almost any activity which develops skill encourages rapid response to sensory stimuli of a certain limited nature.

9. Language work requires ear-training. Faulty pronunciation is very often due to lack of proper ear-training. It may be due to impaired hearing, but is more likely to be due to lack of training. Naturally, we expect the teaching of music to develop auditory discrimination.

10. Even the teaching of literature involves sense stimulation. Poetry abounds with appeals to the eye, the ear, the nose, the taste, the sense of touch. Some poets write far more sensuously than others, but no poet can long talk abstractly, and still remain a poet. The teacher who cannot bring the pupil to see the beauties of nature, to hear both physical and inward harmonies, and feel the contrast between the smooth and rough spots in life, is not in a position to interpret good literature. When we teach students to express what they have seen, heard, and felt, we teach them to see more discerningly, hear more discriminatingly, and feel more deeply. Therefore where composition is taught properly the senses are being sharpened. Here we speak both literally and figuratively.

In conclusion we may say that pupils are trained to be more observant when we constantly draw their attention to phenomena, as they may be observed, rather than to book descriptions of these phenomena. In the Middle Ages scholars referred to the authority of written books. The modern age started when men

cared less for what Aristotle wrote and demanded verification from observation before a so-called fact was called a fact. The marks of a progressive school are this—that a pupil is made a keen observer, investigator, and a sceptic until he himself has seen and heard enough to make a proposition seem reasonable. This results in constant enlargement of experience and living. The marks of a tradition-bound school are this—that the pupils repeat what the textbook or the teachers have said. This results in very superficial understanding, misunderstanding, and a lack of liveliness and adaptability.

4. We Learn by Doing

A well-known American writer of novels, Sinclair Lewis, was asked to speak to a group of students who were ambitious to become novelists. They expected to hear much from this writer of 'best-sellers'. Sinclair Lewis asked them, 'How many of you want to become writers?'

Every hand went up. Then the author said, 'There is no use in my wasting your time by making you listen to talk. Go to your rooms and start writing.'

The students were greatly disappointed. They had expected to hear much that was interesting and helpful from this successful celebrity. No doubt Lewis could have given them many helpful suggestions and much stimulation. But no long speech could have told them as effectively that the only way to learn how was to go ahead and try, try, and try again. Only practice, experience, and learning from experience, plus a natural gift, could make something out of them as writers. *We learn by doing.* Lectures and books are valuable and are indispensable, but only the handling of the materials and tools of the art, craft, or subject-matter we wish to master can give us an adequate understanding. Handwork, too, is study and a very important part of it.

The schools have always recognized some need of 'doing' but only to a limited extent. We do not try to teach the mechanics of writing by describing how

it is done. We make the pupils write. We teach reading and arithmetic computation by giving continuous practice and we recognize there is no other way to do it. We do not go far enough, however, and fail to see that the reading and arithmetic skills are practised in the more advanced stages as well as in the primary; nor have we in India paid much attention to the question of how much practice, and what kind of practice, is necessary at different levels. But we do recognize the need of practising the earlier stages of skills because these are the tools the pupils require before they can master the higher branches of study. We have also recognized the need of practice in the use of maps, but many teachers never get their students to make maps of their own. By making maps I do not mean copying maps from printed copies. I mean the drawing of original maps of small localities such as a compound, a village, or the surrounding country, which pupils can see with their own eyes and walk over and sketch. No one can realize all that a map can tell until he himself has made maps of familiar territory. The revised primary school syllabus in Madhya Pradesh wisely demands the making of maps of the schoolroom, the school building, the compound with buildings, and finally the village, in that order. But that is not enough. The process needs to be continued in the higher classes with more complicated mapwork.

Children are taught the movements of the sun and its effect on the seasons of the year. But all too few teachers get their pupils to make a simple little sundial or to compare the shadows the sun casts in summer and winter, or to note the difference in the place on

the horizon where the sun rises and sets in the different seasons. Only this 'doing' can teach the lesson of the seasons adequately.

We teach about the terrible damage the mosquito does and advise children to destroy the breeding places of the mosquito. We even have charts hanging up in classrooms to show the life-cycle of the mosquito. But recently a group of two hundred teachers, all of whom have taught about the mosquito for years, were asked how many of them had ever brought mosquito larvae in a bottle into the schoolroom. By covering the bottle with a small piece of net so that flying mosquitoes could not enter or leave the bottle, one has proof that day by day some of the larvae leave their little shells in the water and turn into flying insects. Not one teacher had ever done this. In surprise the speaker asked, 'How many of you have seen and recognized mosquito larvae?' A bare half-dozen hands were raised.

It is no use teaching that mosquito larvae should be destroyed unless we can show the children what the larvae look like, where they are to be found, and then get the pupils to drain a few bad breeding places and let them watch the effect of a few drops of oil on the water in which larvae live. Hygiene taught as a subject of 'ought', 'should', and 'always do' is practically worthless. To tell a child how to brush his teeth is useless until he is set to work brushing his teeth in the right way.

The teaching work of the school can be roughly divided into giving practice in the acquiring of *skills* and *information,* and the developing of *thought processes.*

The most commonly taught skills have already been mentioned—reading, writing and mechanical arithmetic. These are practised in the schoolroom because they are needed in the schoolroom. Until fairly recently they were not practised very skilfully. Experiments to determine how much drill is necessary, which methods are best, and how often exercises need to be repeated for the skill to become of lasting value, have been made only in the last half-century. The resultant improved methods of teaching the skills unfortunately are used in only very rare instances in India. The school has recognized the need of certain skills but has not had them practised nearly enough. There are many skills which do not take much time to teach, but which need to be taught if the student is not to leave school without having learnt them well enough to use them with confidence. A few of such skills are listed below by way of illustration, including those that are taught in some schools and which are commonly taught superficially:

Telling the time.
Reading the temperature from a thermometer.
Weighing and measuring.
Buying and selling, together with money transactions.
Making simple sketches to plan a garden.
Making simple sketches to show a carpenter what is wanted (not mechanical drawing but only the simple sketch).
Using a dictionary.
Using the index of a book.
Finding what is wanted in a magazine or newspaper.
Using a railway timetable.
Reading charts of many kinds.
Introducing a resolution to the chairman in a meeting.

Leading a students' meeting.
Leading a group in physical exercise.
Conducting an election in a students' club.
Inviting a speaker to address a meeting (verbally and in writing).
Making the surroundings sanitary.
Proper behaviour before a distinguished guest.
Proper behaviour on various social occasions.
Dressing a simple wound.
How to find what you want in a library.
Treatment of boils and sores.
How to find what you want in an encyclopædia.
How to grow a few small plants.
How to read weather reports and crop-prospect bulletins.

No one is more awkward, helpless, and ill-at-ease than a person who is supposed to know how to do a certain thing but has never done it, and consequently does not know how to start to do it. Some people are far more practical than others. Some are quick to try and quickly succeed. Others simply do not seem to know which hand or foot to use or what to say. Such people need the most practice. The task of every school is to reduce the amount of awkwardness and helplessness of every student. It cannot make a handy person out of everyone, but if it fails to make him considerably more ready and confident to try, no amount of information stored in his mind can make up the deficit. It is not what we *know* but what we *can do* that counts. In later life students use remarkably few of the skills learned in school unless these skills have been sufficiently mastered to prove useful during school days.

Of course, the acquiring of information is necessary. We must have a certain amount of facts at our ready recall or, no matter how practical we may be, we shall not know what should be done. Doing the wrong thing can be worse than doing nothing at all. Only he who knows the facts in the case can act intelligently. It is true that someone who has learned to use a dictionary, an encyclopaedia, an almanac, a Year Book, and a library freely is far better equipped to get the right facts than someone who has memorized five times as much but does not know where to find what he does not remember. But one cannot run to the reference books for everything. The most essential facts must be in the mind, ready for instant use. Education must produce a well-informed person as well as one who has acquired a large number of useful skills.

Information of lasting value is not acquired best by the memorization of long lists of facts. Facts are remembered best when they have had real significance in some important problem. It is the relationship of the fact to certain other facts of significance that impresses it on the memory. For instance, the years between 1940 and 1950 have been years of a shortage of food-grains in India. During and following the war there have been food controls, rationing, and a mere subsistence level of living, high and steadily increasing prices, and even famine. Why? A study of this problem by a class will result in a collection of historical, geographical, commercial, industrial, and economic facts that will impress themselves upon those who sought the answer to the food problem in a way that no amount of plain formal drilling of the facts can ever do. The facts learned will probably exceed those covered by a

stereotyped textbook, and at first sight they may not seem to be as orderly and systematic as when presented in a textbook. They are orderly, however, and actually far more orderly than the textbook presentation, for they have been studied in their logical relationship one to the other, just as they occur in life situations, and not in theoretical form alone.

In the teaching of the sciences two entirely different approaches are necessary. The first is a systematic and more or less theoretical presentation. The second approach involves the actual handling of the materials of the branch of science in the laboratory or in nature. Unfortunately, laboratory work in Indian secondary schools is inadequate and is considered of less importance than the second-hand information given in textbooks or in notes by the teacher. In American and European institutions there is more emphasis on laboratory experience. The pupils come to their science classes better equipped than the Indian child because of preliminary practical experiences. The teaching of physics cannot make much headway when students have no previous experience of handling household, agricultural and carpentry tools, such simple machines and tools as wrenches and pliers, or a simple understanding of how electric currents are made, short-circuited and broken. If physics and chemistry are to be properly taught there should be simple manual training in a variety of tool-handling skills before theoretical science is begun. Students should be familiar with plumbing systems, electric systems, the working of a bicycle, and the use of cogs and drives. When using the science syllabus of Western countries it must be remembered that Western countries presuppose a

greater familiarity with mechanical tools and devices than most Indian students have. The advance of industrialization and the increase of public utilities in India is rapidly changing the situation, but the lack of familiarity with tools with which every European boy plays from childhood on will remain a handicap in this country for another generation.

A child beginning the study of biology should already be familiar with a large variety of plants and animal life if he is to appreciate the formal study of botany or zoology. A student of civics finds his subject dull unless he has some experience of the civic life of his community. Being a student implies a certain background of acquaintance with the common things and facts of life, a background of interest and of recollections of pleasurable experience. A child who has been served hand and foot by relatives, who has been saved from real work and has got almost everything he wants without working for it, is handicapped in his studies as his experience of everyday things around him is so limited. Where these qualities are lacking the school must try to augment them in laboratory, extra-curricular activities, and in every way it can. Even the normal student needs his experiences broadened in school and this cannot be done nearly so well by lecturing or the study of books as through activities of many sorts.

For successful teaching most school subjects need a laboratory. The room will be different from the one provided for science, but it should be a laboratory just the same. For the teaching of geography not only are the traditional maps and globes needed in the geography room, but tape-measures, compasses and squares to

make maps, simple devices to observe the sun, the weather and the rainfall, and materials for the modelling of relief maps in which the action of water on a landscape can be observed. In addition the rivers and streamlets of the surrounding countryside, the rocks, the soil, the fertile fields and the eroded fields, the factories, the communication systems, the markets, the people, the flora and fauna of the neighbourhood are all a naturally-stocked laboratory for the students. A good collection of pictures of other lands, other peoples and their ways of living is laboratory equipment as certainly as a test-tube.

For the study of civics, school assemblies, club meetings, student councils and committees are indispensable, so also is active participation in school functions and civic functions. Visits to the police station, the courthouse, the post office, and other public utilities together with the reading of newspapers for an understanding of current world events enable students to get their knowledge through experience rather than through hearsay only. The grammar teacher is finding out that creative language work requiring the ability to express oneself clearly and precisely in reports, talks, school papers, and assembly functions, does more to teach grammar than learning the parts of speech and analysing sentences in routine exercises. Revising and improving their written work because it must be presented in a satisfactory form to be included in the school magazine or to be submitted in an essay contest, teaches students more grammar than dissecting and chopping up the Classics into grammatical forms. When not used as grammar exercises the Classics can be appreciated for their content and beauty: this cannot

be done when students have to identify every gerund and past participle and twist every indirect speech into direct. If we work creatively with our materials every subject will be more quickly understood and enjoyed than if bare facts are crammed into the cold storage of the mind with a deadening routine. The activity may consist of initiating projects, launching activities, solving problems, making a study, making an inquiry, conducting an experiment, or conducting research. All such activities are creative and may or may not require manual skill in addition to brain work, but when children are busy on something that calls forth creative and original workmanship, they are busy doing something which is bound to result in learning of value. No one ever really knows a thing fully until he can explain it to some one else or make it with his own hands. Till we reach that point we may think we have a full and complete knowledge of it, but our knowledge is hazy and piecemeal and is often inaccurate.

There are very few fields of accomplishment in which one can do valuable work without combining skill of the hands with that of the head. A medical doctor not only has to be clever in surgery in which an awkward slip of the hand may cost a life, but he also has to be a multi-skilled mechanic in order to repair broken limbs, take X-ray photographs, correct posture defects, handle apparatus and instruments of different kinds, and restore organs of the body to their proper mechanical working order. He may even have to design or make new instruments to enable him to treat a certain case. The age of specialization has removed some of the necessity of being a Jack-of-all-trades but not altogether. A musician lives by the work of his

hands or throat as much as by his musical talent. A chemist or physicist can do no original work to speak of without the ability to set up and design and even make apparatus to suit special purposes. If astronomers were not able to show the engineers and manufacturers of their telescopes exactly what they want, they would have to continue looking at 5,000 stars with the naked eye instead of seeing millions more with their giant telescopes which have become one of the great wonders of the mechanical world. The discovery of atomic energy and the way to produce it is one of the triumphs of the human mind but has been possible only because the nuclear physicists, perhaps the world's greatest theorists of this age, are also practical men who plan engineering jobs that ordinary engineers have never even dreamed of. The biologist uses methods and equipment that require delicate skill in construction and use. Even the historian and student of ancient manuscripts must be able to restore legibility to parchments and papyrus on which the ink has faded and to repair papers that have all but fallen apart. There is hardly any important work left in the world for those who have not developed some kind of manual dexterity and the ability to work along original and creative lines.

It was not mere accident that the man who, more than any other, embodied the change that took place when Europe altered its outlook from a musty traditionalism to an age of science and exploration was a man who was among the greatest in painting, sculpture, philosophy, mathematics, anatomy, physical science, and mechanics. His name was Leonardo da Vinci, one of the most versatile men of all time. It is

generally held that he ushered in the modern age. He started a cultural revolution because his hands as well as his mind were exceedingly versatile, surpassing those of most men who ever lived. The new age could not have been ushered in by anyone with unskilful hands. In several respects his work was centuries ahead of that of his contemporaries.

Thomas Edison is another example. Rarely has there been a genius in whom the exceptional co-ordination of hand and mind contributed so markedly to the phenomenal success of both. The story of his education is enough to revolutionize our educational routine. He attended school less than one month and was considered lacking in sanity by his teacher because he, paying little attention to her formal teaching, wasted his time drawing diagrams and sketches of things she could not understand. At home he played with tools while other children played with toys. After his month in school, his mother taught him privately, and by the time he was ten years of age he had covered practically the whole high school course as well as a good many things college students find difficult. He spent as much time with tools as with his books. At twelve years of age he took complete charge of his own education in addition to working eight hours daily on the railway, selling papers and foodstuffs to passengers. He built his own telegraph system and set up for himself a chemical laboratory which not only got him into trouble but advanced his knowledge as well. At fourteen he was a more successful business man than his father. Mentally far advanced beyond his age-group, he was an expert mechanic with a score of simple inventions to his credit. Having patented over

1,400 inventions during his lifetime he easily became the most outstanding inventor the world has known. Although he had had practically no formal classroom education at all, he was as familiar with the Classics at the age of twelve as any American college graduate is today, and his habits of work and creative activity coupled with his reading made him an expert who carried us into the age of electricity and applied science faster than any other person. Ten million people are employed today making the things he invented or perfected.

If anyone should challenge the statement that creative handwork is study, we may reply that the head cannot go far without the bridges, roads, vehicles, weapons, and the tools which the hand alone can create. The mind is as dependent upon the hand for further development as the hand is upon the mind.

The mind is not a sponge to soak up learning but is part of a physical organism that grows by exercise. It is a fact that through our self-made mental blueprints or through our own handiwork we understand much that we can retell in our own words. Only that knowledge is thorough which has been used or can be fitted into use. We can store a certain number of facts for future reference but only when the mind is alert to their possible future use do they remain fresh enough to be put into circulation.

There is almost no limit to the amount of skill the human body can develop. Dancers, jugglers, acrobats, and tricksters give some suggestion of this illusive limit when they astound us with the extraordinary feats that we know we cannot imitate. Although in many cases their bodies are endowed with a natural suppleness,

quickness of reaction or strength that cannot be developed by some of us no matter how much training we may get, their skill is almost entirely a matter of training. Only those properly endowed physically succeed in becoming acrobats. But the commercial skill of many tradesmen is just as great though in a different field, and is developed through experience.

The dexterity shown by a first-rate pianist or violinist is not exceeded by that of an acrobat. Probably nowhere has there been developed a more perfect co-ordination of muscle and mind than in an accomplished piano-player. A good typist seems to find the right keys of his typewriter with a sort of sixth sense. His dexterity has become automatic through practice.

We often hear the term 'sixth sense' employed in reference to some extraordinary ability of individuals to do and comprehend things which are beyond us. Some people seem to be able to read the thoughts of others with remarkable accuracy. Others are able to find their way and direction with the homing instinct of a pigeon or cat. The magician Houdini was able to open any lock and break out of any prison within a few minutes although tied or handcuffed hand and foot. He could open the lock of a safe and free himself even when he was locked inside it. Some mathematical wizards (often children) are able to reckon mentally, within a matter of seconds, multiplication with figures in both multiplier and multiplicand in the million which would take most of us a half-hour to do with paper and pencil. Yet these feats, and thousands more that seem impossible to us, are probably only a special, keenly developed sense of sight, hearing, smell, touch, or taste, with ōr without a correspondingly unusually

developed bodily skill. Psychologists do not rule out the possibilities of other senses, but when we realize what the radio and radar have enabled us to hear and figure out by the mere addition of a few mechanical gadgets, we need to be prepared to admit that the unusual perfection of the senses combined with an individual's skill or memory can produce results which appear inexplicable to those who have less keen senses and less developed skills.

Some of the most common skills are actually quite extraordinary. Take the power of speech, which even a two- or three-year-old child possesses to a remarkable degree. Consider how quickly the throat rejects hundreds of wrong sounds, all closely allied to the correct ones, and limits itself to making the one sound which produces an intelligible word. The physical skill of talking, without even considering the thought-processes behind speech, is more wonderful than the acrobatic stunts of the circus performer. It fails to astonish us only because we all learn to do it.

Suppose that man should find out that the last human being will be dead within 500 years but that animals will continue to live. Suppose further that man should decide that in order to preserve at least a little of the progress he has made at the cost of such tremendous labour and suffering, he should try within the 500 years remaining to teach these subjects to the cleverest animals. Which animal would he choose? Which animal is best endowed to be our successor?

There are many that are keen of eye and ear and nose, far more keen than men. There are some possessing skills that a man cannot hope to equal. But of all these animals there is only one group that we have

any hope of making our successors in even a most elemental way. These animals are our nearest physical relatives, the higher apes, which again are higher relatives of the monkey.

Why should we choose the higher apes to be our successors? Why not the horse, the dog, the elephant, all of which are often spoken of as being intelligent? Because they have no hands. Without hands they will never be able to pick up anything to examine and study it. Nor will they be able to make things. They can handle no tools. The elephant can do a few things with his trunk but not enough. Birds make nests which are wonderful but they make nothing else. With no ability to use tools or weapons other than their limbs, animals cannot be taught to do enough things to set them thinking. We begin to think when we begin to work for greater comfort, for better homes, for better and more regular food, for better protection, for better pleasures and ways of living. Man began to progress far beyond animals when he began to do two things—to work for better living conditions and to walk. Talking developed beyond a few grunts of pleasure or displeasure only after man started working with his hands to improve living conditions and needed the help of his fellow men. He had ideas he wanted to communicate to others, and it was not till he had started to work and had problems and difficulties to overcome that he learnt to talk.

The ape is far less intelligent than man because he has not learned to talk and consequently has hardly started to think except for very simple cogitation scarcely comparable to that of a three-year-old child. But he has hands which show promise of becoming

clever, capable of handling tools, if we could encourage him to use them for the improvement of living conditions and could get him to work together with others of his kind as well as with his teacher, and to develop more sounds to symbolize his wants and difficulties.

It would be a weary and patience-trying job. It is extremely doubtful whether anything could be taught that would survive a few generations of apes. But of all the animals that might be groomed to be our successors in a most elementary way the apes are the least hopeless. Man could never have developed into the intelligent being he is without the use of his very clever hands, which got to be more clever the more he used them. Man started his upward climb through the use of his hands and his voice. Both of them stimulated the use of his brain, and the use of his brain stimulated him to make better use of his hands and voice. The ape possesses hands and throat equipment which might possibly start him on the road to emulate what the first primitive man attempted. We do not see how any creature not possessing these two important physical assets could possibly follow in our footsteps. It is reasonable to suppose that even greater achievements are possible to man because of the advantage the forenamed physical assets give him.

The above paragraphs give some support to the point of view that the development of the brain has been dependent on the development and training of the hand. The implication is that our further development is still dependent on the hand. Each individual is forced to repeat in his lifetime a résumé of the history of the progress of man. Even today we learn best by doing. This fact the school often forgets, and forgets

at its peril. Manual development is still the condition for much of our mental development. You can learn a good many facts by 'cramming', but the facts lack meaning and reality which only broad experience and a good amount of observational and operational skill can give us.

The purpose of this chapter has not been to suggest that a student, when studying for an examination, should start by practising handwork and training the five senses. That should have been done in an earlier stage. In preparing for a written examination he cannot go back to training in elementary skills except for correction of technique here and there. He must have acquired these skills already. The skills are tools. If the student has these, he will be well equipped to get the most out of his course. Without them he will be handicapped in getting a proper grasp of the contents of the course of study. Examiners often report that students give answers that are partially correct but are stereotyped and show no real understanding of the subject. That means the contents of the textbook have been memorized in a perfunctory, mechanical way for examination-writing purposes, but the student lacks the experience and skill which give a satisfactory working ability. Education demands the training of all the faculties. Neglect of any of these faculties results in ineffectual education and sometimes even in mis-education.

5. We Learn by Language

It has been mentioned in the previous chapter that man has had two advantages which have put him practically and intellectually far ahead of all the animals, namely, a hand that can manipulate and fashion tools, and the power of speech. The physical accomplishment of speech is a marvel in itself, but that is not what we are concerned with. We are concerned with its usefulness.

Its usefulness is twofold. In the first place as speech grew more complicated it turned man into a thinking machine, or approaching it from the other side, thought made speech a necessity for the communication of ideas. Each acted on the other. In the second place, speech made it possible for human beings to learn from each other and teach each other in a way that is impossible for animals. Animals cannot communicate thought to each other. Animals do communicate with each other through sounds, through the example of their actions, and probably by other means as well, but these communications do not go far beyond expressing fear or alarm, pleasure or displeasure, pain or exuberance, and the few most elemental physical desires. There is no real exchange or comparison of ideas. That ability only comes with the power of speech.

Thought is language. That does not mean that all language conveys logical thought. Talk may be mere chatter even though good language forms are used.

Thought is language in the sense that there is no clear thought until the language has been shaped to define the thought for others to understand. Often we say, 'I know exactly what I want to say but I just can't say it.' What we should say is, 'I have a hazy idea of what I want to say but I have not thought out the details well enough to present a clear picture. I can picture it in a vague sort of way, but the picture is still badly out of focus.' We shall find that when we finally bring the picture into focus, we have a clear verbal expression. A clear thinker makes a clear speaker and a clear writer.

Experimentalists in animal behaviour have found out that the higher apes use about thirty sounds which convey definite meaning to other apes. We might call these sounds words. They are the ape language. They also indicate the number of ideas (in a very primitive sense of the word idea) which apes may be expected to have. A child of two years should use from one hundred to three hundred words and understand many more. A high school graduate at the time of graduation should understand more than 50,000 words in his mother-tongue, although he will probably not use more than 10,000 in speech and writing. The total number of words a human being may succeed in knowing may run to over a hundred thousand in his mother-tongue alone. That does not mean that he has that many ideas. There are many words for similar ideas and not all words contain an idea, but it does mean that he may have an almost infinite number of ideas. This puts man into a class by himself with no rivals whatever to his position of being the most intelligent of all creatures on earth.

Because animals have no language they cannot impart much of their experience to others. By living in the herd, younger animals no doubt learn something from the older, more experienced animals, but what they learn does not involve thought and planning. It leaves the animals practically unchanged from generation to generation. In contrast, man changes rapidly. In 10,000 years, only a brief interlude in the history of evolution, men have developed from savages, living in caves and depending upon foraging for food from day to day, to builders of steamships, aeroplanes, electric plants, and large cities like New York, London, and Bombay. Each generation is different from the preceding one in a hundred subtle ways. Human nature has not changed much in the last few thousand years, but man has certainly changed his way of living and the appearance of the face of the earth. This transformation would be utterly impossible if each generation were not able to stand on the shoulders of the preceding one and benefit from the experiences of the human race as a whole.

When one human being gets a new idea, it is possible for the most enlightened people in every country in the whole world to know about it in a day or two and for the rest of the population within a few weeks or months. Suppose an animal should get a new idea. The chances are that he is unable to communicate it to another living creature, and it will die with him. Where there is no speech to spread ideas, there can only be very slow and wholly accidental changes.

What we know, have, and are, we owe to former generations and to our fellow men. Man has learned only through hard experience, but the hard experience

need not be repeated by every individual. No individual lives long enough for that repetition or is tough enough to endure a millionth part of what would be necessary.

A human child left to grow up in the sole company of wolves (such a thing has happened in India), or apes, would be more intelligent than his foster-parents, but this intelligence would not lift him far enough beyond the utterly primitive life of his surroundings to enable him to think and act like a human being. On our own initiative we learn infinitesimally little beyond a few needs of mere animal existence. It is the environment of intelligent companions, enjoying the heritage of the ages and the combined efforts of the present generation, that lifts us above the floor of pre-civilized life. Were language and speech suddenly wiped out of existence, man would in a few generations lose all he had acquired in 10,000 years or more. Seeing and imitating others might slow up our reversion to semi-animal existence, but it could only slow it up and not prevent it.

Sir Isaac Newton, one of the most brilliant minds in history, worked twenty to thirty years before he announced his statement of the Law of Gravitation. It ranks as one of the most brilliant achievements of the human race. It was possible only because before his day thousands of brilliant minds had prepared the way. But in a few years every leading physical scientist had followed his thoughts, and nowadays some especially alert boys and girls of fourteen years of age understand it fairly well.

Only a few years ago it was said that barely half a dozen men in the world could understand Einstein's

theory of relativity, but today a whole army of young men in their twenties have been working on the outcome of Einstein's theory, namely atomic energy. Language has made the pioneering thoughts of today commonplace tomorrow. Language is the most revolutionary tool the world has ever known. The invention of the radio pales into insignificance beside it, for the radio is only another gadget to give language a chance to make itself heard everywhere at one time. It is at most only a prop to language.

We cannot realize the full value of language until we see how difficult it is to teach creatures who know no language. A psychologist undertook to teach earthworms to avoid a new kind of danger. He made a ⊤ joint out of material that was non-conductive to electricity. The ⊤ tube was inverted making a ⊥. The right side of the joint was filled with damp earth and charged with electricity so that the earthworm would receive a shock if it turned to the right. The left side was filled with dry earth and was not charged with electricity. The earthworm was let down into the tube from the top. When it reached the joint at the bottom, it naturally turned to the right since it preferred damp earth to dry. Immediately it received an electric shock which was not at all to its liking. Then it turned away from the electric charge to the dry earth and came out of the tube on that side. It was put into the tube once more. Again the same thing happened. The experiment was repeated 157 times before the earthworm learned to turn from the damp earth to the dry without first having to receive the shock. The next day the trial was made again; this time the lesson was learned in 90 trials.

Most two-year-old children could be taught the lesson in two or three trials, perhaps in one. If we have two doors, one red and the other white, and tell the child that it will hurt to touch the pretty red door but that the white door is all right, the child will probably avoid the red door. Some children might try it just because of a defiant or independent attitude, although quite capable of knowing what they were meant to do. But if disobedience is punished by an unpleasant enough experience when the red door is touched, the cure will be just about permanent, unless the child thoughtlessly plunges through the door while preoccupied with something else.

The child has the advantage over the earthworm in that the earthworm has to learn by trial and error while the child does not even have to make the trial in this case. Language saves him from the need of it. If the warning does not sink in, a single trial will be enough to lend force to it. What language does is to remove the necessity of many trials and errors.

Trial and error is a most costly way of learning. Furthermore, it is inefficient, especially when the bad effects of an error do not immediately show up, so that cause and effect cannot be easily associated. I have a friend who got a bad rash every time he slept on a feather pillow. He is allergic to feathers. It took him and the doctors several years to find out what caused the rash. When the cause was at last related to the effect, it took less than a minute to tell the sufferer how to avoid the effects. The rash only appeared a day or two after the feather pillow was used, so it was difficult to associate the effect with its cause.

Teaching consists largely in showing students cause-

and-effect relationships which mankind has discovered through the ages but which can now be described quickly and easily through language. People vary enormously in their capacity to learn through language. Intelligence consists to a large measure in the ability to gather a rich fund of experiences by the easy method of being told rather than having to go through a long tedious trial-and-error process of original experience. An intelligent person learns quickly by observation, by hearsay, by reading. An unintelligent person can be in the company of intelligent people but can fail to hear, see, or otherwise perceive the same things. When a matter is explained to such people, they must hear it several times before it begins to sink in and even then they are likely to miss half of it. The same is true when they read. It takes much demonstration and trial-and-error experience for them to reach the conclusion that a more intelligent person reaches quickly and painlessly.

Were we all geniuses in every subject, we should not need much teaching by professional teachers. We could get enough information just by keeping our ears and eyes open when people talk and when we read. But even the brightest genius needs some first-hand experience. Words cannot describe everything so that it is really meaningful. A person who has never seen a body of water larger than a pond or a river cannot easily comprehend what the ocean is really like. No one who has never looked at the night sky through a good-sized telescope can appreciate what the starry heavens are like, although photographs can do much to help. A sad story can awaken sad feelings, but it is not until we have seen real sorrow or experienced

sorrow ourselves that we can have any idea of all its implications.

Some people are more imaginative than others. From a small amount of experience their imagination permits them to reconstruct other and wider experiences, almost as if they were first-hand experiences. It permits them to benefit from the experiences of others almost as if they were their own. Education is largely a sharing, or rather an acquiring, of the experience of others and making it our own. But you cannot make it your own unless you have a certain amount of first-hand experience so that the new can be built on the familiar.

It took scientists many hundreds and even thousands of years to wrest the simple little secret from Nature that blood circulates, that it is pumped by the heart to carry oxygen all over our body. The blood becomes impure as it gives off its supply of oxygen to the body and then returns through the capillaries to be cleansed by fresh oxygen in the lungs, and is sent on its rounds again and again. It appears simple now that it is known and we find it difficult to understand why scientists did not know about it long ago. The secret can be explained in a few words. But children are likely not to understand it the first time they hear it. They have to be told again. They must be shown charts to illustrate it. And perhaps the importance will not fully dawn upon them until they have seen blood coursing through the veins under a microscope, or have seen what happens when organisms bleed and what happens when they do not get air to oxygenate their blood.

Language is the best learning tool we have. It

increases experience a millionfold when combined with a proper amount of first-hand observation and experience. Without some first-hand experience the pictures it paints get to be more and more drab and lifeless the further they are removed from sense and aesthetic experience. Then words become meaningless, and the imagination refuses to produce images of the phenomena which the words are supposed to symbolize. The words alone are not understood. At most they are understood in part. They only convey meaning when the mind's eye can visualize vividly. The mind's eye cannot visualize without the proper perceptual and motor experience.

Teaching through language has another serious limitation. When language speaks of physical phenomena it can only tell us what others have found. In fact, it usually tells only a small part of what they have found. We cannot go on unless we at least see some things for ourselves. Hearing about an exciting football game over the radio is better than nothing, but the real thrill of the game is lost in not seeing it. Furthermore, you cannot learn how to play football by hearing the radio report. You can only learn how by playing yourself. There can be no thrill in the study of science unless you see the phenomena yourself and try to make discoveries of your own.

Science is progressive only when it is discovery and not mere hearsay. History is history only when it is discovery. It is discovery of the truth regarding the past and not taking the word of any one writer as the whole truth, for there is often room for difference of honest opinion. You make discoveries by working and not by repeating verbatim.

Education should be like a visit to the Taj Mahal. If an ignorant savage went to see it, without anyone having told him anything about its history, and without having been told anything about what constitutes good art and architecture, he might be impressed with its peculiarity and size since it is so utterly unlike anything he had seen in his jungle home. He would probably not appreciate its real significance and the beauty of the workmanship of the building. But education has given you a background of history, a love of symmetry, form, design and colour, especially if you are fond of art. Much of this previous education has come to you through lectures, reading and discussion. Therefore having arrived at the Taj, you eagerly ask questions about this or that and look up facts in the guide book. You point out the beautiful lines of the dome and recognize that the minarets form a perfect setting for it. It is clear that you are making good use of communicated ideas. Compared on the one hand with the experience of an ignorant savage, whose conversation never touched on anything relating to the Taj Mahal, and compared on the other with the one who has to be content with reading or hearing about the Taj because he has never seen it, or even a picture or model of it, your experience is infinitely richer. You have heard about it, you know something of its history and of art, and now you have seen it. All these factors combine to give you a fuller appreciation of its beauty.

The scope of teaching and learning through language is very wide, but it takes active participation and the full use of the senses to enable an individual to assimilate and utilize the human race's infinitely large mass

of communicable experience. This can only be done when the imagination can reconstruct the original experience in at least a part of its original strength.

6. We Learn by Reading

Reading is the ability to interpret symbols which restore thought expressions to life. Reading is like making use of gramophone records. All we have to do when we have the proper literature is to exercise our reading ability, and the thoughts of men and women of past ages are repeated for our benefit. No matter if they have spoken different languages, if we have a proper translation before us, their sayings are restored to life for us in the language we can understand. We have all but the speaker himself before us.

It is inevitable that such a tool, which preserves such a large number of properly recorded thoughts expressed through language, making them timeless and universal for anyone who has the ability to read, should become one of education's handiest tools. It is like going to a collection of gramophone records and putting on Plato, Shakespeare, or Tulasi Das to hear their masterpieces. It is like making the very best scientists, philosophers, historians, statesmen, and news reporters lecture to us. We can even invite the salesman to give his sales talk. And all this can be done to suit the convenience of the reader. Reading is an indispensable educational tool.

No student is equipped for efficient study unless he is an expert reader. The expertness must be more than just being literate. It must be more than just being able to read when one has to do so. It is the

ability to get enough pleasure and incentive from reading to make one read much more than the mere requirements covered in the syllabuses of present-day Indian schools. One cannot be a true student unless one loves to read and does read a great deal. It is possible to be a student of practical affairs and natural phenomena up to a certain point without being a good reader, but students who are satisfied with that alone never develop the enlarged horizon that people do who easily call on the experts through books, papers, and journals.

There are other symbols that convey meaning besides those that consist of the written or spoken word. There are numerals and mathematical symbols. Mathematicians have developed a language of their own, their formulae. It is said that putting atomic energy to use (which is more than just the manufacture of the atomic bomb) is the working out of new formulae. Almost every branch of learning or profession or even trade, develops its own codes and symbols which are unintelligible to the uninitiated but mean as much to those who can read them as language does. Diagrams, charts, maps, and the like, as well as music notation and shorthand, are only an extension of the device of using symbols from which we read certain predetermined meanings.

The simplest form of writing is picture-writing. Primitive forms of picture-writing were used by the American Indian until comparatively recent times. Boy scouts often revive some of this elementary communication for their amusement and instruction. In picture-writing there are no letters. Pictures express ideas. The limitation to picture-writing is that it

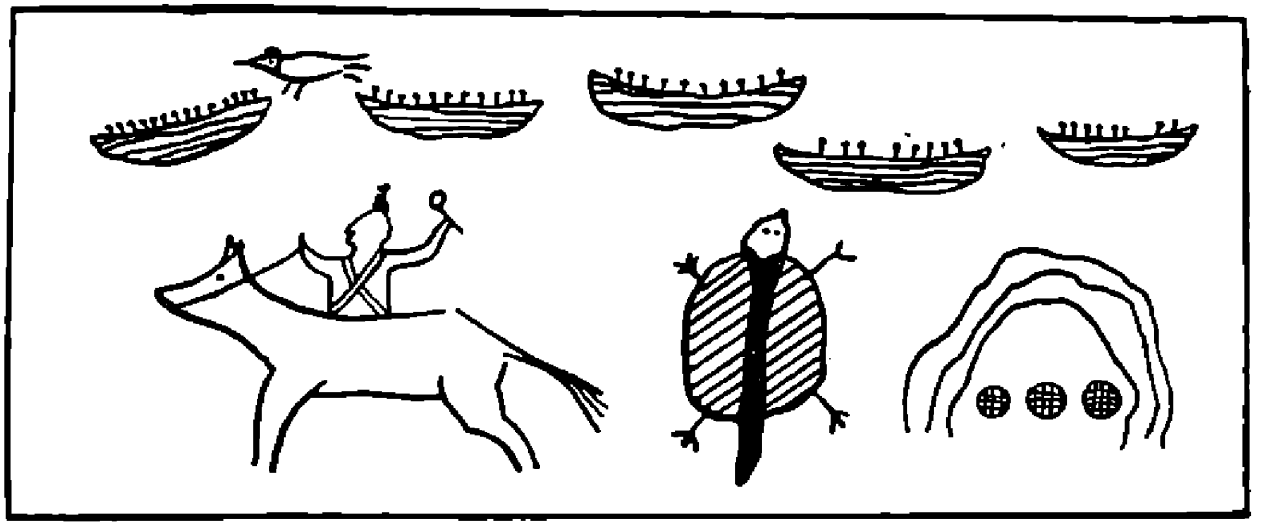

FIG. 1. A RED INDIAN PICTURE STORY

This picture tells the story of fifty-one Indians in canoes who took three days to cross a lake. The days are shown by three suns under arches. The chief, on horseback, was named Kingfisher (his name represented by a bird) and the turtle, a land animal, indicates a safe landing.

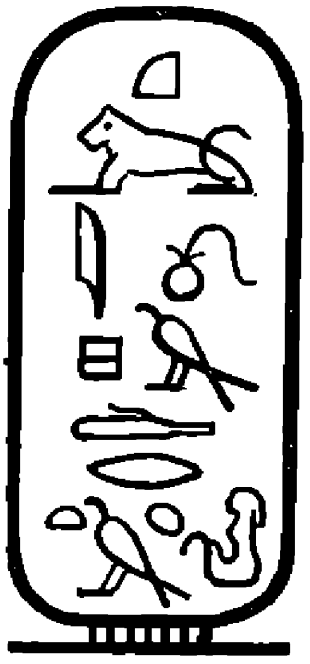

FIG. 2. EGYPTIAN FOR CLEOPATRA

The cartouche contains the name Cleopatra (Kleopat) spelled out with alphabetic characters; the quadrant, K; the lion, L; the reed, I (English E); the knotted cord, O; the shutter, P; the eagle, A; the hand, T; the mouth, R; and the eagle, A. The egg indicates the feminine gender, and the image signifies that the one intended is a deified creature.

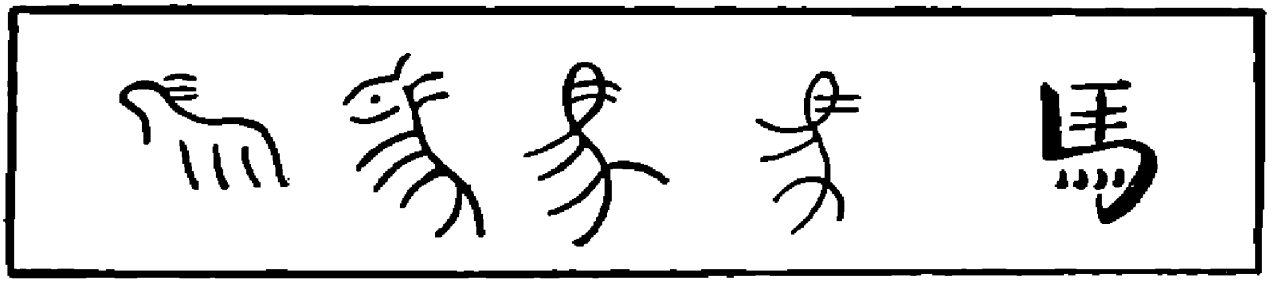

FIG. 3. THE CHINESE CHARACTER FOR HORSE

The character, or idea sign, for horse has gone through many changes. The one at the right is in use today.

EXAMPLES OF PICTURE WRITING

conveys and receives only very simple messages. Different picture symbols are needed for every type of thing to be expressed. The ancient Egyptians went far beyond the Red Indian in their hieroglyphics, but they too could not express very much. The Chinese have gone even further and made thousands of pictures to represent the ideas they want to record. The more pictures they made to represent certain ideas the more difficult it became to make pictures that did not look like others. The pictures became so complicated and so stylized that after a while no one knew just what the original picture was like, although scholars knew the meaning of each stylized symbol. In time picture-writing ceased to be picture-like but still retained a mass of meaningful symbols. A different symbol developed for every word. When there are many thousands of words in a language you can imagine what a job it is to learn to read and write. The Chinese man who wants to learn to read and write must spend nearly a lifetime simply to be literate. The highly literate man is spoken of as a 3,000-word (or -character) scholar and a man of still greater learning as a 5,000-character scholar. Such a system of reading and writing is not nearly as efficient as the letter systems in which 25 to 75 letters can express all the words of the language. It took a long time to develop our present alphabets. Some alphabets are considerably more efficient than others, nevertheless, the worst alphabet is better than the very ingenious but ponderous picture-writing system developed by the Chinese.

Writing (even picture-writing) is the beginning of the keeping of records. Man of the pre-writing day could keep records of very little except what he kept

in his memory. One occasionally meets illiterate or almost illiterate contractors and shopkeepers who keep their accounts remarkably well considering the fact that they write down little or nothing. But no one else knows the accounts. If the man dies, no one can untangle his accounts. No developed civilization was possible until man learned to keep written records. Thus, the ability to write and read not only helped people communicate their ideas and increased a hundredfold their opportunities of learning from each other but it also made available to us facts and figures gathered by mankind through the ages. It has given reliability to information and has made it possible for mankind to deal precisely with forces and phenomena. Without the means to make reliable records intelligible to all who take the trouble to learn the system, we simply could not organize on any scale beyond tribal dictatorship. Learning to interpret, make, and maintain accurately many kinds of records is one of the first skills necessary for the student. It is a part of and an extension of the reading skill. A good part of study is the making and using of records. Reading, writing, organizing data, accounting, classifying, cataloguing, and summarizing are all skills to be jointly used in intelligent study. This résumé should give us an idea of what naturally grows out of the reading activity and what we have access to through this activity.

It takes a good as well as a versatile reader to be a good student. In India reading skill is not nurtured nearly enough during the school years. As a result a large proportion of students never learn to read skilfully enough to make reading a tool that can be used for the regular classwork and also as an art to be used

freely, naturally, and voluntarily for enjoyment and the increase of knowledge. By the time the Indian student completes his high school course an English or American student is expected to have read five to ten times as much. Many Western students read much more than they are required to. All that they read is not good material, but they at least use their skill and thereby increase their ability to make their reading profitable when it has to be used for their academic work.

After the primary-school level Indian schools concern themselves very little with the teaching of reading. At the primary stage pupils have just about covered the elementary phases of reading. The more developed phases of reading skill cannot be taught to the average student until he gets into middle and high school and therefore as a result of the inadequate early training high school students use a hesitant word-by-word method which focusses the attention on the individual words rather than on the content. Effort is expended merely in trying to reproduce the words, and the meaning of the passages read is grasped with difficulty. Good reading is essentially thought-getting and not word-calling. Many students have never progressed far enough to realize this fact.

In order to get the most out of reading, silent reading must be as natural and easy as talking to one's friends. Yet silent reading is not even taught or practised in many middle and high schools. The only reading that many pupils do is the traditional oral classroom reading and a rather painful study of textbooks and notes.

The writer has standardized a number of Hindi reading tests in addition to using extensively informal reading tests of various types. In all he has examined

at least 30,000 students whose mother-tongue is Hindi. One-fourth of the students in the matriculation class do not read as well as the brighter boys in class five. Fully one-half find their reading skill only a dull tool at best. It is not adequate for intelligent independent study. Silent reading should be taught until students in high school can read at least 250 words a minute in the mother-tongue. When reading at this speed, they should be able to remember at least fifty per cent of the main facts of matter of average difficulty, such as one finds in newspapers, books, and magazines. Only a minority of high school students remember fifty per cent of the main facts even when given considerably more time. Although some students in Indian high schools and colleges compare favourably with students anywhere, far too large a proportion never get beyond what should be expected of middle school students. Obviously no matter how hard they work such students are poorly equipped to derive the full benefit from their studies. Some of their hard work should be devoted to sharpening their tools instead of plodding along with dull ones. A teacher is guilty of criminal neglect when he lets his students muddle along half-heartedly on account of their dull tools.

Most people can improve their own reading efficiency within two months by thirty to sixty per cent, with a little intelligent drill each day. How to do this is treated at length by the author in the book entitled *Suggestions for the Improvement of Reading Habits.*[1] Much of the material in that book is pertinent to our consideration of training in study-habits. Much of the training in better study-habits consists of guides

[1] Oxford University Press.

showing how one can get the most out of reading.

Every reader reads with his own eyes. That is meant figuratively. It is meant in the sense that although several readers read the same words, and words are supposed to have standard meanings, they have very different associations for each one of us. The word 'mother' means the best and kindest friend on earth to some, while to others it means someone who always scolds or who quarrels with Father, and to still others it means someone who was useful to feed, clothe, nurse, and serve one, but who belonged to a different day and age. There are thousands of other associations conjured up by that one word in the minds of different people. Mature and intelligent people recognize that there are nearly as many kinds of mothers as there are women who have borne human children. Therefore, we conceive of the word as denoting the average type, not the best or the worst. But a person's concept is coloured somewhat by his own personal experience. In the same way the term 'national independence' has quite a different meaning for those who have fought, struggled, and suffered imprisonment for their country than for those who do not care who rules so long as they get enough to eat.

Consider the following passage:

I am weary of my island life. I am weary of the pleasures spent upon myself, weary of the dividing sea which makes me alone.

I look upon the monotonous waves that roll between me and my brother, and I begin to be in want; I long for the time when there shall be no more sea.

Lift me to the mainland. Unite my heart to the brotherhood of human souls. Place me on the continent

of human sympathy where I can find my brother by night and by day—where storms divide not, where waves intervene not, where depths of downward distance do not drown out love.[1]

There is required more to understand such a passage than a mere knowledge of words, language and the geographical terms used in the metaphors. A reader may be an excellent reader mechanically, and yet understand little in that passage. It is safe to say that a group of college students might differ from each other on a percentage scale all the way from ten to ninety according to the amount they understand when reading such a passage in their mother-tongue.

The above-quoted passage is a very metaphorical and emotional one, employing the language of poetry rather than of prose, though it is in prose form. Nevertheless in the reading of the most prosaic and factual type of statements the same lack of comprehensive ability is found.

The following paragraph was given to hundreds of high school students in India to read. It was also given to some adults in their mother-tongue. They were told to remember the main facts since questions would be asked on the contents of the paragraph, and they would have to depend upon their memories to supply the answers.

During the so-called Middle Ages in Europe (the years between about 800 A.D. and 1500 A.D.) there was very little progress in science. In fact, less was known of science than had been known 1,000 years before. There are several reasons for this. In the first place there were

[1] George Matheson as quoted in *The Meaning of Service* by H. E. Fosdick, Association Press, New York.

very few educated people and the few that there were lived in monasteries. A monastery is a sort of ashram, where the interest was more that of *sanyasis* than of people who are interested in the world in which they live. There was also a peculiar idea that science had to be learned from old books rather than from nature. Books can tell only what scientific discoveries were made by others. They never make a scientist because a scientist must learn from nature. Science deals with nature and the study of science is sterile unless we study nature itself. Books are only a help. At that time people were very superstitious. They believed in magic more than in science. They thought scientists were magicians. They would not permit the doctors to cut up the bodies of dead people to find out how the human body works, and so doctors knew little about the human body. Finally it must be said that many wars had made people so poor, afraid, disease-stricken, and unsafe in their living that they had little time or desire to study and find out the truth. They were hardly civilized any more. Under such conditions there can be little progress of scientific questioning and study.

Questions.

What was the state of progress of science in the Middle Ages?

Why cannot science be learned only from books?

Why did doctors know so little about the human body?

What condition made the people too poor and afraid to be interested in scientific questions?

The majority of students were able to give correct answers to only one or none of the questions. The paragraph contains no unusual words or technical concepts. What then made the paragraph so difficult for them to understand? There is nothing in it that

is not simple, commonsense expression. However, a background of general knowledge is required. The language is plain, but unless one knows something of the mentality of people before the scientific age, and the attitude of people towards traditional authority as well as the devastation caused by war, the situation described does not become vivid enough to stir the imagination and remain in the memory. What cannot be visualized is soon forgotten. Or rather, what is not visualized during the reading process does not actually enter the mind, although reading over the words gives us an impression that we do understand. We understand only isolated words and phrases and not the real theme of the passage.

The next paragraph quoted is a little more imaginative. It is the kind of language one might expect any eloquent speaker to use.

> Puny in strength compared with the beasts of the jungle, man has reinforced his arm with weapons sharper than the tiger's tooth and surer than the lion's spring. His sight is weak compared with that of the hawk or eagle, but he has made for himself magic glasses to bring the stars near and to reveal the marvels of the world invisible to the naked eye. Less fleet of foot than the dog or deer, he has harnessed steam and electricity to carry him over land and sea and to send his thought and spoken word across the world with the speed of lightning.[1]

Every high school student might be expected to understand something of this paragraph, but to understand it fully one has to be familiar with a good many things,

[1] Hatfield, W., Lewis, E., and Guilfole, E., *English Activities* (American Book Co., New York), p. 326.

not thoroughly but at least in an ordinary way, namely,

The way of wild beasts
The way of primitive man
Use of telescopes and microscopes
Use of steam and electric power, railways, and ships.

A good deal of knowledge, understanding, and reasoning ability has to go into the reading of this passage in order to get much out of it. We get out of it exactly what we have to put into it. With little general knowledge and experience to put into study we cannot expect to get much back.

The ability to read certain passages depends upon familiarity with the subject-matter discussed. It also depends upon the general level of experience and maturity of the reader. All of us are not equally familiar with all subjects and equally mature in all things. Just as we may be experts in one subject and quite ignorant in another, so we may act like mature human beings in many life-situations and like irrational children, who have never thought beyond their own petty desires, in others. Even when a reader is mechanically skilful, previous knowledge and previous personal development determine how much or how little he can derive from the reading or study of certain books or other materials. No amount of so-called 'study' of facts which may be required in the examination can lead to an understanding of these facts unless there is an understanding of the broad base of facts to which these particular facts are related. For instance, to understand what is meant by the oft-repeated statement, 'The price at which we may expect to buy cloth

must be left to the law of supply and demand to determine', requires a good deal of economic and social common sense. To examine the statement critically demands even more. Lacking this economic and social grounding, the meaning of the sentence eludes one. Rarely does any reader realize how much is eluding him. If he knew it, he would be hunting for the escaped meaning, but not realizing it, he can read the passage over and over again and fail to discover its real meaning. Study is practically useless when the reading is done without the reader raising question after question.

The key to finding out what is in books is to read with an inquiring mind. This does not mean that one should sit down and formulate questions before opening a book. A book itself should stimulate most of the questions for us. When we read without such questions as who?, what?, why?, why not?, when?, how?, where?, etc., being stimulated, we may be certain we are not getting much from the reading. School textbooks are sometimes so difficult that they do not stir up such questions. In such a case help should be given. Sending a student back to his textbook with a few questions, the answers to which he must find, may start a chain of thought revolving in his mind. As he gets deeper into his subject, questions will arise of themselves.

A student without questions in his mind is a lifeless and hopeless student. On the other hand the quality of a student cannot be judged merely by the number of questions he asks. The best students often find out the answers themselves and are therefore not conspicuous as questioners. It is the student who is not absorbed by questions, although he may ask a few perfunctory or superficial ones to give the impression of being

interested, who is not really working. It is the quality of the students' questions as well as the number of them which is significant.

There is not much need to ask questions when one learns verbatim. Neither is there much learning.

To summarize this chapter briefly, we repeat that of all the skills or tools useful to the student, language and the device for making utterances and records from various times and peoples available just when and where we want to use them, in the form of reading, are the most useful. But a higher grade of reading skill is required than most students in our high schools and colleges in India today possess. Not only must the student's mechanical skill be developed, but he must have a good fund of experience, common sense, general knowledge and genuine curiosity in order to read effectively. What can be gained from reading and studying particular materials depends on what knowledge and understanding of a more general nature the student already possesses. The foundation of education must be laid broadly. Studying only that which is required in the syllabus or in the examination does not provide a short cut to a full education.

7. We Learn by Memory

There is no need to stress the value of memory in the educational process. Without memory it is impossible to profit from experience. It is as easy to handle liquids and gases without a container as it is to learn without memory. Without memory the mind is a volatile gas without solidity or form. We need not plead for memory in this chapter. Rather we need to point out its limitations, for it is very commonly used in the educational process to do things which it should not be asked to do, whereas, at the same time, its greatest field of usefulness is often neglected.

The first thing to recognize about memory is that there is not one kind of memory only: there are many kinds, and the right kind must be employed to result in good learning. The second thing to recognize is that one may have a very strong memory for some things but a weak memory for others. The development of one kind of memory is sometimes actually to the detriment of the development of other kinds.

We are not concerned with subconscious memory but will confine ourselves to the types coming into the purview of the ordinary teacher and consciously directed towards retention of knowledge.

The kind of memory students in India are most apt to rely upon is verbatim memory. Verbatim means word for word, or at least approximately word for word. The intention is to reproduce the original statement in

essentially the same words and phrases. This ability to memorize quickly, verbatim, is to be valued. For instance there is no other way to make poetry really your own. Verbatim memorization is useful to the speech-maker provided he does not become a slave to it; singers and actors need it constantly; students of literature and philosophy often need it, and fortunate is the student of law who can remember what the law says.

People vary enormously in their capacity to remember verbatim. Practice can greatly improve one's ability and the lack of ability to memorize accurately can often be traced to a refusal to make a real effort to do so. But practice only helps within limits. Natural endowment determines a great deal. The writer confesses to a great dislike for committing to memory. He would rather do anything else, including the digging of ditches. Whether his poor showing in learning poetry, for instance, is due to his dislike for memorizing or whether his dislike for the task is the result of his poor natural ability is a debatable point. Probably both contribute towards making a vicious circle. On the other hand, his wife knows a song by heart after singing it three or four times and can still sing songs with many verses learned in childhood, although they have been used very little since that time. Such a gift is not to be deprecated.

Similar to verbatim memory is the ability to reproduce music exactly as it was heard. An Italian orchestra conductor, famous in all countries where Western music is appreciated, is famed for his prodigious memory. It is said that he can get up and lead the orchestra in a different programme lasting an hour

every night, for a year, without ever having to look at the music notation. He knows exactly what each of the hundred instrument-players before him should be playing. In Western music the score is written out exactly, every note of it. Therefore even after allowing for a certain amount of exaggeration in this story, the feat is most remarkable. To this conductor memorization is a very useful ability and is a natural ability rather than the result of hard work, for he never works at memorizing. He just remembers.

Back again to the discussion of remembering word for word. It is a very useful gift or accomplishment to be able to do it easily, but it is also a trap that pupils and teachers constantly fall into to the detriment of the student. The danger in verbatim memorizing is that the words are quickly mastered but not the substance. Without the substance the words are chaff. Pupils and teachers think they are learning and teaching the substance of the particular subject but they are not. Since the routine repetition of words is learned more easily than the meaning of the words, it is easier for a child learning to read to memorize a lesson than to learn to read it with full comprehension. So he memorizes it. It is easier for him to memorize a statement as to why the monsoon comes than to understand the reason for its seasonal arrival. When we can easily repeat the wording, we are tempted to cease trying for a real understanding.

What we know well we can express in our own words. But a great deal of preliminary labour is necessary for self-expression, whereas adopting the wording already worked out for us in the textbook is so easy. In checking a pupil's work a teacher must ask himself

if the student possesses a real understanding of the subject which he can state in his own words or is he merely adept in reproducing in speech or writing what others have worked out? It is often difficult to say. What the pupil repeats from a book has usually been said so much more accurately and concisely than the pupil could say it that the teacher automatically prefers the student's restatement of what appears in the textbook. In the original expression of the pupil mistakes of fact and expression are identified but in the second-hand expression from the textbook the words of an expert appear, but the brain of the student is not vitally involved. Anyone can memorize even the most obtuse definition; the contents, however, enter the experience of the learner only with real understanding. Even college students often use the words of philosophers and theologians with an understanding approximating that of pre-adolescents.

The use of a foreign tongue as the teaching medium has no doubt greatly increased the tendency, which is strong enough under all circumstances, to memorize instead of expressing that which has entered the experience. It cannot be expected of students to do original thinking when they have hardly learned to think in the language used. Learning a foreign language so well that one actually thinks in that language is an advanced stage not to be expected in secondary schools except in rare cases. The foreign language medium is to blame in great part for the Indian student's lack of reality and first-hand experience, but there are other reasons also. The main one is the traditional methods of teaching all work so that the student may pass the examinations. To this end memorizing always seems

the easiest and quickest way, but it is deceptive, for it simply cannot produce the real thing. There is no real substance behind it. It is only a smoke-screen which in the long run fools only the fool, although at first it may impress others with the student's ability. Verbatim memory is of value for the learning of poetry and for what is to be quoted literally, but its usefulness is confined to narrow limits. Used outside of these limits it is harmful to the educational process rather than helpful to it.

Students in the primary school spend much time learning the multiplication table. Yet when asked for the product of 7 x 8, they hesitate because some of them cannot arrive at the answer until they have repeated to themselves the entire table, 1 x 8, 2 x 8, etc., up to 7 x 8. Such a method is very cumbersome and leads to many mistakes. Many pupils never succeed in breaking themselves of this habit of going through the lengthy tables for every simple problem because they have been taught to memorize the elementary facts of multiplication as a series rather than to associate individual products. The more psychological way of preparing the ground for multiplication is to drill by continuous use of the isolated multiplication facts, that is, to teach 7 x 8 apart from the 'pahara' or tables. The response of 56 should come automatically as a result of such drill.

This illustrates how the use of facts is a better method of teaching than the memorization of certain words or sequences. We need to associate relevant facts rather than commit to memory certain forms. You cannot associate without memory coming into action to recall the facts to be associated, but that

involves a vastly different kind of memory from the form or setting in which the facts sometimes appear, but do not always appear.

The writer knows a man who has a prodigious memory for zoological facts. He probably knows the scientific names for 100,000 plants and animals, and not only their names but also the important facts about them. Strangely enough, however, he often forgets to brush his hair. After two days he hardly recognizes a man he had talked to previously for two hours unless that person had talked to him about zoology or botany. But he remembers what he talked about and, when reminded of the conversation, will immediately recall the person with whom he talked. Similarly, the writer knows a medical doctor who does not recognize the faces and names of some of his patients but will recognize them as soon as he applies his stethoscope to listen to their heart-beats.

In contrast to such people who do not remember people, we have some people who remember for years afterwards almost everyone they have met. Some of the best politicians are men and women with a prodigious memory for people. This is a very valuable ability in politics where knowing many people gets votes. It is said that Jim Farley, who helped Franklin Roosevelt win the election for president of the United States of America, knew hundreds of thousands of people by name, together with details about them. There is almost no limit to the capacity of the human mind to remember details that are of real interest to the person concerned. A certain telephone operator was supposed to know from memory the telephone numbers of thousands of persons. Such memories may,

or may not, be combined with weak memories in other fields.

A memory for such detail is of great value to one working with much details. But it is rather unrewarding when put to work on facts which are of no use. People have been actually known to memorize the names and telephone numbers of everyone listed in the telephone directory. This information is of use to a telephone operator but is useless luggage in the mind of the average person. One of the great helps to a student is to train him to select details which concern the matter he has in hand and to teach him to concentrate on those.

We may say that the more that is stored in the memory the greater the storehouse of the memory, that is, the capacity for remembering, becomes. In other words, the memory grows with exercise. That is true, but there is a catch in the statement. The capacity of the memory is enlarged with exercise and also with association. When we recognize the relationship of certain facts, we are unable to think of one fact without thinking of the related facts that go with it. But the memory can also be burdened with a great deal of unimportant detail. It is almost as important to forget as to remember. The memory would indeed be a storehouse of rubbish if we were to remember everything. At least 95 per cent of everything we do, say, or hear should be quickly forgotten. If one tries to remember everything that is in a book, the chances are that one will not have a clear idea of the outline or argument of the book and that the main points the author wishes to make will have been lost in the maze of detail. It is more important to know the relative

importance of facts and to be able to forget unimportant facts than it is to remember a great deal without a proper sense of comparative merit.

The best minds are not those which have become 'walking encyclopaedias' of information but those which have a proper sense of proportion. You cannot have a proper sense of proportion without a good storehouse of well-digested factual material at your command; but mere information is no guarantee of judicious use. Judicious use is what we are striving for and is the real test of the alert mind. The best student is not the one who remembers the most, but the one who has the greatest ability to find material which is relevant to the problems to be faced. You cannot remember or know everything. It is extremely unwise even to try to do so for much information soon becomes obsolete.

It is better to keep the mind open to receive fresh facts than to rely on remembering facts as they appear at a time when no real problem occupies the mind or when the problem to be dealt with is a different one. Facts often change their applicability when viewed with a changed problem in mind. You cannot tell which facts of the many you learn in school and college you may want to use later on in life. Moreover you need to know facts which may not have seemed important when you learned them but which may be very important when a relevant problem arises. So it is far more important to know where to look for the facts than to try to remember them all.

A limited number of facts do however need to be memorized. For instance, it is foolish to try to remember a large number of dates in history unless

one is making an intensive study of a certain period. But one does need to remember three or four of the most important dates in each century. When one remembers these, one can quickly make calculations backwards or forwards and arrive at a tentative idea of the period into which certain historical facts fit. Similarly, one does not need to know the exact atomic weight of every chemical element, but it is important to know the weight of the most important ones; and if one has a fairly good idea of the relative standing of the various elements in the chart of atomic weights, one can make the rough calculations needed for general use. For exact work one must, of course, look up the exact weight; and if this fact is needed again and again, it certainly pays to memorize it.

It is more important to train students to remember ideas than facts. Facts are apt to remain in the mind in isolation. Ideas on the other hand call for the proper grouping of a large number of facts. These facts become significant because they are important parts of the idea. Learned as illustrations of ideas facts are easily remembered and are easily recalled for practical use. In the second part of this book a good deal of emphasis will be placed on training for the remembering of ideas. Much of the ability to study efficiently consists of a wiser use of the memory than most students and pupils at the present time employ.

In this chapter, it will be enough to emphasize that although the memory is all-important in study, the memorizing done at present is not only inefficient but is distinctly a miseducation. The memory has to be trained to remember ideas and the way ideas are interrelated rather than to recall unrelated facts. Facts

that are not related to ideas are more or less sterile. Facts become useful when they fit in with ideas. When we say 'fit in', we do not mean that the facts are to be twisted to fit any preconceptions. We use the words 'fit in' in the sense that the facts become a part of the development of the idea and achieve their importance because they have entered our thinking and habits of thought and living as parts of our ideas.

Rules in themselves are rather meaningless until we learn the reasons for the rules. The rule is a generalization or an idea, and the reasons are the facts on which the rule is based. There is an intimate interdependence between idea and fact and one must strengthen the other through the memory if both are to have the significance which neither has in isolation. Facts without ideas to utilize the facts are useless. In schools in India the emphasis has been so heavily on facts alone that it is time to emphasize the other side.

Habit is an important aspect of memory. It is the most thorough kind of memory carried over into regular action. It is the type of memory which works so automatically and quickly that it no longer requires conscious effort on our part. What has been habituated is not easily forgotten as long as the habit rules action.

This emphasis gives strength to the conclusion that 'we learn by doing'. Those things which need to be remembered for instantaneous action need to be learned so well that they are made a matter of habit. It would be a great burden to a motor driver if he had to consciously remember to do each stage of the several things that need to be done in order not to hit a motor car which has suddenly come around the bend of a road. There are many things the driver may have

to do. He may have to judge the speed at which he is approaching the other motor car, to put on his brakes, to steer to the left, to avoid hitting a pedestrian, to avoid turning so abruptly that his car overturns, to make provision for getting back on the road again. These and other factors may have to be taken into consideration. If he has to stop to think of all of these things, his reaction will be too slow for him to avoid the accident. But if he has been well trained, he will carry out the required action automatically, faster than he can think of the details of action. His action is automatic but by no means blind or unintelligent. Every situation in which the motorist finds himself is different from the situation he has passed through before. But he quickly makes his adjustment to the new situation. Habits are helpful as long as they are adjustable. They are mechanical but not merely mechanical. In contrast, the actions of a moth which instinctively flies towards a light exemplify strictly mechanical habituation, for the moth flies into the light repeatedly regardless of whether doing so is helpful or harmful. It burns itself to death but will not abandon or modify a habit learned by the species millions of generations ago. Habits are memorized actions, but in order to be useful to intelligent beings they must be flexible and adjustable.

The same may be said for memory in general. Memory which can be drawn on for instantaneous reaction while taking all factors of the new elements in the situation into consideration is most valuable. Without it we are incapable of thinking or intelligent action. But the memorizing which is mere verbal repetition or does not result in reactions which are

automatically modified by the changed elements in the situation, impedes intelligent thought and actions. Much of the studying done by Indian students is unfortunately not of the kind which gives flexibility and adaptability to the mind.

PART II

DIRECTLY TO THE STUDENTS

8. How to Study a Textbook

1. How do we set about studying effectively? Many students waste most of their study time doing what is hardly helpful at all and neglect to do what is really helpful. The trick in studying is to stop wasting your time doing that which does not really advance your learning and to turn to that which leaves a lasting impression on your mind. In some cases, in order to study to achieve a lasting impression, it may require practice in certain required skills until they become automatic and are ready for instant use.

2. The most common form of studying is the mastery of the contents of a book. It may be the regular textbook for the course or some other book. This is only one type of study among several and is less important than half-a-dozen other types, but since it is what students usually consider to be the most important form, we will start with that.

3. There are two types of notes, the type the teacher gives to the students and the type students formulate from lectures, books, etc. The teacher's notes are predigested, that is, someone did the thinking in advance and, as a result, all the students have to do is to swallow them. But to most students the notes prove rather indigestible, for they learn the words but not the full meaning. They tend to memorize the notes without having made the contents a real part of their own thinking. This method of study has little value, if any.

It encourages the student to think he has learned far more than he actually has.

We shall deal later with the value of notes which the pupil has made himself from his books and lectures. Let us move on to the study of printed matter.

4. It does little good to read a passage again and again mechanically, merely following the arrangement of the words. Reading becomes valuable when it is approached in a spirit of inquiry. A reader who does not examine and question while he is reading derives little pleasure or benefit from it.

5. In the narrative type of reading the questions may be very simple, consisting of anticipation of how the action will develop or how the characters will react and behave in certain circumstances. If such questions are not automatically present in the reader's mind, it is usually a proof that the story is not exciting. It probably lacks interest and the reader will soon put the book aside or go to sleep while reading.

6. In reading factual matter, philosophy, discussion, etc., the questions are, of course, more difficult and require a higher order of mental activity. But the questions must be there in the mind of the reader as he reads, otherwise nothing registers in his mind. If he already has an interest in the subject and the book deals with material relevant to this interest, and can easily be understood by him, the reader has no difficulty in finding out what the book says. When such interest is present textbooks become more exciting than story books. But if there is no interest to begin with and the book does not succeed in winning the pupil's willing attention, he gets nothing from his reading. You must first have questions in your mind in order to find

answers to questions. Sometimes the answer seems to come first and arouses the question, but this fact does not alter the statement made above, for it is only after the question has been aroused that the answer becomes important. Subconsciously the question was present although the reader may not have been aware of it.

7. Reading textbooks is usually a difficult task for students, for the textbook deals largely with new material. A few wide-awake students are full of curiosity and find almost everything stimulating, but the large majority of students find the reading of textbooks hard work rather than a stimulating exercise. When the student, after finishing one chapter, asks himself, 'Now what is the next chapter about and how will that throw further light on what has gone before?' he is on the threshold of becoming a student with an interest instead of just a student by compulsion. Until a student is curious about what the book has to say, what he is studying will not be properly assimilated in his mind. Anything which has excited curiosity is interesting, and anything which fails to excite curiosity is boring. Things which interest are learned more easily than the things which bore.

8. See what a difference the following passage makes when you have a question in mind.

The physicians of Egypt were famed throughout the ancient world. Seven hundred years later than Joseph's time, Homer could say, 'Such cunning drugs had Helen, drugs of a healing virtue, which Polydamna gave, the wife of Thon in Egypt, where the fruitful soil yields drugs of every kind . . . There everyone is a physician, skilful beyond humankind.' This was because the civilization of Egypt with all its arts had been continuous for many

centuries; and though the physicians were not embalmers, because of that art the Egyptians had a truer understanding of the human body than did any other people. The usual job of the physician was to heal and to beautify, to accomplish both of which a knowledge of magic was necessary. Their materia medica included powders and decoctions made of sycamore figs, dates and other fruits, the piths of certain trees, salt, oil, magnesia, honey and sweet beer; often mixed with such unpleasant ingredients as rancid fat, bone dust and the droppings of animals. Here for example is a prescription for inflammation of the eye: 'Parts: 1 myrrh, 1 Great Protector's seed, 1 oxide of copper, 1 citron pips, 1 northern cypress flowers, 1 antimony, 1 gazelle's droppings, 1 oryx offal, 1 white oil. Place in water, let it stand overnight, strain through a cloth and paint it on the eye for four days with a goose feather.' Physicians please take notice.[1]

Now read the passage again trying to find the answers to the following questions.

What did Homer think of the Egyptian system of medicine?

How would the long period of Egyptian civilization encourage the development of medical science?

How would the custom of embalming the dead encourage an understanding of the human body?

Does the prescription for sore eyes reveal a scientific approach or belief in magic? To what extent?

Does the passage now make sense? Probably a good deal more than it did the first time you read it. Had your own mind raised the questions instead of the author

[1] Bailey, Albert E., *Daily Life in Bible Lands* (Charles Scribners Sons, New York), p. 80.

of this book, the passage would have meant much more to you the first time you read it.

9. In order to get the fullest benefit from reading curiosity is essential. In other words, relevant questions must be formulated in the mind as you read. These questions are the key to real study. It has been said, 'There is no thinking without a problem'. A problem is a question in substance even though it may not necessarily be so in form. No intelligent studying can be done without problems in mind. The great psychologist Thorndyke, in a treatise on the psychology of reading, said 'reading is problem-solving', and then went on to show how each paragraph in a book poses a problem which the reader has to solve. The act of reading becomes the solving of one related problem after the other until the paragraph-problems all fit into the larger problem raised by the chapter, which in turn is only part of the problem treated by the book as a whole.

10. In reading a difficult chapter in a book we continually need to ask ourselves, 'What is the problem in this paragraph? Have I solved it?' If you cannot deduce what problem the paragraph raises, naturally you cannot find the solution to it. Too many students get nowhere at all with their study because they do not know the first law of study which, simply stated, is this: You must have the problem clearly in mind and seek its solution in an intelligent way.

11. Some books, meant primarily for student use, include questions at the end of each chapter to help the student to think along the lines treated by the chapter. These questions may be of two types: (*a*) the type which draws attention to the salient points made

in the chapter, and (*b*) the kind which give problems for further exercise, or to elucidate principles stated in the chapter. We are not concerned with the latter, which are far more difficult than the former, but we are concerned with reading-helps. Too few textbooks contain such questions, so the student is required to make up his own questions. How can he do this?

12. If questions arise naturally during your reading, additional questions will not be necessary. But in most cases the student will find the contents difficult and consequently pertinent questions will not arise. Only the question which indicates his difficulty of understanding the subject-matter may come to his mind, such as 'What is this really about? What is the writer trying to say?' Or he may be in a still worse position where, after reading, it will appear to him that the writer seems to say nothing of significance. When this is the case, he must set about systematically unravelling the contents of the paragraph. To try to remember the whole paragraph or any of its sentences verbatim is futile. *Memorizing its sentences* will not aid understanding. Whenever it is necessary to memorize verbatim in order to remember, it is proof that you do not understand. Having memorized verbatim, you may think you understand but you do not. Much of the trouble students have with their subjects arises from this fallacy. They have been misled through verbal memory. If no question comes to mind automatically, you must try to find what problem or question the author had in mind when he wrote the particular paragraph.

13. It is not difficult to find because, somewhere in the paragraph, the author gives the direct answer to

the problem. In one of the sentences he makes a summarized statement which reveals the problem he is presenting. This is the key sentence or topic sentence of the paragraph. The rest of the sentences in the paragraph usually do nothing more than confirm, illustrate, or supplement the key sentence of the paragraph.

14. One also finds logically constructed paragraphs in which there are two topic sentences of equal importance. These may be separated from each other, but usually it is true that the heart of the contents of every well-constructed paragraph can be located in a single sentence or even in a part of such a sentence. Occasionally no topic sentence is given but the main theme is easily discernible to the reader in the paragraph heading.

15. Most often the topic or key sentence is the first one, because an author or speaker naturally begins with a statement and then explains or adds to the statement in the rest of the paragraph. The next most likely position for the sentence containing the central thought is the last place. This position is most often found when the writer or speaker presents an argument. He finishes the paragraph by summing up his main argument. This method is also used to maintain an element of suspense in order to increase the reader's interest.

16. But the answer to the problem of the paragraph may be in any one of the many sentences of a paragraph. And the student's job is to find it. Until it is found the paragraph is meaningless. The student will merely be struggling with a dozen sentences whose importance and meaning are obscure instead of allowing one sentence to explain immediately what all the

others are about. This key sentence will help the student to remember what the whole paragraph says.

17. The following examples illustrate different positions of topic sentences. The topic sentence is in italics. Note that all the other sentences contribute to the information given in the topic sentence. They either add to, clarify, modify, or illustrate the key thought. At the same time they complete the meaning of the paragraph. The topic sentence is practically complete in itself. This single sentence gives a summary of what the entire paragraph deals with.

(*a*) *Robinson Crusoe's hardest lesson was to learn to live alone.* There was no one to talk to. There was no one to help him. The only food he could get was what he found or raised himself. In the beginning he felt so lonely that he cried. But with time he became used to being alone and felt it less a hardship.

(*b*) A baby needs twenty-four hours of sleep a day. A child of eight should have ten or twelve hours. At fourteen years of age about nine hours of sleep are required. An adult can usually manage with seven. *The amount of sleep a person needs depends on his age.*

(*c*) There was a sound of grinding brakes. A horn sounded loudly. Women and children screamed. Then came a crash. Soon a crowd of people gathered. *There had been an accident.* One motor bus lay on its side and another had its front smashed.

(*d*) I have a friend who is afraid of the dark. My sister is afraid of snakes. My brother cannot climb trees because of the fear that he might fall. Some people want to run when a dog barks at them. *Most people are afraid*

of something or other. The danger is usually imagined rather than real but people act the same way whether the danger is real or imagined.

(*e*) In the North snow covers the ground during the winter, making it difficult for animals to find food. *In order to save themselves from dying of hunger some animals have adopted a wonderful plan.* They sleep all winter. They sleep very soundly. Their breathing almost stops and the heartbeat is very faint. Their temperature also becomes less. While sleeping they need no food because they made themselves fat before they went to sleep.

18. Some paragraphs have two topic sentences, usually one at the beginning and the other at the end. Both say practically the same thing in different words.

Music is one of the most restful recreations man can enjoy. It takes our thoughts away from ourselves especially if we perform as well as listen. It can change our moods at will and this results in recreation, for recreation is not inactivity but change to something else from that which has fatigued us. Music stirs the imagination; it arouses the feelings and the sense of beauty. It can change our pulse and rate of breathing. If you perform or compose it gives you the joy of creating something beautiful and gives pleasure to others. *There are few recreations equal to music.*

19. The following paragraph has no real topic sentence. Careful reading is needed to suggest the contents, which might be summarized in this way: 'There was a gradual development in the tools needed for harvesting.'

When men first planted their fields to grain, they

harvested by pulling the heads off by hand. Then someone introduced the use of a knife by which several heads could be reaped at once. The knife blade developed a curve that became a sickle, and the sickle grew to a scythe, with corresponding increase in efficiency. Finally the modern age brought the harvester, which reaps many acres of grain in a day.[1]

20. Turn to the story of Helen Keller on pp. 30-3 and note the following list of topic sentences giving the entire story in résumé.

When Helen Keller was nearly two years old she had an attack of scarlet fever and became blind.

She used a few very simple signs to express her thoughts but she was not very successful.

Her parents asked the principal of that school to send them a teacher for Helen, and he sent Miss Anne Sullivan.

The 20-year-old teacher had a difficult time with her self-willed naughty pupil.

Miss Sullivan knew that Helen must first learn to obey, and she began lovingly and patiently to teach her.

'The little savage has learned the first lesson in obedience.'

Helen soon learned to spell words.

Suddenly Helen understood that things have names.

From that time the little girl made rapid progress.

Helen was very clever.

Helen greatly desired to speak with her mouth.

It was uphill work but the thought that her little pupil would be able to understand her when she could talk urged Miss Sullivan on.

21. Now let us try to select the topic sentences in

[1] *Better Work Habits* (Scott, Forseman & Co., New York), p. 34.

the paragraphs of this chapter which you are reading. The paragraphs of this chapter have been numbered so that we can carry out this exercise. Try to find the topic sentences yourself and then check with the list given below. Some sentences have been somewhat shortened.

1. Many students waste most of their study time doing that which is hardly helpful at all.

2. The most common form of study is the mastery of the contents of a book.

3. There are two types of notes.

4. It does little good to read mechanically merely following the arrangement of the words.

5. In the narrative type of reading the questions may be very simple.

6. In reading factual matter, philosophy, discussion, etc., the questions are, of course, more difficult and require a higher order of mental activity.

7. Until a student is curious about what the book has to say, what he is studying will not be properly assimilated in his mind.

8. See what a difference the following passage makes when you have a question in mind.

9. No intelligent studying can be done without problems in mind.

10. You must have the problem clearly in mind and seek its solution in an intelligent way.

11. So the student is required to make up his own questions.

12. You must try to find what problem or question the author had in mind when he wrote the particular paragraph.

13. In one of the sentences he makes a summarized statement which reveals the problem he is presenting.

14. Usually it is true that the heart of the contents of

every well-constructed paragraph can easily be located in a single sentence.

15. Most often the topic or key sentence is the first one.

16. The answer to the problem of the paragraph may be in any one of the many sentences of the paragraph.

17. The following examples illustrate different positions of topic sentences.

18. Some paragraphs have two topic sentences.

19. The following paragraph has no real topic sentence. Careful reading is needed to suggest the contents.

20. Turn to the story of Helen Keller on pp. 30-3 and note the following list of topic sentences giving you the entire story in résumé.

21. Now let us try to select the topic sentences in the paragraphs of this chapter which you are reading.

22. Note that these sentences provide a complete summary of the contents of the entire chapter.

23. In some cases a phrase suggests to our imagination everything we need.

24. Let us consider two examples of how past experience and the association of ideas give meaning to experience.

25. Assuming you have understood the contents of this particular chapter, a few words tell you all you need.

26. Let us eliminate the unnecessary phrases.

27. Some headings should be reduced to the position of a sub-heading or even a sub–sub-heading.

28. In every chapter there are usually only three or four main thoughts under which everything else can be classified.

22. Note that these sentences provide a complete summary of the contents of the whole chapter. There is really very little detail that your memory will not automatically supply when you review these sentences. The topic sentences of a chapter give you excellent review material and you actually need little besides this

for review purposes. Sometimes you need to summarize detailed facts under the topic sentence but an important step in intelligent study has been achieved when the student can line these details up under the correct heading. We will come to that later.

23. Some of the topic sentences are long. So let us shorten them. In some cases a phrase suggests to our imagination everything we need. The phrase does not actually *tell* us everything we need but memory and imagination supply the rest for us. Unless we have the memory and imagination to fill in the essential details we are very dull students indeed.

24. Let us consider two examples of how past experience and the association of ideas give meaning to imagination. When I say the word 'sunrise' any imaginative person immediately sees the entire episode of light appearing in the East and growing in intensity with the final appearance on the horizon of the fiery orb called the sun. It first appears as an arc and then as the complete fiery ball in its golden splendour. When I mention 'sunrise' you do not have to be told that the sun rises in the East, that the sun is round but that you cannot see its complete circular shape until it has cleared the horizon. You do not have to be told that the brilliance of the sun is different at sunrise than at noon; that the air seems to shimmer around the sun, when it is close to the horizon; that there is a glow in the sky and other such details. These details are part of your experience of having witnessed many sunrises, and suggest themselves with the presentation of the word 'sunrise'. Similarly we may read that a certain explorer measured the height of a mountain by triangulation. One who knows geometry well

immediately knows that the explorer did not climb to the top of the mountain. He simply measured the distance to it, measured the angle at which he had to look to see the top as well as a second angle and then calculated the height of the mountain by applying geometrical formulae. All this is inherent in the word 'triangulation' and needs no further explanation to those who know how it is done, but it needs a great deal of explanation to anyone who is not a practical geometrist. Former knowledge and imagination supply the detail so that a word or phrase suggests a great deal.

25. Assuming that you have the experience, which alone enables you to understand a statement, a few words tell you all you need to know to suggest quite complicated matters. Therefore we can proceed to shorten our topic sentences. Assuming that you have understood the contents of this particular chapter which you are now reading, you do not need anything more than the following notes to remember its contents.

A separate statement for each topic is not given since one phrase in some cases covers the contents of several paragraphs.

1. Avoid waste in study.
2. The place of textbook study.
3. Reading without questions in mind is useless.
4. The effect of questions.
5. Questions and curiosity.
6. Questions are really problems.
7. Every paragraph has a problem.
8. Reading is problem-solving.
9. How to find the problem of each paragraph.
10. Topic sentences give the clue to the problem.

11. Locating the topic sentence of each paragraph.
12. Topic sentences may occupy any position.
13. Occasionally there are two topic sentences.
14. Occasionally the topic sentence is missing. Substitute a heading.
15. Note how topic sentences give a résumé of the life of Helen Keller.
16. Note the topic sentences of this chapter.
17. Summarization of this chapter through topic sentences.
18. Suggestive phrases may suggest as much as sentences.
19. Use of the imagination for suggestion.
20. Reducing the number of suggestive phrases.
21. Organize material into an outline.

26. There are still more paragraph headings than we actually need. Let us eliminate the unnecessary ones. We can get along without 2, 4, 5, 7, 12, 13, 14, 19 and 20.

27. The simplifying of the contents of this chapter is still not complete. At first we treated every paragraph as if it were of equal importance. Then we picked out the topic sentence for each paragraph regardless of whether it was an important paragraph or not. But in the last operation we struck out certain paragraphs which are either of less importance or which have contents of such a nature that they are already suggested to us by the shortened topic sentences of one of the other paragraphs. In other words, some headings should be reduced to the position of a sub-heading or even a sub–sub-heading. Here it is necessary to distinguish between main-headings and sub-headings and details under each sub-heading. In every chapter there are usually only a few main thoughts under which

everything else can be classified. In this chapter the main thoughts are:

Questions are necessary to intelligent reading.
Each paragraph needs to be considered a problem.
The topic sentence tells you what the problem is.
Develop skill in locating the topic sentence.
The topic sentences give you the résumé of the chapter.
The topic sentences can be organized in a suggestive outline which gives you the entire chapter in a nutshell.

28. Now let us use these thoughts together with the list of suggestive phrases and organize them into an outline, such as the author must have had in mind when he wrote the chapter. By using the main headings and sub-headings we can indicate the relative importance of the various topics and their relationship to each other.

HOW TO STUDY A TEXTBOOK

The place of textbook study (Introduction)

How to read the textbook:
- With questions in mind
- Solving the problem of each paragraph
- The value of the topic sentence for solving the problem

Locating the topic sentence:
- Different positions in the paragraph
- Examples of different positions
- Practice in locating the topic sentence

The use of the topic sentence for summarizing and outlining:

Reduction of sentences to suggestive phrases
Reduction to main thoughts
Organization into an outline

When you understand the outline. you understand the contents. (Conclusion.)

The last sentence in the outline is the one to be emphasized. You cannot understand the contents of a book or chapter unless you have grasped its outline. Sometimes authors give the outline for the readers' benefit. In fact many authors do, especially in textbooks. A study of the author's outline is well worth while. But the mere outline is not enough. The outline is not the entire contents but is only suggestive of the contents. The outline helps you to understand the details and to organize them so that they become intelligible and remain in the memory. Without it you become lost in a maze of details.

Both the outline and the detailed facts are essential, each enabling the student to comprehend the interrelated significance of the other. Details can be remembered much more easily when they are correlated.

Assume that the topic sentences of a chapter to be studied have been underscored. Assume also that the author's outline is clear in the student's mind. It is then a very simple matter to go back and review the contents of the chapter. The details naturally fall into place as the topic sentences are re-read. Each time they are read the whole chapter comes to mind more clearly. The first review may take half an hour, depending upon length and difficulty. The next will

probably take fifteen minutes and the next ten minutes or even five minutes. With careful study the review of a chapter may be done in a minute. Usually there are only a few points which have to be referred to again.

But it is well to remember the limitations of text-book study. Sometimes it is necessary to study the contents of a book or chapter carefully exactly as the author has presented them. But this is at best mere reproduction. Independent thinking is important. One must be able to find out what the author says and then understand exactly what he means. But this is only the very beginning of study. The student must ask himself, 'What have the facts stated in the book done for me? What thoughts have they started in me? What further information have I gathered to support or refute or supplement what the author has said?' Real study starts at the point when you do your own thinking and are not simply repeating what another has said.

9. Outlining

Outlines are necessary whenever we want to put system and organization into our thinking. Without an outline we usually think in circles or haphazardly, covering some ground again and again and other ground not at all. An outline is like a compass. It helps us to keep our direction.

In our chapter on 'How to Study a Textbook' we tried to find the framework on which the author had built up his subject. We found that to reconstruct the author's outline was a great help in understanding his book. An author knows fairly well what he wants to say but he must first plan the basic skeleton for his book. The general outline on which he has worked is to be found in the table of contents.

The table of contents often also contains details of the separate parts of the book, the chapters. Each of these chapters has its own outline. In books intended primarily for use in schools a fairly detailed outline is usually given, though as a rule books intended for the general public do not contain such conspicuous outlines. Sometimes the outline is suggested in bold-type headings. Whether the outline is displayed or not, the author has had an outline. He may or may not have written it down, but he at least has had it in mind.

An experienced thinker and writer thinks in terms of outlines. As soon as he begins to organize his thoughts

he finds he is automatically framing an outline. There are two types of experience which make it automatic for him to think in outline form. In order to write his books in a logical form he has found it essential to work out his basic outline first. With practice it has become automatic for him to arrange his facts in an organized relationship. Secondly, he has read and studied many other books and while doing so has made it a point to discover the writers' outlines; as a result of this type of experience, preparing his own outlines becomes easier. He is used to discovering the outlines of others as well as making his own. Both these experiences are necessary for clear thinking and effective organization.

Let us now deal with the question of making our own outlines, outlines of material that we are organizing for our own special purpose. This is more difficult than tracing the outline in the work of other writers and we do not learn the one well until we have learned the other.

Of course, we shall deal with short and simple subjects. But short compositions need just as careful organization as longer works. The less time and space you have at your disposal to say a thing, the more carefully you must plan to say it. It is easier to write a long composition than to treat the subject adequately in a short one. Most poor writers and orators take a long time to say what skilful writers and orators say in a much shorter time. A speech or an oration that is too long is usually a sign that the author or speaker did not effectively organize his material. Organization is revealed in the outline of the whole and of the parts. Sometimes the parts are nothing more than paragraphs,

but each one of these needs to be carefully organized.

You may never write a book, and you may stop writing compositions when you stop going to school, and yet you will find that you need to organize material in outline form again and again. If you ever give a speech—you are very likely to do so at some time or other—you will need to outline. If you ever have to give reports to a business firm, a club, a political organization, a religious organization or whatever it may be, you will need to organize your thoughts and facts systematically. So when you are learning to outline, you are not only doing a school exercise but you are also learning to do what every educated man is called on to do from time to time and needs to be able to do well. People who cannot make good outlines are usually lacking in system and organization.

As mentioned before, the teacher who assigns a theme for a composition and then gives an outline to the students, is a poor teacher indeed. It is as important, if not more important, for the student to make the outline as it is for him to do the writing. There is no such thing as a model outline to be copied. Each writer must make his own. Your own outline is your only adequate model, for it is from that alone that you can expand your thoughts. It is very good for the teacher and pupils to work out a certain number of outlines together as an exercise for the whole class. But these outlines are not the ones to be used for your own writing unless you are a pupil still in the elementary stage, i.e., just coming out of the primary school. A ready-made outline is not conducive to much original thinking.

In planning what is to be said in a report, a news-

paper article, or a composition, the following steps are useful:

(1) Choose and state your subject clearly.
(2) Decide just what you want to include in a report of your topic and then collect your material.
(3) Plan how you want to present your facts and ideas.

If the teacher or examiner gives you the exact wording of a theme on which you must write, you have no choice but to write on that subject. But if the exact wording is not obligatory, you can develop your own ideas and present them in your own words. In fact, this calls for your best thinking. There are no other half-dozen or dozen words in the entire report on which you need to work with as great care.

Do not make your subject too wide or too general. You can only do so with effect if you are a real master in writing. Do not choose a subject which takes a whole book or even a series of books to treat adequately. Choose a theme which can be covered in the length of the report you are writing.

You cannot write a good essay on 'India', in three hundred words, but you can write a good one on 'Why I am Happy to be a Citizen of India', or on 'One of the Beauty Spots of India', or on 'The Day India became a Republic'. You cannot tell everything about the tiger in three pages but you can, if you have had such an experience, tell a good story entitled, 'The Time I Saw a Tiger in the Wild', or 'When the Tiger Killed our Bullock', or 'The Usefulness of the Tiger'. These themes can be handled in a few hundred words.

If you were to try to write on 'How India Achieved its Independence', you would find that there is so much material that you can hardly make a start in two thousand words. But you can make an acceptable speech on 'India's Debt to Mahatma Gandhi', or 'The Charka, a Symbol of Independence'. An entire book could be written on each of these themes, but it is also possible to state something significant in a short composition or speech.

The larger the subject, the greater the danger is that you will only mention superficially a few facts, without saying anything worth while about any of them. The more general your subject, the greater the danger of talking about everything in general and nothing in particular. Therefore, confine your subject to that which you can talk about intelligently in a short compass.

The wording of your outline is important because it not only tells you what you should talk about but also what you should not talk about. It helps you to stick to your subject. Proper limitation of your subject saves you from that confusion which comes when there is so much to say that you do not know where to start and when to stop. Do not think that because the subject is large it will be easier to find enough to talk about. A limited subject is usually more suggestive than a very broad one and it is certainly easier to make an outline for it with only the significant points to be presented.

When you begin to collect the material to be included, you will probably find that the facts you wish to present come to you disconnectedly. You need not become concerned about this disconnectedness for this is the way thoughts and suggestions come even to

experienced writers. It will be helpful to put the facts down just as they come without any logical order. The order may be considered later. Let us select a theme, 'My Visit to the Seashore' for practice in outlining. Everyone will write differently on such a subject for each individual will remember various impressions which he alone experienced. Even when a hundred people go to the same place at the same time, no two of them will remember the same things. What is noticed and remembered reveals individual interests and personal likes and dislikes. This is how the memories of a visit to the seashore in Madras come back to me:

rolling waves
salty smell in the air
swimming in the waves
sailing boats
crabs running on the sand and digging in
fishy smell
fishermen's huts
getting bowled over by the waves
many people wading in the water
laughter and shrieks when waves wet their clothing
wide sandy beach
pounding, roaring surf
receding waves washing sand from under the feet
the beggar nuisance
fishermen taking their catamarans apart
different kinds of fish, crab, etc.
hauling in the big net
moonlight on the water
peanut vendors
sea shells
a sea snake

Now let us try to get a little order into this list. Which are the main events or interests around which most of the memories cluster? Which reminiscences are connected and can easily be treated together in a description of the visit? It seems natural to start with the first impressions upon arrival, and immediately these headings are suggested: 'Arrival at the Beach' and 'At the Water's Edge'.

Other experiences are dominated by memories of the thrilling swim in the Bay of Bengal, of the fishermen and their catch, and of the nice, lazy lounge on the beach until dark when across the water the moon made a silvery path leading towards Burma.

Under these headings we can quickly make an outline bringing in the various events recorded in our first list.

A VISIT TO THE BEACH IN MADRAS

I. Arrival at the Beach
  Bus to the Marina
  Evidences of being near the beach even before you can see it:
    the sound of the waves breaking on the shore
    salty smell of the air
    occasional smell of fish
  Walking across the wide sandy strip to the water
  The sign 'Beware of Sharks'

II. At the Water's Edge
  Rolling in the waves
  Hundreds of people wading
  Their shrieks and laughter as the waves wet them
  Crabs running on the sand:

trying to catch a crab
how they disappear in the sand
The feeling of sand being washed from under your feet by the waves

III. The Swim
Getting past the breakers
Being tumbled over by the waves
In the midst of white-caps
Riding up and down on the waves
Salty taste of the water
Remembering the sign about sharks

IV. The Fishermen
Watching their sailing boats come in
How they beach their boats
How they take their catamarans apart
Their catch:
large and small fish
odd shapes of some of the fish
crabs and prawns
squids and an octopus
off to their huts with the catch before too many people help themselves
Hauling in the big net
the catch
tossing out a sea snake

V. Relaxation on the Beach
The peanut vendor
Gathering sea shells
The beggar nuisance
Refreshing sea breeze
Sunset and rising of the moon
Beauty of moonlight on the waves

This is not the only order in which the events can be arranged. To me it seemed the most logical one but there are many other possibilities. Actually a theme of this sort requires less of a logical order than simply an agreement on how to keep together items which naturally belong together, and adopting a way of going from one phase to the next. Presented in such an order it makes much more interesting reading. When you jump about from one subject to another, the listener or reader cannot visualize properly what you are trying to say. In a descriptive composition a picture has to be drawn in words, and so arranged that each part has its own place. Your outline helps you to give its proper place to each item. Without such arrangement your description is more like a jigsaw puzzle before the pieces have been fitted together. People cannot be impressed by writing which lacks orderliness and coherence. The necessary orderliness can be achieved through the organizing of an outline. The outline need not necessarily be written down, but it must at least be in the mind of the speaker or writer. But in order to acquire the proper habit of organizing outlines must be written down. Reducing outlines to writing gives focus and precision to your thoughts.

Suppose we are thinking of the natural resources of our country and their preservation. There is an almost unlimited number of these resources. Let us list a few as they come to mind:

coal
trees
grain
cotton
iron
clay
water
lime
jute
fish
wild animals
domestic animals
nuts
wool
chemicals
rubber
tea, coffee
oil
grass
fruit
vegetables
lumber
coconut
coconut fibre
water-power

Now let us try to get these into some kind of logical order. Look over the list of natural resources. We can classify them according to their origin. We can easily distinguish between

gifts of the soil
gifts from under the soil
gifts of the forest
gifts of animal life
gifts from rivers and streams
gifts of the sea
gifts from the mountains

Such classification is most helpful in making an outline. With these classifications in mind let us see what order we can bring to the list. As soon as we begin arranging in order more items suggest themselves to us. These classifications are not mutually exclusive. For instance, the forest itself is a gift of the soil, and yet the forest makes a distinct contribution in contrast to that of the cultivated field or the soil itself. Therefore, we accord it separate treatment. After considerable shifting about we arrive at an outline something like this:

I. *Gifts of the Soil*

Food: grain, oilseeds, vegetables, fruits, nuts, coconuts, sugar, tea and coffee
Clothing: cotton, fibre of many kinds
Shelter: bricks, tiles, mud walls, stone, coconut leaves, grass thatch, timber, bamboo, glass
Utility articles: jute, earthen water-pots

II. *Gifts from Under the Ground*

Power, heat and light: coal, oil, natural gas
Utility Products: coal-tar products of a thousand kinds, metals, chemicals, minerals
Shelter: stone, cement, iron, lime, glass

III. *Gifts of the Forest*

Food: nuts, animal life, fruits
Shelter: timber, bamboo, rubber
Utility: wood, paper, turpentine, rubber, alcohol, lac, chemicals
Prevention of soil erosion
Protection to wild life

IV. *Gifts of Animal Life*

Food: eggs, milk, meat, fish
Clothing: wool, silk, fur, leather
Utility: glue, leather, manure, catgut, bristles, feathers
Transportation and labour
Destruction of insect pests

V. *Rivers and Streams*

Irrigation
Water-power
Homes for fish and fowl
Transportation

VI. *The Ocean*
Fish and other seafood
Salt
Chemicals
Transportation

VII. *Mountains*
Forests
Water-power
Effect on rainfall
Mines

A mere listing of natural resources in organized form brings with it suggestions of dozens of themes concerning the exploitation and preservation of these gifts of nature. Here are a few, any one of which could be expanded into a separate outline for treatment within a few minutes:

Fighting forest fires
The need for afforestation
Saving soil from being washed into the sea
Flood control
Development of water-power
New farm lands being created by irrigation
The dangers of overgrazing
Fish planting in tanks
Much cattle but little milk
The tree of 1,000 uses (the palm)
Paper shortage. Why?
The need for cheap building materials
Oil from under the sea
Valuable materials that have been wasted
Farming methods: helpful and harmful
Synthetic clothing
Reclaiming the desert

The speed with which an outline can be made indicates general knowledge and understanding of the subject. It reveals orderliness of the mind and a grasp of the relationships of the relevant items. There is hardly any method of understanding a subject as effective as organizing its parts into a logical outline. Practice in outlining is not only necessary for the writing of essays but for the creating of order in the mind. Learn to think in terms of outlines. Learn to reduce what others say into outlines; also learn to form outlines to guide and stimulate and clarify your own thinking. Once a good outline for a subject is created, you have a solid, logical framework into which details soon seem to fit themselves.

10. Taking Notes

What are notes? When you ask students this question, you get a variety of answers.

One student answered, 'Notes are what you write down or memorize from the dictation of the teacher.'

Another student answered, 'Notes are information recorded in your notebook which you expect to be of use when studying for the examination.'

A third student answered, 'Notes are short phrases or sentences written to remind you of important things to be remembered.'

A fourth student answered, 'Notes are short hints written down to remind you of the ground you have covered in your courses and to remind you where you can find fuller information. They also help to remind you which are the important points.'

No one of these four definitions is complete but they do point out the main uses of notes, as well as some very common misuses of notes.

The least useful notes are those taken down from dictation. That is not to say that you should never take down anything verbatim in your notes. There are some facts which need an exact record. For instance, you need the exact wording of a rule or law like Boyle's law in physics. But the number of items where the exact wording is needed is very small.

It has been truly said that you never understand a thing properly until you can explain it to someone

else. We often claim we understand, but somehow or other we just cannot put our thoughts into words to make it clear to someone else. This usually denotes a lack of clarity in our own understanding of the problem. Our comprehension is often incomplete. We know something about the subject but not enough. Unless the problem has been carefully and systematically thought out and analyzed it is not easy to give a clear explanation of it to others. Therefore, you should think of notes as suggestive phrases on which you can base your exposition of the subject to someone else. The more clearly you have the matter in mind, the shorter and fewer the phrases needed to get your brain ready for a clear explanation. The more familiar you are with your subject-matter, the less notes you need to help you in a review. The better you have your subject organized in your mind, the easier it is for you to review it without having to reread much of the material. A few words are suggestive of whole paragraphs, and even a chapter, when you really understand the contents.

When a student needs to take down entire sentences and paragraphs spoken by the teacher, it is a sign that he understands very little. I have seen students get completely lost when the teacher does not proceed slowly enough so that they can take down verbatim every word he is saying. Without complete paragraphs in their notebooks, their notes are confusing to them. This reveals a wrong idea of the purpose of taking notes. Notes on a lecture, for instance, are not to give you the complete information, or even the complete idea, but are only suggestive words and phrases, helpful in reconstructing what has been said and taught.

Even with a knowledge of shorthand it would require complete attention just to take down what was said; and as a result very little of the meaning of what was said at the time of the lecture would be absorbed. The better way of taking notes is to listen very carefully and try to understand thoroughly what is said. Then you need write down only a few words or phrases which are so suggestive that they bring back to memory the main points of the lecture. You cannot get every detail, but you must get the main points. If you fail to do so, what you actually note down will only be a confused mass of details.

In India the medium of instruction has up to very recently been English, the mother-tongue of exceedingly few students of this country. One does not understand a second language as well as the mother-tongue, at least not until there has been far more practice in it than most students get until they finish college. This struggling along in a second language has made it necessary for teachers to proceed very slowly and give word for word the important things they wish to stress. On the part of the pupils it has meant that they cannot follow the teacher unless sentences and paragraphs are dictated slowly. As a result some very bad practices have grown up and perpetuated themselves. Where the medium is the mother-tongue, this old method of giving and taking notes needs to be radically changed.

We have said before that what you understand well you can explain in your own words. This statement makes clear the necessity of recording notes in *your own words*, rather than in the words of the teacher or textbook, because what you explain in the words

of the teacher or the text can never have the same meaning that your own words have. You may be able to repeat whole pages of the textbook or the teacher's wording but at the same time understand practically nothing. Your own explanation, in your own words, no matter how faulty or incomplete, means much more for your learning than the other. Therefore, your notes should be in your own words as much as possible. They should be an *interpretation* rather than a *repetition* of what you have heard.

I once had a teacher of philosophy who lectured without paying any attention to his students. He talked by the hour, not attempting in any way to get his students to take part in a discussion. He thought if he lectured, it was enough. As a result no student had any idea what the course was about. To meet this difficulty, since there was no textbook for the course, the teacher prepared elaborate notes and had them cyclostyled for the students. The students 'studied' or rather memorized these notes. The majority succeeded in passing the course because of these notes, but I never attended any class where the students knew less of what the course was actually about. The 'teacher' was one of the most learned men I have ever known, but he was also the poorest teacher. Elaborate and well-ordered notes prepared by the teacher can never take the place of short, incomplete, even confused notes written by the students themselves at the moment when understanding flashed upon their minds.

If you understand what is being taught at the time of taking your notes, the chances are that you will understand your notes. But notes taken without under-

standing are of little value. Nor can one student borrow the notes of another student with any real profit. Your friend's notes do not mean the same to you as your own. Notes are really valuable only to the one who worded them, for good notes are highly suggestive phrases which can be highly suggestive only to the one who got the original suggestion for them.

It has been said that notes should be short and suggestive phrases rather than long, completed sentences. This does not mean that the shorter the notes the better. The student who understands little or nothing very often has no notes at all, or very few. One glance at the notebooks of some students shows that during the entire year the student has received few or no suggestions at all from the lessons he has listened to. A good notebook sometimes contains comparatively few pages, but it will contain many suggestions per page. Your notes are not to be evaluated by the number of pages but by the suggestive content of each page.

There is a big difference in the kind of notes you will want to keep, depending upon whether or not there is a textbook on the course. If there is a textbook, the book itself will be part of your system of notes. The underlining of words and phrases here and there means a great deal to some students. However, very many students underline without any real plan, and without anything significant having entered their minds at that time. Such underlining is not helpful. Other students underline almost everything in the textbook. That again is a sign that little of significance has been learned. If you have learned something well, a few words will suggest the content of an entire paragraph, page or even several pages.

If an entire paragraph is of great significance, then one or two vertical lines may be put into the margin. One line indicates that the paragraph is important and two lines that it is very important.

The insertion of your own comments can be of very great help, for, as has been said, what you have re-interpreted in your own words means more to you. There is much the author of the book has not said. You may add to what he has said. And you may not only insert notes in the textbook to help remember its context and to add something the author did not mention, but you may also insert criticisms. No textbook writer is infallible. A thinking person will disagree in some respect or other with almost every author. If you have any critical judgement, you will surely question what the author says and have some suggestions of your own.

The only way to develop critical judgement is not to accept as being beyond dispute everything you see in print, but subject it to the same questioning and doubt as statements made in ordinary conversation.

A really good teacher, keen on his subject, will give you many facts besides those in the textbook. Therefore, it is good to maintain a notebook in addition to making notes in the textbook. Ordinarily there will also be instructions, references, etc., not found in the textbook.

Later on, when you are revising for the examination, a single glance—or at the most two or three glances—at a textbook that has been intelligently annotated and underscored will recall to your mind the entire contents of a paragraph or page. If you have to reread a good

part of a paragraph or page, it shows that you do not know your subject-matter well; furthermore, you have not been able to make the underlinings or insertions suggestive enough to indicate the outline of the writer's argument, with all the minor details automatically and properly fitted into their places. Or it may mean that you are not a good enough reader to skim quickly over familiar material. A good reader needs only a few glances to remind him of the contents of familiar matter, especially when there are marks or notes to guide him.

It is best to make your comments and do your underscoring in the textbook with a pencil, so that in case of a mistake or a change of mind corrections can easily be made, or in case someone else is to use the book your marks can be erased. It goes without saying that you only have a right to mark a book if you own it. You have no right to mark books that are rented, borrowed, or belonging to the school or library.

How should you take notes on a reading assignment? Suppose you have been asked to read and report on a chapter. You want a few notes to remind you of the contents. One method of preparing these notes has already been given in Chapter 8 which deals with the underlining of the topic sentence of each paragraph. That is a long and careful method, giving us a general review rather than a careful detailed study. 'Notes' implies briefness and suggestiveness rather than completeness.

In order to get notes which quickly give the general argument of the chapter, it is best first to read the entire chapter. It is not wise to make your notes on every paragraph unless the material is so difficult

that you have to proceed slowly step by step. You will do better to concentrate all your attention on first getting the general idea. By stopping to take notes and going into detail before you have the general idea, you break the line of the thought and do not get the general argument nearly so well. When you have finished the chapter, then think over the contents for a moment and see if you can frame a few headings to capture the trend of the general idea. You may glance through the pages again in order to complete this review. You will be surprised how the contents of the various paragraphs fit into place once you have the general idea clearly in mind. From this stage on it will not take you long to go through the chapter again and jot down the supporting facts and arguments as they appear. The more you can make your notes look like a brief outline the better.

At this point it will be helpful to include a few comments on the value of putting all notes, whether lecture notes, classroom-work notes, or notes on books, into a form which immediately catches the eye and suggests the relative importance of the various facts jotted down. Proper indentations, together with numbering and lettering of details (as in a well-organized outline), are more suggestive than much writing and explanation. The physical appearance of your notes can suggest, in one glance, more of the relative importance of various items than an hour studying notes written without any regard to relative importance. It will pay you to rewrite notes and put them into clear outline order. Once you have put your notes into this order you have organized your material in such a way that a few glances are all that is needed to bring into

clear recall the main contents of what you have read. Half of the value of notes lies in proper headlines, sub-headings and sub–sub-headings largely made through indentations, numbering, lettering, and position on the page. The other half of the value lies in the actual wording. Good notes are recognizable by what the writer does not have to say in order to make the meaning clear, as much as by what he does say.

Diagrams often indicate far more than any wording, but these diagrams have to be your own. Here again is a case where the eye is a quicker organizer than language.

In conclusion, it is good to be reminded that you really understand nothing until you can explain it. Learn, then, by trying to explain. Explaining is the very best kind of study. When your notes help you so that you can quickly *explain in your own words* (you may use supporting illustrations and diagrams wherever helpful) then your notes are really what they should be, namely suggestions brief enough to recall and reconstruct for you what you have learned.

11. Are you Efficient in the Elementary Skills?

Many students enter high school, and even college, with so little efficiency in the important skills which they should have learned in primary and middle school that they are handicapped in everything they do. In many cases a daily half-hour of effort to improve these elementary skills would help them more in their high school and college work than endless hours of so-called study of the class syllabus. Moreover, it would help them more than private tuition.

What do we mean by the skills? They are different from knowledge in that they depend on habits of workmanship rather than on knowledge. They require practice, that is, exercise. They are not a matter of understanding so much as a matter of having done the thing so often that you can do it as easily as you walk, automatically and without effort. What are these skills? The ones important for us at present are the elementary ones for which the school has long been famous, the so-called three R's, namely reading, writing and arithmetic.

Of course, you can read. You would never have arrived in high school if you could not. But can you read well enough to do what a high school student needs to do? Can you pick up books, magazines, or newspapers and read them with as little mental difficulty as you jump on your cycle and pedal up the road,

or jump into the water if you are a good swimmer? If you do not actually like to read books or magazines you are undoubtedly a poor reader or you would be reading continuously just as a good swimmer likes to get into the water and strike out for the other side of the stream. Of course you can do ordinary arithmetic, but are you so accurate that the chances are at least nine out of ten that your answer is right? Can you say to yourself, 'Oh! the answer to that is easy, all you have to do is so and so, and the answer simply must come out right?' Of course you can write, but mere mechanical pushing of a pencil or pen to make intelligible words and sentences is not what we mean. The word should be 'expression' instead of writing. In other words, can you easily say, or put down, in writing what you have in your mind? Have you an opinion, and can you state it so that others easily understand what you are talking about? That is what we mean by writing, or rather, expression skill: the ability to state in your mother-tongue clearly, correctly, and forcibly what is in your mind. It is deplorable how few students come into high school and college with enough of these three elementary skills to be able to begin to do the work which they need to do if they are to become real students and not mere memorizers of teachers' notes and textbook passages.

We have called these the three elementary skills, the ones for which the primary schools are responsible. But we must remember the primary school is responsible for their beginning and not for their perfection. Their perfection is a life-long art. However, there is a certain minimum skill every student needs to have before he can even begin to make any real progress

in foreign languages, chemistry, civics, mathematics, history and natural science. It is amazing how many students try to do high school and college work with such poor command of these elementary skills that it is impossible for them to study intelligently.

The writer has tested the reading skill in the mother-tongue (Hindi) of thousands of students. He has found that some students in the first year of high school can read ten times as efficiently as others. This fact means that some have only one-tenth the efficiency that others do. They do not belong in the same class but happen to be there. Just where do you stand? Are you among those whose efficiency is barely beyond that of the average student coming out of primary school, or are you among those who read as well as the average student entering college? We can soon tell. After an hour of testing, the writer can tell you just how good or poor a Hindi reader you are. And this is very important for you to know. It is important for you to know how good you are in each of the skills, for if you happen to be weak, the most important thing for you to do in order to study more effectively is to improve yourself in that skill. This you can easily do with the right kind of practice. But it has to be the right kind of practice, and you can get this only if you really know what your weakness is. Very few students know where their weaknesses really lie.

Try the reading test given in English in Appendix A. Full directions are there. The rules and the timing must be strictly observed. After you have answered, to the best of your ability, the questions given in the test you may turn to the answers and grade your paper. After you have done this grading

you may compare your score with that of other students of your level of education and see whether you are good, average, or poor. It will take about an hour for you to finish the entire test with the evaluating, so you should allow at least this much time and retire to some place where you will be undisturbed during the test. If you are disturbed you will not have taken the test under standard conditions, and therefore, the comparison with others will not be reliable. This test, when taken in your mother-tongue, can give you a fairly good idea just where you stand in comparison with other Indian students. You must, however, remember that the present standard of reading skill in India is not nearly as high as it will be after Indian students do more reading on their own initiative. So you need to be well above average to be considered a satisfactory reader.

In general it may be said that any student who does not read for pleasure is a poor reader. If he does not read at least two hundred words a minute, he is very likely to be inefficient, not only in speed but also in understanding, for he who understands easily naturally reads at least as fast as a very fast talker. People who read more slowly than they talk are 'word readers', that is, they read one word at a time instead of phrases and thoughts. It is as difficult to understand properly when you read slower than you talk, as it is to understand people who stutter in their talking. We do not do our thinking one word at a time but through connected series of words, and we must be able to read in the same way in order to comprehend the thought properly from the printed page. Even the best reader does not remember everything he reads, and actually,

one should not even attempt to remember everything any more than we should make an effort to remember everything that people say. What is printed is usually more thoughtfully and carefully stated than ordinary talk, but remembering everything would be an unnecessary cluttering of the mind with much that is useless. We should be able to remember about fifty per cent of the non-detailed facts about which we are reading and, what is even more important, we should be able to state the main argument of the writer. The reading test given in the appendix was constructed on the assumption that an efficient high school student should be able to read about two hundred words of non-technical material per minute, and remember about half of the points made for a short period following the reading of the paragraph.

Suppose the test indicates that you are only average or below average in reading ability when compared with other members of your class. Then what should you do? You may want to do these things even if you are above average, for all of us can greatly improve our reading ability with a little bit of systematic practice. Even high school and college teachers can greatly improve their efficiency.

The subject of improving your reading habits is too large to be treated in this book. Much more detail is given in the author's book, *Suggestions for the Improvement of Reading Habits* [1] and his pamphlet entitled *A Little Practice Can Double Your Reading Speed and Comprehension,* published by St Christopher's College of Madras. Generally speaking it may be said that in order to develop into a really

[1] Oxford University Press.

efficient reader you should be doing the following:

1. *Get more practice in reading.* Read not only the materials you must read for school, but read stories, magazines, newspapers, etc., for your own private pleasure. You will be a better student if you read more for pleasure. Even books with superficial stories of little educational value have educational value in that they help you to master the mechanics of reading. Most Indian students need far more practice in the mere mechanics of reading than they have had. In the early stages easy reading is more helpful than difficult reading. The more you read the less reading seems to be work, the less it tires you, and the more it becomes a pleasure. Choose that which *interests* you first, then venture into new fields which are more difficult but which soon become easy.

2. *Read silently.* Not only should you not make sounds, but your lips should not move. You cannot learn to read fast until you stop moving lips and throat muscles. If your lips or throat muscles move you cannot learn to read fast, for your muscles cannot move fast enough to keep up with a fast reader. It may not seem important to read fast, because you may have plenty of time. But it is important to read fast, because fast readers understand more than slow readers.

3. *Try reading faster.* At first you may not understand as much as when you read slowly, but gradually you will understand more. By reading faster you naturally try to see several words at a time. This is as it should be because we understand better when we group words than when we consider them one at a time. The expression and meaning are clearer when we see

words in relationship. That happens to be the way we listen. When we listen, we pay little attention to unimportant words and more attention to the important words of the sentence. Fast reading encourages us to look for the important words and take for granted those which are only helpers. Fast reading helps you look for ideas rather than for mere words.

4. *Visit the library often.* It is when you see interesting books and magazines that you are stimulated to read. Borrow books from friends and, if you can afford it, buy books as well and keep a newspaper in the home. You should know what is to be found in every library to which you have access.

Now let us pass on to skill in mechanical arithmetic. Here again a test can quickly inform you how you stand. In the test in Appendix B you will notice four examples for various types of computation. You should get at least three out of four right to be considered efficient. Even that score is rather low. You should be able to do the problems quickly. We have chosen only such problems as are generally useful. There are many other problems which do not handicap you much in case you cannot do them, but the problems given are of such a fundamental nature that lack of ability to solve them quickly and accurately will handicap you in higher mathematics, in chemistry, physics, or in anything dealing with quantities. In case your efficiency is low, it will pay you to remedy the situation. This improvement can be achieved with a little daily effort and will make regular study assignments much easier.

Few students are weak in all arithmetic. They are usually weak in one or two main branches, and this

weakness makes it difficult for them to progress in other branches. Several secondary schools in Madhya Pradesh have banded together to make up a practice book (in Hindi) for students who are weak in arithmetic. Many of the exercises in the practice book are taught in the primary school or in the middle school. These practice books have helped many students to find their weaknesses in arithmetic and correct them. In order to correct a weakness you need to know exactly what the weakness is, and use the proper exercise for correction. Such a practice book can prove very helpful, depending upon the intelligence and diligence with which the student uses it.

Because you once were good in multiplication, it does not follow that you will always be good in it. If you have not practised, the chances are you will make many mistakes. We have found that high school students are only a little better in multiplication and division than students just going into middle school. That is because they are out of practice. When a high school student has need to use multiplication or division he needs higher accuracy than the student just finishing primary school, or else his problems in higher mathematics, physics or chemistry do not come out right. Therefore, practice is necessary. We need short refresher courses in the elementary skills, and nowhere is this more apparent than in arithmetic. Why fail in higher mathematics or science because what you once did fairly well in the lower classes you no longer do well because of lack of practice? Intelligent study means improving your efficiency wherever needed, even though it means repeating something that you did long ago in the primary, middle or high school.

We cannot give you a test to test your efficiency in language expression or ability as easily as we gave you one in reading and arithmetic. We can give you one in language usage but usage is a small part of what you need to look into. Expression is much more important and this cannot easily be tested. But here are some questions which you can put to yourself and answer. The answers will tell you how you stand in language ability.

1. Can you retell a story that you recently read or heard in such a way that people will like to hear it?

2. Can you talk fluently and intelligently with people about ordinary affairs of life or do you speak only a few sentences? Do people have to ask you one question after another to keep up a conversation? A good conversationalist is easy to talk with.

3. Do you complete your sentences when you speak? Is your grammar fairly correct? Do you have to search for the right words to use or do the right words easily come to you? You do not know your mother-tongue if the right word does not readily come to you.

4. Can you put forth a good statement of your opinion with the reasons why you hold such an opinion? Can you submit it in writing so that it can be read before a group without your having to be ashamed of the language and lack of clarity? You should be able to do this.

In this connexion it may be said that the usual way in which composition is taught in Indian high schools and colleges is ruinous rather than helpful to the development of language expression. When the teacher gives 'model compositions' for the students to imitate,

or gives them the outline for the composition, there can be no helpful practice in expression. Students need to make their own outlines if they are to do their own thinking, and without their own thinking there can be no real self-expression. There is no such thing as a model composition or a composition worthy of imitation. The composition needs to be the student's own. You can write well only about that which really interests you, and it is utter folly for teachers to assign themes and expect students to write on them with interest and pleasure. Until students are interested in their theme they have nothing to express. The mechanical way in which composition is generally taught is ruinous to good habits of thought and expression.

In order to judge yourself in your expressional ability ask yourself how well you say and write what is in your mind. Nothing can give you the skill to do this except practice, correction, trying again, more practice, and more practice.

12. Study Tools

The abilities to use certain literary aids are commonly called study tools. It is essential for anyone calling himself a student to learn their use. Among these study tools are the following:

Ability to use the table of contents of a book.
Ability to use the index of a book.
Ability to use the dictionary.
Ability to use encyclopedias, anthologies, and other collections of information and literature.
Ability to use year books, almanacs, Who's Who, catalogues, handbooks, concordances, etc.
Ability to interpret maps, graphs, keys.
Ability to use an atlas.
Knowledge of the organization and operation of the library, including use of the card index.

It is exceedingly difficult to generalize on the use of information, sources, and materials of study in India because of the lack of standard conditions. Every college and university has a library but there are very few adequate libraries in high schools. What is called a library in many high schools is a haphazard collection of old books mostly in English. Since English has to be learned as a foreign language by all but a very few students in this country, it is self-evident that only very easy English books can be successfully used by them. But most of the books found in the libraries are either the classics, which are very difficult, or other materials

beyond the comprehension of high school students. Some of the college libraries are even stocked to a large extent with difficult books of the textbook type, and contain very few books of an easier nature which the student can read without help, or which he is inclined to read without compulsion. When it comes to books in Indian languages very few are available. A great deal of progress has been made in the last few years in the printing of books in Indian languages, but so much remains to be done that it will take another fifty years before satisfactory libraries are possible, even in the most widely used Indian languages.

It is claimed that Hindi, Tamil, and Telugu have a rich literature, and this is true as regards classics, but only as regards classics. There is almost nothing on science, applied science, the social studies, or any branch of knowledge which gives up-to-date information. Works of reference such as encyclopedias, dictionaries, biographies and histories, compendia and the like are almost altogether lacking. It is, therefore, exceedingly difficult to give any specific directions as to the use of such materials, especially since we are dealing not only with one Indian language but with at least half a dozen. It is also difficult to generalize in regard to the English library for, with the exception of a few university libraries, the selection of books to be found in any one library is so limited in comparison to what is available in English that it cannot be assumed that the same references are available to any large number of students. So we must confine ourselves here to pointing out how to locate whatever references may be at hand. We cannot do much besides emphasize the importance of using to the fullest extent possible

what limited resources of study there may happen to be. The more limited the resources, the fuller and more efficient use you must make of what you have.

Let us choose a subject for study and see how the study tools can help us. The use of an example will illustrate more clearly than simply giving general directions. Let us choose as our subject, 'The Mineral Resources of India'. Where shall we seek information for this study?

Naturally we should go to the library. How shall we go about looking for material there? If the library is a large one, it will have a good card index. The card index lists all books according to title and again according to author. Any title having the word 'mineral' in it should carry information on minerals in general, though perhaps not specifically dealing with the minerals found in India. In the card index look up 'M' and then 'minerals', and you will find at least some of the books containing the word 'mineral' in their titles. All books in a large library carry numbers on them, and these numbers give you the key to the subject, for books on the same subject all have numbers close together. For instance, in the Dewey-decimal system all books that carry the number 549 deal with minerals. Decimal fractions added to 549 give the key to various branches of mineralogy. If the library rules allow you to go to the shelves, you need only seek out these numbers to find together all the books whose subject-matter is primarily minerals. You can examine these books and choose what you think will be helpful. You can also look up geology (No. 550), mining (No. 622), metallurgy (No. 669), all of which are subjects related to minerals. It will,

therefore, be well for you to go also to the shelf or shelves containing more general books on India. Also these books should be close together.

How will you find out whether the books you see on the shelves contain information on the given subjects? You certainly do not want to read all these books all the way through. There is no need to do so. There are two ways in which you can tell in a few minutes whether the book contains anything likely to be of interest in the study of your subject. First, look at the table of contents in the front of the book. This table gives you the chapter headings; and if you are at all clever, the chapter headings will tell you whether your subject is treated at length. But even if your subject is not treated at length, there may be valuable information in this book. Therefore, turn to the index at the back. Not all books have an index but any good reference on an informational subject should have one. The author's job is incomplete if a fairly complete index is not supplied. (Look at the back of this book to see what is meant by the index.) An index contains an alphabetical list of all major and minor subjects treated in the book. The subject-matter is followed by a number. This is the number of the page of the book on which the topic is treated or reference to it is made. Turn to the page and see what it is. Look to see if there are such words as minerals, geology, ores, or the names of particular minerals. In two minutes you can tell if there are any such references and can turn to the pages to see whether the references will be of any help. A good index is a catalogue of all things found in the book. It is like the address of a house. A man going to the city to see a friend will have

to walk through the city many weary hours before he finds his friend, unless he knows his address. The index is a list of what is to be found in the book, it quickly tells you whether your subject is mentioned in the book at all, and if it is, exactly where it is.

No matter how poor the library at your disposal is, there is no excuse for any student not being able to use the index to books. Indexes are available to all who use English books, and undoubtedly in the future, more authors of books in Indian languages also will adopt this very useful and necessary device for cataloguing the information given in a book.

Most books of a technical nature give references to other books and other sources of information besides books: these are called bibliographies. Study the bibliography, if there is one, for it will give you the titles of other books on the subject which may or may not be found in your library. Good encyclopedias always give bibliographies after each important article. There may be a way for you to obtain from some other library, or from an individual, the books mentioned in the bibliography. At least you will want to know what has been published.

There is another part of the library you need to look into besides the shelves where books on special subjects are kept. You need to look into the encyclopedias. Assume that you are using the *Encyclopaedia Britannica*. You will find articles under the heading of minerals, ores, mining, geology, India, etc., and also under the names of many specific minerals or groups of minerals. But there is much help in the encyclopedia in addition to the articles under the headings you may look up. There may be a hundred or more articles which carry

references to your subject. So turn to the most valuable volume in the entire encyclopedia set, the *Index*. This is much like the index found in single books, but since the encyclopedia carries as much information and material as a hundred or more books, the index is a very large one. Here, if you are clever, you will find the exact location of many helpful references.

There are many sets of encyclopedias and similar reference books. Your library will contain only a limited number. Be sure to look into them to see their plan of organization. Hardly two sets are organized alike. Some go according to the natural relationship of subjects rather than alphabetically. Anthologies and historical references may use a chronological order. A few hours devoted to examining reference works, to see how they are organized, is time well spent. Unless the arrangement is alphabetic, always look at the table of contents. And always regard the index as the key for finding out what is in them.

Here we will digress a moment from the pursuit of our special subject to point out that larger libraries contain not only dictionaries of words but dictionaries of biography, history, psychology, education, etc.[1] There are encyclopedias of special subjects such as religion,

[1] Biographical material includes such reference books as *Who's Who in India* which gives brief biographical notes on prominent living people of India. There is one for America also and one for England. There are even such references as *Who's Who in Education, Who's Who in Science, Who's Who in America, Living Authors,* or *Authors Today and Yesterday. The Statesman's Yearbook* gives the latest information about every government in the world, including the names of the men at the head of each government. There is a *Yearbook of Athletic Events.* This is illustrative of how information is brought together for the benefit of all who may need it. About the first thing you should do when you enter a new school is to find out what kind of reference books your school library contains.

the sciences, and the arts. There are entire series of works on history. There is one on the animals of India containing about fifty volumes, the *Fauna of British India. The Indian Yearbook* is a mine of information. Yearbooks usually give the latest information on a large variety of subjects including politics, economics, population, even sports, commerce, etc. If you want recent information about progress in almost any general field, by all means look into the yearbooks. They are far more up-to-date than encyclopedias and usually tell you what happened during the last year. *The Indian Yearbook* can be counted on to tell you something about any subject of current interest. *The World Almanac* covers, as the title suggests, a much wider field and gives comparative figures for different countries. In respect to our subject, both of these give some recent information on mining products.

The library probably has a collection of atlases and maps. When you want to know the location and size of any area, the natural resources, topography, vegetation, soil, climate, etc., nothing is as helpful as an atlas. There will be maps to show just where the various mineral products of India are found. Every atlas contains tables and statistics which are also invaluable. Speaking of statistics, pay no attention to the sentiment often expressed that statistics are dull. They are dull for those who are not interested, but they are most interesting and important to the one who is genuinely interested in a subject. Facts and figures are the very heart of many problems. But one must be careful not to jump to quick conclusions upon superficial scrutiny of a few statistics. Interpreting statistics is a skill which needs to be learned. You need

to know how information was gathered for the statistical tables in order to know just what they mean.

When seeking information never neglect the diagrams, statistical tables, charts, etc., given in your works of reference. These often give you more information than a hundred pages of reading matter. When you are building a house, a blueprint or ground-floor drawing means more to your contractor or workmen than an hour's verbal description. Charts and diagrams are like blueprints. Only the regular use of such helps can give you the skill to benefit properly from the valuable help they give. Our specific problem of mineral resources may not require the use of many charts or diagrams, but it will require the examination of maps, statistical tables, and graphs.

For recent information there is still another source of information which must not be neglected, namely magazines and journals. A good part of the information which gets into books first appears in shortened form in journals and magazines. Students working on M.A., M.Sc., or Ph.D. degrees have to look through magazines and journals very carefully because much important information which never gets into books appears only in journals and articles in magazines. Magazine articles are often concise, and are easier to understand than lengthy books. You will want to know what newspapers and periodicals come into your library, for they are very important to the real student. Usually only the most recent number or numbers will be found on the periodical shelf of the library, but you can ask the librarian for back numbers. In a good library these are carefully preserved and are made available to anyone asking for them. At the end of the year many

magazines publish an index showing what was printed in the various issues during the year. In America and England most libraries have a special Readers' Guide which lists the contents of all articles printed in the more important English magazines, so that a research scholar can quickly find out what has recently been published in this language on any subject.

Many students will not have the advantage of going to a library equipped with a good card index. However modest the library may be, examine it to see what it contains. Remember that even though there may be no book, or very few books, on the special subject on which you want information, there will in all probability be dictionaries, anthologies, encyclopedias, yearbooks, and other books of reference, as well as magazines, newspapers, and journals containing considerable information valuable to you. But you will have to know how to use them in order to find the required information, and the acquiring of this ability constitutes one of your principal jobs as a student. Also you must remember that although there may be a few or no books on the exact subject in which you are interested, it is extremely likely that there will be a dozen or more books containing chapters or a few paragraphs on the subject. Such books can easily be found if you develop a little skill and knowledge regarding the type of books likely to touch on your subject, and are skilful in the use of the preface and index of the book.

13. Learn to Analyze Problems

Our subject is much broader than the analyzing of mathematical problems, but we will start with mathematical problems, as the method to be employed is so typical of the method used in other subjects. There is nothing in this chapter that has not been taught by every good teacher. We wish to emphasize strongly the good old method of analyzing problems for use during private study in many subjects.

The very first thing to do in trying to solve any problem put before you is to make sure you know what the problem really is. If the problem is given in the form of a question, examine the question carefully and answer what is asked, and nothing else. Anyone who evaluates examinations can testify that one of the most common blunders students make in every subject is careless reading of the question. They often give an answer that contains no incorrect information, but is simply not the answer to the question asked. You cannot be too careful in reading the question. If the problem is not posed in the form of a question, you still have the same problem before you, namely, that of finding out what is wanted. When you have the problem clearly in mind, the first and most important step has been taken.

How easily students let themselves be fooled through careless reading of the question is borne out by the answers given to the following arithmetical problem:

If I cut a foot-rule into two parts so that one part is one inch longer than the other, how long is the longer part?

Work out the answer but think carefully before you answer. This problem was given to more than 2,000 high school students, out of which less than 250 gave the correct answer. More than 700 answered '7 inches', which is, of course, wrong. The answer is 6½ inches. Many people say, 'But that is a trick question, and trick questions are not fair in an examination.' It is not a trick question. The question is very clear. It states that one of the two parts of a twelve-inch rule is one inch longer than the other and asks how long the other part happens to be. Only one answer is possible. Always see whether your answer has met the demands of the question. The question not only states your problem but constitutes the means of proof of your answer. The answer must meet all the requirements of the question and usually should concern itself with little else.

In order to answer the question in an arithmetical problem there is certain information you must have. Some of it will probably be given to you in the statement of the problem, and some you are expected to know to begin with. In the above problem you were given the information that one of the two parts of the foot-rule is one inch longer than the other. The other piece of information necessary for the solution of the problem is the length of the rule in inches. The fact that a foot contains twelve inches you were expected to know. In arithmetical problems you are given all the necessary information except that of fixed relation-

ships, such as the relationship of the different units of measurement: yard-foot-inch, rupee-anna-pie, maund-seer-chatak, hour-minute-second. You are expected to know the relationship between the circumference and diameter of a circle, the number of degrees in a right angle, the relationship between dimensions and area, dimensions and volume, etc. You are expected to know these fixed relationships or you are permitted to look them up, but other quantities must be given you as part of the information of the problem.

The problem may give a great deal of information besides that which you need. You must select what is necessary. As soon as you understand the problem, ask yourself what information is necessary to solve the problem. Look over the wording of the problem carefully to see what information given is useful, and ask yourself whether that is all you need to know. You are expected to know some information in advance, e.g., that of fixed relationships. If you do not possess this fundamental knowledge the problem becomes more difficult to solve.

At the same time as you are noting the information required, your mind will be busy selecting the method of calculation required. The information needed depends partly on the method of calculation you intend to employ. Similarly, the method you are going to use depends on the information in hand. Thus you find yourself in the midst of the actual solution.

The solution requires certain mechanical skills, such as ordinary addition, subtraction, multiplication, division, or more complicated processes involving vulgar fractions, decimals, units of measurement, square root, etc. Sometimes the mechanical processes are so easy

that they can be done mentally in a second or two, and sometimes considerable work with pencil and paper are required. Some people who are very good in mechanical arithmetic are very poor in problems. These two processes are very different from each other. The one requires perfection in the mechanical rules of arithmetic and knowledge of fixed relationships, the other requires language ability and thinking.

Some students acquire a limited amount of success in solving problems without actually doing any thinking, that is, they learn in a mechanical way just what steps they must take in a certain kind of problem, and do all problems of that kind in the same way. For example, assume the problem to be:

> A merchant bought a pair of bullocks for Rs 200 and sold them for Rs 220. How much profit did he make?

If you have learned to use a formula, such as 'subtract the cost of the goods from the price at which he sold the goods in order to find the profit', you can do this problem very easily. Most students do try to use a formula. It is not always as careful a formula as this one. It is more apt to be something like 'subtract the smaller amount from the larger amount and this gives you the answer'. That formula works only when there is actually a profit. If there happens to be a loss, then the latter formula will give you the wrong answer. If you use formulæ, you must be careful that you have a good one that covers the case.

The formula method is a good one to a certain extent. The trouble with the method is that there are so many different kinds of problems that many people

fail to select the right formula. Any little change in the type of problem immediately deceives the student who employs a formula mechanically, without carefully thinking out the problem. In other words, formulæ are very handy and help you to a quick solution in cases where the problems are more or less stereotyped. When there is anything new or unusual in the problem, the formula is apt to mislead you unless you are a thinker careful enough to see the difference between this problem and the ones you are used to solving. You cannot be a good problem-solver by simply trying to remember the method to be used in the different types of problems. You need to learn to think out the problem. That is what few students attempt to do. They expect problems to be of the same type they have learned to do mechanically and unthinkingly, and therefore, are not prepared to use the thinking method. But the only safe method is the thinking method.

The thinking method always involves steps which were mentioned before and are repeated here in the résumé, namely,

1. Visualizing clearly what the problem is.
2. Noting carefully the facts given or implied.
3. Choosing a method of solution which is feasible with the facts at your disposal.
4. Working out the computation.

This method of attack is always useful. In familiar types of problems the solution suggests itself at once, but in unfamiliar ones considerable thinking may be necessary. No matter what type of problem you have before you, the application of these steps will enable

you to solve it, provided you have mastered the necessary skills and knowledge needed in the solution.

Some problems are very complicated and require several steps in their solution. Some may be considered several problems in one, but this complexity does not provide too much difficulty if the student is careful to proceed systematically from one step to the next.

Let us work out in detail an arithmetical problem which is fairly simple in its arithmetic, but which involves a number of facts that need not be taken into consideration. This problem is longer in its statement than necessary, but this has been purposely planned to show that the main problem lies in understanding the wording.

A certain contractor who lived in Nagpur received the order for building in Jubbulpore a two-storeyed school, with an area of 4000 square feet, costing Rs 100,000, on which he calculated he would make 11 per cent profit. The building had to be finished by 1 October. Hotel expenses in Jubbulpore would cost him Rs 100 per month, for three months. Then he was offered two jobs in Nagpur, both of which would have to be finished by 1 October. He could do both of them at one time. He had to choose between the two Nagpur jobs and the one in Jubbulpore. One job in Nagpur was a contract for a single-storeyed building, 5000 feet in area, for Rs 60,000 on which he could profit 14 per cent. The other job was a flat fee of Rs 5,000 for supervising a construction which would involve expenditure of approximately 25 per cent of the fee. Which proposition is the more profitable for the contractor, the Nagpur contracts or the one in Jubbulpore? What is the difference in the profit?

First step—Understanding the problem. What is

involved here? There is an opportunity to choose between work to be done, at the same time, in Jubbulpore and Nagpur. The contractor could not take the contracts in both cities.

Second step—Study the information available. The size of the two contracts is given as well as the rate of earning. So the earning can be calculated without much trouble. Hotel expenses in Jubbulpore also need to be taken into consideration. The supervisor's job for which he is to receive Rs 5,000 gross earnings involves an expenditure of 25 per cent. Therefore, the net profit on this contract can be readily ascertained.

The number of storeys in the building, and the area of the buildings do not concern us in any way, so we may ignore entirely the information given about them.

Third step—The method of computation. Calculate the net profits on the Jubbulpore job and also the net profit on the combined Nagpur jobs. Then find the difference.

Fourth step—The computation.

(i) Jubbulpore job: Rs 100,000 x .11 — 100 x 3 = Rs 10,700.

(ii) Nagpur jobs:

Job I: Rs 60,000 x .14 = Rs 8,400.

Job II: Rs 5,000 — 25% expenditure = Rs 3,750.

Add the profits; 8,400 + 3,750 = Rs 12,150.

(iii) Difference in favour of Nagpur jobs Rs 12,150 — 10,700 = Rs 1,450.

Algebraic problems in particular require this kind of reasoning for their solution, and give excellent practice in the systematic reduction of the problem by the steps mentioned above. In algebraic formulæ you make use

of letters, such as a, b, x, y, z, etc., in order to make formulæ for the solution of a problem when you do not know the exact quantities. For instance, if you do not know how old a man is, but know his brother is two years older than he, and his second brother four years older, you can conveniently put down their ages as x, $x + 2$, and $x + 4$ respectively and can then conveniently incorporate these facts into a formula. Making up the formula to be used in an algebraic problem calls for real brain work. Comparatively few people make use of algebra. But everyone who has studied it can employ the reasoning method used in tackling problems in many fields besides mathematics.

Next we will consider a problem in physics:

> The specific gravity of a certain coal is 1.3. A coal bunker on a ship measures 25 feet by 20 feet by 20 feet. Allowing 10 per cent of the total volume for air spaces between pieces of coal, what weight of coal can be stored in the bunker?

Understanding the problem. You are to find out how many tons of coal can be stored in a bunker of which you can easily calculate the space in cubic feet. You have not been given the weight of the coal but you have been given the specific gravity. Your problem obviously is that of calculating the weight of a cubic foot of coal from the specific gravity. Since the specific gravity assumes solid matter without air spaces between particles, and since there are many air spaces between lumps of coal as ordinarily stored, the reference to '10 per cent of air space between pieces of coal' gives the required information for making a necessary adjustment.

Study of facts given or implied and the choice of a method. As stated above the data for volume of the bunker and adjustment for air space between pieces of coal is sufficient for simple calculation. But the lack of data on the weight of the coal forces us to deduce the weight per cubic foot from the specific gravity. In order to do this we have to have a thorough understanding of the meaning of specific gravity and its relationship to weight per cubic foot. This is a knowledge a physicist is supposed to have.

Specific gravity of a substance may be defined in different ways but the relevant facts in this case are as follows: sp. gr. equals $\frac{\text{Density of a substance}}{\text{Density of water}}$. One is expected to know the meaning of density, and also the value of density of water. The density of water is 1 gram per c.c. or 62.4 pounds per cubic foot. As the dimensions of the bunker are given in feet, the pound-cubic foot relationship must be used. Now writing the above equation again, we have sp. gr. equals $\frac{\text{Density of a substance}}{\text{62.4 pounds per cubic foot}}$ or sp. gr. of coal equals $\frac{\text{Density of coal}}{\text{62.4 pounds per cubic foot}}$.

The computation

The volume of the bunker is 25 x 20 x 20 . . . 10,000 cubic feet.

Deduct 10% of the weight of coal as calculated on the basis of specific gravity for air space.

81.12 — 8.112 = 73.008 pounds which is the number of pounds of coal contained in the bunker when full. For convenience the answer should be reduced to tons:

730,080 ÷ 2000 = 365.04 short tons.

Let us take a current problem in economics, one of national importance: Why is it necessary for India to

become self-sufficient in the raising of food?

This problem appears at first to be very different from an arithmetical or algebraic problem. And yet the method used in its solution is very similar. First, let us inquire as to whether we have understood the problem. The word 'necessary' implies necessity or urgency. It assumes the fact that there will be considerable harm if self-sufficiency is not achieved. But what is self-sufficiency? If we do not know what that means, we cannot understand the problem. Self-sufficiency in this case means the ability of the inhabitants of this country to raise all the food they need without having to buy from other countries.

It does not necessarily mean that nothing of food value is bought from other nations; but it does mean that no more should be bought than we are prepared to sell, thus making an even exchange of foodstuffs. The phrase 'raising of food' is simple to understand, but we need to have a fairly broad conception of all that is included in foods. We need to be able to visualize not only the daily meals we eat in our homes but also the vast amount of grains, such as wheat, jowar, rice, ragi; the dairy products, such as milk, ghee, butter; the edible oils, such as coconut oil, monkey-nut oil; green vegetables; fruits; nuts; potatoes; sugar, condiments, onions. We must also think of fisheries, poultry-raising, the raising of cattle, sheep and goats as industries important in the economic life of this country. We must have some conception of the vast amount of food it takes to keep 40 crores of people alive, in order to understand our simple little question of why it is necessary for this country to be self-sufficient in foodstuffs. We must be able to realize the amount of

agriculture and industry necessary to supply this nation.

Why should not the people of this country go out and buy what is needed? To buy you need money. Some individuals in India have plenty of money to buy what they need personally, but has the nation enough money to buy what is needed for 40 crores of people? The question implies that either the nation has not enough money or that it is undesirable to spend what money it has to buy food. So, evidently, our problem is to find out whether or not there is sufficient money available and, if there is enough money available, the reasons why the money should be spent on necessities other than foodstuffs. That then is our problem, and until we have all this clearly in view we have not taken the first step towards finding the proper answer, namely, understanding what the question asks.

Let us assume we have the problem clearly in mind. Then the next step is to see what information we have available. This problem differs from a mathematical problem in that it gives us no mathematical quantities. Nevertheless, the answer requires mathematical treatment. We need to calculate whether the nation can afford to buy food. What is our budget? How much money has the country and what does it need the money for? The student of economics has to look for such information anywhere he can find it. The Government keeps accurate information on production of food and other essential products, on exports and imports, on the balance of exchange, or in other words, on the amount of credits we have so that we may buy from other countries without sending away what money we have in this country, for one cannot send away more money than is available.

Let us assume that the question is one for study, that is, a question meant to make you gather the information required from various sources and not a question given for mere examination purposes. You are free to search for your information. The entire library is at your disposal. Hardly a newspaper is devoid of some information of value to you. Your knowledge of geography, history and economics comes into account. This demand for various items of information makes it much more interesting than a mere arithmetical problem. There are thousands of facts which are helpful for giving a clearer idea of the problem as a whole, but many of these facts are not actually useful in the direct solution of this problem. You must carefully select those which are most helpful in this situation.

Right at this point we have touched on the greatest difference between arithmetical problems and those in the social studies. In arithmetic most of the information is very exact and restricted. Most of it needs to be given in the problem. In the social studies the facts are much broader and sometimes are debatable. Few of the facts are given in the statement of the problem. These facts are a matter for investigation and study. They are less mechanical and exact and much more a matter of independent and original study.

The information needed for an intelligent answer is fairly comprehensive. One needs to have answers to the following questions:

How much food does India raise?
Is it sufficient?
If not, what is needed?

What other needs besides those of food are there to be met?

What is the relative importance of these needs?

Can India produce more food?

What is needed for the production of more food?

Is it more possible to raise all the food we need than to meet the other essential needs?

If we buy food from foreign countries what materials shall we have to forgo or how much shall we have to export in order to get the money to pay for imported food?

In answering such related questions, the problem of the need of industrial development, the need of heavy machinery, the problem of production and foreign exchange and buying power come into review. Each is a problem which can engage a class for months, or even a year, and prove very profitable. Such study is of much more value than textbook memorization or paraphrasing.

Together with the gathering of information comes an initial study of solutions proposed by various schools of thought. One needs to select the solution which seems most plausible and constructive. Even this may need suggestions for exchange. This stage of working our problem corresponds to that stage in mathematical problems when one selects the method according to the need.

The final statement of the investigation with conclusions corresponds to the step in mathematical problems when we execute the computations for the answer.

We have taken as an example a case which is in extreme contrast to the mathematical problem. Problems in physics and chemistry are in between, approxi-

mating more nearly to the mathematical. But even in the example given one can see how a systematic approach, such as has been used for centuries in the study of mathematics, namely, careful defining of the problem, the gathering of facts, choosing a method of solution and applying the solution, can shed light on problems in almost every field. Such a mode of study is in strong contrast to memorization of the textbook or notes. Memorizing may aid in the passing of examinations but adds little to one's understanding. Problem-solving is the most profitable kind of study one can attempt, and is the only kind that results in real education. It requires more thinking than all other types put together; and since an education is meant to make you think and apply intelligently the tools of education, problem-solving fulfils this task well.

It should interest you to know that those who are good at solving arithmetical problems are not necessarily efficient in mechanical mathematics. It has been found that the best readers succeed better in solving mathematical problems than the best computers, simply because reading and problem-solving are essentially language and thinking assignments and not mere mechanical exercises like the computational side of arithmetic. When we get to solving problems in the social studies or in any sphere which requires the collecting of information not given in cut-and-dried form in the statement of the problem, it is even more the case that the best work is commonly done by the best reader. This chapter should again impress you with the fact that you cannot be a good student until you voluntarily do much reading for the sake of enlarging your information, and also for pleasure.

14. Power with Words

There is a very rough way of measuring the number of ideas you have. This way of measuring will not tell you how valuable, deep, or sound your ideas are, but it will tell you in an approximate way how many ideas have at least flitted through your brain at some time or other. The method of measurement is very simple. It is a test to see how many words you know the meaning of.

The development of a civilization can be judged by the number of words which need to be entered in the complete dictionary of the language used by the people of that civilization. A psychologist by studying a list of the words you know can tell a great deal about your accomplishments, your interests, and the type of environment in which you grew up. Words represent ideas. They happen to be the means through which ideas are compared and built up. Therefore, it is quite evident that your failure to know the meaning of certain words is an indication that you have not thought much about the matter. Your knowledge of words is an indication that you have at least heard of or read about matters suggested by the words and have devoted some thought to them. Men soon frame a word to designate the things they work with and think about. There is no need to coin words for what is outside their thoughts, interest, and experience. Similarly, the individual gains familiarity with words to the

extent that he at some time gives attention to matters symbolized by those words.

I can tell quickly whether or not you have some acquaintance with, or interest in, the following subjects. If you fail to know the meaning of at least two-thirds of the words in each line, it is fair proof that you are practically ignorant of the subject printed in capital letters at the end of the line:

cell, marsupial, asexual, invertebrate, maxilla, phylum: ZOOLOGY

parallel, plane, radius, equidistant, axiom, rhombus: GEOMETRY

schizophrenia, I.Q., moronic, inhibited, sublimate, masochism: PSYCHOLOGY

gerund, subjunctive, past perfect, prepositional, accusative: GRAMMAR

equation, double negative, coefficient, quadratic, bracket: ALGEBRA

stratified, lateral thrust, Silurian, igneous, basalt: GEOLOGY

erosion, isotherm, volcanic, trade route, continental: GEOGRAPHY

stamen, pistil, osmosis, deciduous, alga, fertilization: BOTANY

valence, atomic weight, molecular, saline, basicity: CHEMISTRY

galvanic, refraction, focal, fulcrum, positive pole, hydraulic: PHYSICS

ion, chain reaction, isotope, critical mass, proton: NUCLEAR PHYSICS

valve, bushing, delco, ignition-point, differential, grounding: MECHANICS

We must qualify the statement that we can tell with which subjects you have practically no acquaintance.

A totally illiterate man living in the jungle may have a very keen knowledge of the animals and the habits of the animals living in that jungle, even though he does not know the meaning of even one of the words listed under the head of zoology. The words we have given are technical terms, that is, words given a special, narrow meaning of a scientific nature in a particular branch of knowledge. So, failure to recognize properly the technical words in the lists above does not necessarily mean that you have no knowledge of the things dealt with, but it does mean that you lack technical training in the subject. Of course, this list printed above is a good test for you only if you know English very well.

Every developed language has for use in all subjects general words such as climb, speak, run, satisfy, enjoy. In addition every subject, trade, ideology, or school of thought has its own vocabulary of technical words. These may be special technical words coined for, and used only by, that subject or trade; on the other hand, they may be common words used in a special way by the people working with that particular subject-matter, or in that particular trade. For instance, a 'stick' in general is a piece of wood. We usually think of it as a dry branch that has fallen to the ground, although it may also be a piece of wood in the form of a cane carefully prepared by a carpenter. But to an aviator it means the steering gear for his plane. Thus, a very common word becomes a technical word.

We must remember that most words have not only one meaning but several. Some words acquire several technical meanings varying with the subject you are talking about. Some words have fifteen or twenty

meanings. The word 'cell' means quite a different thing to a zoologist, a prison warden, a keeper of bees, an electrician, and a nun.

Most words, whether technical or ordinary, have several meanings; some have as many as a dozen meanings. Take the very ordinary word 'house' for instance. See the many meanings of the word used below. Even this list does not exhaust the possibilities.

A place to live in (noun). He built a house
To put into a house (verb). Where should the refugees be housed?
A family. He and his whole house went to the wedding
A legislative body. He was elected to the House of the People
A commercial company. The House of Martin & Miller, Ltd
One of the twelve divisions of the heavens, a sign of the Zodiac. The House of Leo
An audience. The entire house applauded his speech
A college in a university.
A team in a boarding school.
Housing means a place to live in, shelter from the weather, a container for a piece of machinery, a part of a ship, or a part of the harness of a horse.

In order to know a word you must know not only one meaning but several of its meanings. It is therefore possible for you to have some acquaintance with a word but not a thorough enough acquaintance to enable you to apply the right meaning in a particular setting. It is not only the number of words you know but how well you know the words which will have to be taken into consideration when trying to estimate

from the words you know your ideas and experience.

You cannot understand conversation or reading matter unless you know the meaning of nearly all the words used. You can guess the meaning of some words from the context, but sometimes the meaning does not become clear from the context. Often the word happens to be of such importance that the entire paragraph or even chapter is obscure until you learn its meaning. Take the following paragraph:

> The motor came to a sudden stop. As the petrol tank was almost full the driver reasoned that the trouble must be in the contacts. He pressed the button of the horn and there was no sound. He switched on the light but there was no light. So he opened the battery chamber, took some sandpaper and sanded down the contacts. When he had finished this he was able to sound the horn, the lights went on, and the starter worked perfectly. He turned to his companion and said, 'Always see that your contacts are clean.'

The meaning of this paragraph will be perfectly clear to one who knows something about the electric system of a motor, and who knows that contacts are the connexions between two conductors of electricity. Lack of knowledge of the meaning of a single word, or a very hazy understanding of a single word, often makes paragraphs and even chapters difficult to understand. When a word happens to be a key word, very little progress in understanding a passage can be made until one finds out the exact meaning of the word in the particular context.

All the foregoing has been written to impress upon the student the necessity of knowing the meaning of words, and having a rich and varied vocabulary at his

command. You can talk and think intelligently only about those aspects of life in relation to which you have mastered the words that are descriptive of their phenomena. One of the first tricks of any trade is to master its vocabulary.

When we speak of mastery, we mean not only having learned the definition of a word but also having acquired the ability to use the word intelligently in both speech and writing. Since most words have various shades of meaning, we must know the various shades of meaning, or we shall use the word in ways confusing to those who know its right use. Knowing the word only the one way in which it was used on a certain page in a book is of little value.

You can increase your vocabulary by conscious effort. Most of our vocabulary is acquired without special effort on our part through conversation and through reading. Once again the value of wide and extensive reading in various subjects is stressed. But in addition to reading, writing, and conversation we need to pay special attention to the meanings and uses of words, for they are the stuff of which language and ideas are made. We will list a number of helps to this end.

1. Make a point of writing out new words when you come across them. It is a great help to memory to write a word down. It is good to keep a notebook for this purpose and to note in it, not only the definition of the word, but a sentence in which the meaning, or meanings, become clear. The surprising thing about new words is the way they seem to meet one everywhere all of a sudden. I have sometimes thought it peculiar that a word I had never or seldom met before suddenly seems to be in use in many places. One

meets it in a book today, seemingly for the first time. Then one notices it in a newspaper, hears it over the radio, or hears it used by a friend, all within the course of a few days. I have asked myself, 'Why the sudden popularity of this word?' The chances are that I have seen and heard it many times before, but having paid no real attention to it, I allowed it to escape notice. Not until it accidentally happened to attract my attention on a particular day did I begin to notice that it is not such an uncommon word after all. It is similar to noticing a certain bird or insect for the first time. Suddenly, you realize that there are many such birds or insects about, and no doubt they have been there much of the time, but you simply did not notice them. We notice only a small fraction of what we see and hear, but once having noticed a particular thing, it attracts our attention by its presence in many places.

2. Attempt to secure the meaning from the context: Asking the teacher, or other people, the meaning of the word is helpful at times, and of course, the dictionary is the real mine of information as far as the use of words is concerned. However, there is not always someone whom we can ask, nor is the dictionary always available. And since it is very delaying to have to refer to either while you are reading, you should learn to be adept at 'guessing' the meaning of the word from the way in which it is used. But be cautious. Sometimes we guess wrongly, and a bad guess in the end proves to be confusing. So keep your mind and attention open to learn more about the word. You will probably soon meet it again in the same conversation or in the same book, perhaps in the same paragraph. The oftener we meet it the better will be the

opportunity of really getting acquainted with its meaning, or meanings.

3. Try to understand words through recognition of their prefixes and suffixes. English is not the only language that has prefixes and suffixes. Every developed language has some. Very many word roots can be enlarged to give a great variety of meanings simply through the addition of prefixes and suffixes. See what a large number of meanings the two root words given below have:

agree	direct
agreement	director
disagree	directorate
disagreement	directress
unagreed	directorship
agreeable	direction
agreeability	directive
agreeableness	directly
	directrix
	indirect
	indirectly

Every prefix and suffix has its own heading. If you know the word to which it is attached, you should have little trouble in reasoning out the prefixal or suffixal meaning. Here are some of the most common prefixes and suffixes together with their meanings and an example or two found in the English language.

PREFIXES

ANTE, before	anteroom, antedate, antecedent
ANTI, against	anti-religious, anti-socialist, anti-foreign
CON or CO, with, together	confidence, consistent, construction, co-worker, co-operate

DIS, not	disloyal, disrespectful, disreputable
DE, away from	destruction, demilitarize, defame
IN or IM or IR, not	incomplete, immodest, irrespective
POST, after	postwar, postscript, postposition
PRE, before	prewar, prehistoric, preposition
PRO, for	pro-Gandhist, pro-Communist
RE, again	regain, repeat, re-enter
HEMI or SEMI, half	semi-annually, hemisphere
TRANS, across	trans-Himalayan, transport
UN, not	undesired, unconcerned, unpatriotic

SUFFIXES

-ABLE or -IBLE, able, capable of	lovable, contemptible, usable, pitiable
-AL, pertaining to	personal, sentimental
-FUL, full	beautiful, plentiful
-HOOD, showing condition	bachelorhood, childhood, motherhood
-LESS, without	careless, childless, harmless

A mastery of the meaning of the suffixes and prefixes is a rewarding method of word and language study and will give the clue to the meaning of countless words which will otherwise confuse you.

4. Attempt to secure the meaning of a word through root meaning. The root of a word is the main or common part of a whole family of related words. When you know the root, you are more apt to understand all the words derived from it. Take for example the Latin word *manus* meaning 'hand'. From this root we have manual, manufacture, manuscript, together with a large number of forms built up on each of these words through the addition of

prefixes or suffixes. One of the most useful of all roots is 'graph' which in Greek is the root for 'writing'. From this word we have telegraph, phonograph, graphic, photograph, hectograph, heliograph, and many other technical terms all of which refer to writing or the making of records. Graphite of which pencils are made is a material used in writing. The Greek word *scopeo* meaning 'I see' has given us telescope, microscope, spectrascope, helioscope and dozens more names of instruments for seeing.

All languages contain root words that give us the key to the meaning of whole families of words. It pays to know these roots. Therefore, remain on the lookout for words derived from familiar roots which can be learned with the greatest of ease when one knows where the main body of the word came from.

The Sanskrit language gives us many roots which are recognizable through a dozen or more languages or dialects. Knowing Sanskrit is of help not only in learning Indian languages and dialects but in learning European languages, including the ancient Greek and Latin from which so many of our English words and scientific words come. Observe how the traces of the roots *pitri* for father and *matri* for mother go through various languages.

Sanskrit	mitri	pitri
Hindi	mata (or ma)	pita
Tamil	amma	appa
Oriya	mata (or ma)	pita
Greek	mater	pater (accent on last syllable)
Latin	mater	pater (accent on first syllable)

English	mother	father
German	mutter	vater
French	mère	père
Italian	mama	papa

5. Use the dictionary. To do so requires practice. Of course you need to know the order of letters in the alphabet and how to alphabetize words. You should be able to find a word in a few seconds. It is easy when you have the practice, and difficult when you have not.

A good dictionary tells you not only one meaning of the word but several, and indicates the different parts of speech of the word. English dictionaries tell how the word is pronounced, although languages which are written phonetically do not need this guide. A good dictionary also indicates the root and the language from which the root comes. It shows related words and in its definitions gives you synonyms and sometimes opposites, all of which help you to understand its uses. No one can claim to be a student until he is adept in the use of the dictionary. A comprehensive dictionary gives you a good part of the family connexion of the word.

6. Practise using synonyms. Synonyms are two or more words which have meanings that are *almost* alike. There are very few exact synonyms, but there are many words with a meaning closely related to that of some other word. Learn to know the similarity and dissimilarity of synonyms, the fine shadings which distinguish one from the other. A forceful speaker and a clear writer needs to know these shadings well. Note the differences in the words which often are more or less regarded as synonyms.

ignorant	without knowledge in general
illiterate	without the skill of reading
unlettered	without literary knowledge
untaught	without the benefit of teaching
unknowing	ignorant of some particular thing or event
foolish	acting ignorantly even though he should know better

7. See how many different meanings you can attach to a common word. We list sixteen meanings for the word 'run'.[1]

To move swiftly	The boy will run home
To move on a certain route	The boat runs to Boston
To be a candidate	He will run for the presidency
To hunt or pursue	They ran down the criminal
To maintain in a certain condition	He ran his business well
To cause to enter	He ran a nail into his foot
To allow bills to mount up	He ran up a big bill
A continuous demand	There was a run on the bank
A ravel in knitted material	She had a run in her stocking
A series	A run of good luck
Time during which something continues	The play had a long run

[1] Kelley, V. H. & Greene, H. A., *Better Reading and Study Habits* (World Book Co., New York, N.Y.).

A place in which animals are kept	The sheep run
A contest	He had a close run in the election
A cricket term	He made 98 runs
Playing-cards in consecutive order	A run of spades
Freedom to go about	The dog had the run of the house

A similar, although less lengthy, list can be made of many common words. The dictionary will help you as you make such lists, but be on the lookout for meanings not in the dictionary. Words acquire new meanings very rapidly in these days of quick changes, and no dictionary remains up-to-date in giving all these meanings. Moreover, few dictionaries are complete.

8. Practise using words that are new. This is perhaps the most important advice that can be given to anyone who wants to increase his vocabulary. Of course, the word must be used correctly to be helpful. One of the chief values in using it is that you are forced to know its exact meaning. You know no word really well until you can use it freely and correctly in conversation without being conscious of the fact that it is a new word.

9. Increase your vocabulary by wide reading. This advice is almost as important as No. 8. Few, if any, people who do not read widely have an extensive vocabulary. As you read, your vocabulary automatically grows.

10. Increase your vocabulary by developing many different interests. It was emphasized in the beginning of this chapter that every subject has its own voca-

bulary. Therefore, every new interest that you develop necessarily acquaints you with additional words as well as with new uses of familiar words. A person of few interests has no need of a large vocabulary. Your knowledge of words indicates where you have been in your thoughts and studies. You do not go very far if you confine your attention to textbooks and what is taught in school. It is your interests outside of school and after you leave school which determine whether you are really an educated man. No person can be considered educated who does not learn and study throughout his life, for although he went to school, and may even have a degree, he has only the tools of education, not education itself. Real education can be had only from continuous use of these tools.

15. In the Laboratory

You cannot do proper work in the laboratory unless you fully appreciate the value of work done there for humanity. You will be able to understand these values when you know something of the great heroes of science and the great battles they have fought there. The laboratory has done more to change our way of living and to change the appearance of the earth than any other intellectual agency. Within half a century it will probably be true that the laboratory has done as much to feed people as several million farmers; that it has done as much to clothe people as the cotton and woollen industries; that it has saved more people from premature death than war has sent to premature death; that it has made it possible for twice as many people to live on this earth as could live on it had there been no laboratories. The laboratory is largely responsible for the great difference between the modern age of science and the age of ignorance and superstition.

The laboratory has made itself the heart of the industrial system. No modern motor car could run off the assembly line until it has been built, and rebuilt, and improved in a thousand ways in the laboratory. No one was safe from cholera, smallpox, plague, and many other maladies until research workers gave their lives for us in the laboratory. The farmers' acres would yield hardly half what they do today, and not a quarter of what they will yield in fifty years from now, if there

had been no agricultural laboratories. Hundreds of fruits and flowers available today would be non-existent but for experiments carried out in experimental farms, which are extensions of the laboratory. Thousands of metals, plastics, chemicals, textiles, and innumerable other substances, which have never existed in the natural state, have come into being through the painstaking work and ingenuity of the laboratory worker. When you enter the laboratory, you are entering a place which has altered the very appearance of the face of the earth and continues to alter it.

A knowledge of the lives and work of the great men and women who have laboured here before you will prove to you the importance of the laboratory. You must read how Jenner forged a weapon against small-pox; how Pasteur conquered anthrax and hydrophobia; how Van Leeuwenhoek discovered a new world of living things when he invented the microscope; how George Washington Carver rebuilt worn-out farms by finding several hundred new uses of the hitherto almost useless peanut and sweet potato, which when grown enrich the land; how Dr and Madame Curie discovered radium; and how the discovery of chloroform made it possible for major repairs to be carried out in human and animal bodies doomed to pain and early death without these repairs. Battlefield heroes have not shown nearly as great courage, genius, and ingenuity as our laboratory heroes have. Before you can learn anything worthwhile in the laboratory, you have to catch the spirit of patience, hard work, honesty and self-sacrifice shown by these workers, as well as their stubbornness in refusing to believe anything proved until they saw, heard, smelled, tasted, and felt with

their own senses what they were looking for.

Turn to pages 15 and 16 of this book and read the story of how Edison invented the electric bulb. Read that fascinating book, *Microbe Hunters*, by Paul De Kruif and its companion volume, *Hunger Fighters*, in order to see what kind of labour is needed in the laboratory. If you are interested in nature study, read some of the books by Jean Henri Fabre, a simple villager who had no scientifically-equipped laboratory but who used the worthless insect-ridden fields about his house to study insects, and thereby became one of the world's most renowned entomologists. A laboratory need not necessarily look like a school laboratory. It can be anywhere. Some of the most famous inventors had laboratories which were only little workshops, much like a carpenter's, mechanic's or electrician's workshop. A laboratory is a workshop. Never forget that, and it is the workman who makes the workshop. When you enter the laboratory it is to become a workman like the men and women whose discoveries have made the age of science so different from the days before the year 1400 in Europe and 1850 in Asia.

Not everything that has been done in the laboratory has been a blessing to man. The discoveries of the laboratory have also made it possible for men to destroy each other by mass murder. Science has been used for destruction, since all forces can be misused as well as used properly. But misuse is hardly the fault of the laboratory or of science; rather is it the fault of mankind. Although it is a social and a moral problem of the greatest importance, it lies outside the immediate object of this book. We are here concerned

with the benefits that can be won for mankind through experiment, discovery, and invention.

There is quite a difference between a research laboratory and a laboratory intended for high school and college students. The heroes of science have worked in research laboratories, or invention workshops, rather than in school laboratories, but the student must never forget that the school laboratory is intended to be the stepping-stone to research and invention. It is here that you are to acquire the habits and the spirit which can make you develop from a schoolboy into a scientist or inventor in your own right. Only a small proportion of those who take science in high school or college become professional scientists, but everyone can learn the painstaking care, honesty, and truthful regard towards facts which constitute the scientific spirit. This spirit is useful in all walks of life, nowhere more than in our social relationships. There is hardly a field worthy of application in which it is not needed. Therefore, it is important that you regard yourself as a searcher after truth when you enter the laboratory. This search must never cease regardless of where you may happen to be. In the school or research laboratory our search for the truth is limited to physical phenomena, but the habits learned here should be a help to us in social and spiritual relationships as well. All life is a laboratory requiring the same careful, factual, experimental, and truthful approach as in the study of physical phenomena.

Unfortunately, very many students entirely miss the purpose of the laboratory assignments. They think of their assignments as consisting of certain prescribed experiments, performed as quickly as possible, so that

they may be written up for the teacher and checked off the list of work to be done. When done in this spirit, the experiments are not experiments but mere academic exercises. It is important for you to learn why you are in the laboratory.

What are you supposed to do in the laboratory? There are several things which are important.

1. You are to train yourself to demand proof and not believe the proof readily even though you produced it yourself. Many of the most important discoveries were made by people who refused to accept generally accepted facts. Einstein started his theory of relativity by challenging one of the axioms of geometry, the one that defines a straight line as the shortest distance between two points. In nature there are no straight lines. All lines are curved even though ever so slightly. This discovery started Einstein thinking along lines which upset the old physics entirely. A good scientist tries to disprove even his own conclusions. Only after his theories have withstood every attempt to disprove them are they believable.

2. You are to learn certain laboratory techniques. You have to be able to handle the tools and materials of your trade. You can only learn their use by handling them. That means you have to work with them until you are as much at home with them as a cricket player is with the bat and ball. It takes practice. Probably the time given in the school laboratory is not enough. But there are innumerable opportunities outside of school to increase your experience. The more skilled you are with your hands the better you will fit into the laboratory. A botanist needs gardening; a physicist needs tool-work of all sorts; a chemist

can profit from careful cooking; all can profit from drawing. These are but a few examples of how every-day tasks can aid laboratory technique.

3. You need to learn to become strictly objective. You must record your data or facts exactly as they are, whether they prove your point or disprove it. You want to find out the facts regardless of where they lead. You must never hide information simply because it does not seem to be helpful. Many of the greatest discoveries have been made when scientists were annoyed because their experiments did not seem to produce the right data. The seemingly wrong part of the data held the secret to a great discovery. *Scientific* is synonymous with truthful; it means recording strictly according to the observed facts.

4. You need to be on the constant lookout for examples of the kind of phenomena you have seen in the laboratory, and need to relate what you see in the laboratory to what you have seen about you in the ordinary pursuits of life. Thus your laboratory experience is increased a hundred-fold. Everything about you becomes a part of your laboratory.

5. You need to think of the application of natural laws seen in the laboratory. What practical use can you make of this particular phenomenon? When Edison stuck a vibrating needle into his finger he could feel the vibration in his finger.[1] This set him to pondering whether a needle made to vibrate because of sound, could not produce a track in a soft material, which in turn could cause a needle to vibrate in the same way if the needle were run over this sound track produced by the original vibration. The result of that

[1] See page 39.

reasoning in his mind finally produced the gramophone. We are not all inventors, but we all need to know what kind of work natural forces do. That is one reason for studying science. We watch the working of nature in the laboratory so that we may get to understand better how to make use of natural forces.

You will never develop the above-mentioned qualities unless you have some idea of how the great scientists worked in their laboratories. Therefore, an important part of your laboratory course is the reading of the biographies of great scientists. Unfortunately, this is much neglected in Indian schools. Much literature of this sort needs to be produced in the Indian languages. In no other way can the proper tradition be acquired.

It will not be nearly so difficult to write up your laboratory experiments, or to understand the principles involved in the phenomena you are supposed to have observed, if you regard the laboratory as a time for seeing with your own eyes, and try to visualize the significance of each thing that you see. It is then that it becomes important to you, and when it is important to you, you can more easily describe its importance, and you will be more careful in giving the significant details. Interest in the subject is of vital importance. When reproducing what you have learnt you are not supposed to try to write up experiments in an exciting way. Scientific language sticks to the bare facts, but unless your interest and excitement are aroused, even the bare facts will probably escape you. But eagerness to find out will make even the dullest facts intensely interesting.

I am indebted to Mr John Narsaiya for the following example of a common laboratory experiment in physics

which can teach much, if the student is careful to demand proof for conclusions reached. This experiment can be done in a hasty, slipshod way; but if so done, it will mean little to the student and may even teach him to accept false conclusions readily. The example is quoted to show that students may go through the formality of an experiment without catching the really important point as they go along, unless they doubt and question and cross-examine every conclusion.

Repulsion is the Sure Test of Magnetism

The above problem in elementary physics appears to be very simple, and a casual or careless reader is apt to be misled to some form of answer which is quite irrelevant to it. But actually, the answer to the problem is quite simple and short, and can be arrived at only after careful thought and a great deal of elimination of those properties of a magnet which have no bearing on the problem. The properties which come to mind on reading about magnetism or a magnet are the following:

(i) A magnet attracts iron or a magnetic substance.

(ii) If suspended in such a way that it is free to move in a horizontal plane, it always points in a particular direction, approximately to the geographical North and South.

(iii) Unlike poles attract and like poles repel each other.

Now, if anybody, by using the first, second or first half of the third property, tries to find out if a given piece of iron is magnetized or not, he will be 'out of point'. These properties have nothing to do with repulsion even though they have bearing on attraction or a particular direction. The answer should be

connected with repulsion and nothing else; and so after elimination, the conclusion is that he must take the help of the latter portion of the third property of a magnet quoted above.

The conclusion arrived at must be borne out by facts, i.e., a simple experiment performed must prove it. Take a compass needle which moves freely in a horizontal plane on a pivot. Bring one end of the given piece of iron, say, to the North Pole of a magnet and observe the effect. There may be attraction or repulsion. If there is repulsion, you can at once say that the given piece of iron is a magnet and the end presented to the North Pole of the compass needle has north polarity. How simple! But are you sure that there will be repulsion? There may be attraction. Then what can you conclude? Either the given piece of iron is simply 'iron' or is a magnet having south polarity at the end presented to the North Pole of the compass needle. Are you sure it is a magnet? Of course not. Pay particular attention to the word 'sure' which occurs or appears in the given problem. Since you are in doubt, you cannot stop here. You must proceed further. Now, suppose you present the other end of the given piece of iron to the same North Pole of the compass needle. There may again be either attraction or repulsion. In the case of repulsion you can at once say that it is magnetized with north polarity at that end. But in the case of attraction what will you conclude? Can you say with assurance that the given piece of iron is not magnetized because both its ends have been attracted by the North Pole of the compass needle? It may still be a magnet though both its ends have been attracted to the North Pole of the compass needle. Can you believe this? If you cannot, you are under the impression that the two ends of a magnet must always have unlike polarities. Actually, this is not always so. There may be

some magnets with like polarities at their two extremities. Yes, you can prepare such a magnet yourself. Try that. So, if the North Pole of the compass needle attracts both ends of the given piece of iron, you can conclude that either it is ordinary un-magnetized iron or a magnet with the south polarity at its two ends. You are still not sure, so in order to be sure you now present any one end of the given piece of iron to the South Pole of the compass needle, instead of the North. If again there is attraction, it is an ordinary piece of iron; and if there is repulsion, you are sure it is magnetized with south polarity at both ends. From the above, find out when you can say with surety if a given piece of iron has magnetism or not. In case you understand the problem and the suggestions given above, it is very easy now to find out the answer to it. It is very brief and convincing. Have you got it?

From the above it is clear that just seeing the deflection of a compass needle with its direction is not enough. It is necessary to see when, how, how much, and under what conditions it is repelled. At the same time considerable reasoning needs to be done about its action. Physical effects are sometimes infinitesimally slight but are nevertheless tremendously important. The eye does not see properly until the mind perceives, and the mind does not perceive until the senses also perceive.

Tycho Brahe was an astronomer in the days just before the telescope was invented. All of his observations were made with the naked eye. Twenty-five years later Kepler looked over his notes on observations of the positions of the planets. There was a slight discrepancy between the positions Tycho Brahe reported and those Kepler expected, a difference so slight that

most astronomers were ready to ascribe it to inaccuracy by one or both of the observers. But Kepler had found that Brahe was extremely accurate in all his observations. He felt sure that the difference in positions was not due to inaccuracies of observation but to a difference in fact. He began to suspect that the course of the planets was not exactly that of a circle. From this suspicion he was able to deduce the Harmonic Law of the movement of the planets, a notable step forward in astronomy.

In the above historical anecdote we see the value of a scientist's accurate workmanship. Scientists have to deal with very small quantities as well as with large ones, and everywhere extremely accurate measurement is needed. Science is measurement. Not until we measure very accurately do we become scientists. Radium was discovered while trying to find out what happened to less than one ten-millionth part of pitchblende, a black tarry substance. Even an ordinary ten-inch mirror for a reflector telescope such as amateurs make in their own homes (the author has ground several although he is neither a physicist, astronomer, nor optical technician) can tolerate an error of not more than three one-millionths of an inch if it is to give a true image. In order to be successful a scientist must be accurate to the nth degree, clean to perfection, and skilful in the use of his tools, apparatus, and materials. None of these skills can be acquired overnight but have to be acquired through faithful work. Your job is to acquire these skills. Without them you are an unskilled labourer. You are not a scientist.

The laboratory is a place for study which includes keen observation, keen analyzing, keen thinking, very

careful workmanship, good organization of your plans and materials, and absolute honesty and faithfulness. It is study of the highest order. Without study your laboratory work has no value.

Of course, you will not develop into a research chemist, physicist, biologist, physiologist, or psychologist while you are in high school or even in college. But it is here that you catch the spirit of those whose study of science has been of great benefit to humanity. You begin to form the habits which will make you acceptable in scientific work.

The student of history, economics, philosophy, religion, and sociology must take the same spirit into the library and into his habits of thought that the natural scientist takes into the laboratory, for these studies also have their scientific side which demands the same approach as we use in the laboratory.

16. Foreign Languages

There are two languages of the utmost importance in India. One of them is foreign to only half of the population of this country. This language is Hindi, the mother-tongue of the remaining half of the inhabitants and the literary language most closely akin to numerous dialects spoken by a large proportion of India's population. The unity of this country is dependent to a large extent upon whether or not non-Hindi speaking people learn this language.

The other foreign language is English, so important because it constitutes India's link with the rest of the world, culturally, politically, industrially, commercially, and in scientific and technological pursuits. English is no longer the language of the ruling power, but it has come to be the nearest thing to an international language that has ever existed in history. Probably half of the world's important literature and technical information can be reached through the English language. This is true of no other language. No other language can offer you even thirty per cent of the important literature and technical information that English can. Certainly no Indian language can at present offer much besides its local literature; it can offer practically no technical literature.[1] Therefore, the importance of the study of both Hindi and English

[1] The proportions expressed here are mere guesswork on the part of the author but the difference between what English has to offer in comparison to other languages is not exaggerated.

looms large. A knowledge of both is extremely necessary for neither can take the place of the other.

The study of foreign languages is different from that of any other subject; consequently, the method must also be quite different. In the advanced stages the study of foreign languages approximates to the study of the mother-tongue, but that stage is not reached until one nears the end of the college course. Surely it is not reached in high school. In this chapter we will deal more with the elementary and intermediate stages than with the advanced stage of study.

The study of foreign languages is only to a very small extent a reasoning process. It is, especially in its early stages, almost purely a memory and skill-acquiring process. This fact is not properly realized by middle and high school teachers, with the result that English is very inefficiently taught. This wrong approach is not altogether the fault of the teachers but is also the fault of the syllabus. A faulty syllabus, not fully understanding the fact that the mechanical process of learning a foreign language takes much more time than has been allowed, has plunged the pupil into the study of difficult literature and has demanded of him expressional activities which are beyond his power. Now that English is no longer the medium of instruction and now that, as a consequence, the amount of practice obtained by the student is hardly half of what it used to be, a thorough revision of the syllabus is all the more urgent. We repeat here that the mechanical processes of acquiring the language must be much better graded and the student saved from the confusion resulting from being forced to attempt that which is considerably beyond his powers, if there is to be any

appreciable progress toward mastery of the language.

How does one learn a foreign language?

1. You must learn new sound symbols (words) for the concepts that you hitherto expressed in your mother-tongue. *I do not mean that you should translate each word from your mother-tongue into the foreign language. We want to avoid that process. For that reason we use the direct method, that is, we try to speak in the new language without reference to expressions used in the mother-tongue. We want to avoid a translation method of learning the language, but we do have to acquire new sound symbols for objects and actions we name easily in the mother-tongue.

2. These new sound symbols must not only be remembered, but the sounds have to be reproduced as well. Imitating sound is very difficult. This skill takes much patient practice on the part of the teacher. Speaking is related to hearing, so this process involves both hearing correctly and imitating correctly.

3. You do not speak through isolated words but through groups of words. The word-order of the foreign tongue is entirely different from that of your mother-tongue.[1] The idiom is also entirely different. This idiom cannot be learned through reasoning processes but purely through memory and imitation. In learning a language original expressions are not wanted. It is simply a matter of remembering how the people of the foreign language say it. This memory work is not done as it is in the learning of a poem but by

[1] This is less true when people who speak a closely related language, such as Oriya, Marathi, Bengali, Gujarati, or Urdu are learning Hindi than when an Indian-language speaking person is learning English.

endless practice in conversation and, later on, in composition. Pronunciation, recognizing sounds, and speaking are skills, and skills are developed only through drill-work which calls for repetition, more repetition, and still more repetition in the form of idiomatic use of the language.

4. In addition to a difference in word-order and idiom there is also the matter of strange grammatical construction. This aspect of language proceeds according to rules, and has some element of reasoning in it, but not nearly as much as teachers and pupils assume. Middle school pupils pay little attention to grammatical rules, no matter how well the rules are drilled into them. High school pupils pay some attention to rules, and college students a little more, but still not enough. The memorization of short sentences involving grammatical usage, and the use of these sentences as formulae, is helpful in the early stages of learning a foreign language.

5. The accumulation of a vocabulary. In order to use a language you must know a large number of words and their exact usage. But accumulating a vocabulary is a very gradual affair. We do not learn words by seeing them and using them two or three times only. They have to be used many times. New words have to be introduced far more systematically, and practice in their use has to be far more systematic than at present. When too many words are introduced at once in conversation, or when reading matter is filled with too many new words, confusion results. A student needs to hear conversation which will not confuse him because of the abundance of unfamiliar words. He needs to do a great deal of reading which

can be done without his having to ask the meanings of words, and without his having to look up many of them in the dictionary. There should be a great deal of conversation for which the pupil has a sufficient vocabulary, and a mastery of usage forms, so that he can converse without stumbling all over himself and making so many mistakes that continual correction breaks up the conversation.

6. Whether listening, reading, or speaking the learner needs to be familiar with the language used. Exactly the same matter is involved here that was mentioned in the previous paragraph, since fluency is dependent upon having an adequate vocabulary. It is important for the pupil to keep on reading without stopping for unfamiliar words. He should read in such a way that interest in the story is maintained. Listening to speech in the language being studied, he should understand at least enough to know what the conversation is about. If he is to achieve this goal, the language used in his presence must be simple in construction and within his vocabulary. New words should also be introduced but their number should be restricted, to avoid any possibility of discontinuity of thought or understanding. Moreover, he should be encouraged to talk, and to keep on talking until he has said what he wants to say. To begin with his speech will consist of simple sentences of three to six words, but gradually he will be able to speak or write entire paragraphs without stopping.

7. Reading and writing are undertaken fairly soon after starting to learn the language. Reading and copying English are not difficult tasks and since this part of the teaching programme is seldom neglected,

not much needs to be said on this score. We merely want to point out that you need to recognize words by the entire word-image, that is, to recognize the word as a whole, as you read, rather than to break it up into all its letters. Once these words become familiar, it is as easy to recognize entire words as it is to recognize single letters.

The foregoing sufficiently states the principles which we need to keep in mind as we plan our method of the study of English. Now we are ready to state the method. Here are a few suggestions on the proper method of studying a new language.

1. You can learn to speak a foreign language only by speaking it. Just as you cannot learn to swim without getting into the water, even so you cannot learn to speak a language without conversing in it, which means both speaking and having to understand what the other person is saying. You need practice in listening and thinking out your answer to whatever is said, just as much as you need practice in speaking the answer.

2. If the person with whom you are conversing speaks English well, then imitate his pronunciation. Try to say things as clearly as possible. Some people learn to understand a certain foreign language very well and come to speak and write it idiomatically and grammatically. Others find it very difficult to make themselves understood when they speak because of their poor pronunciation. It is not easy to imitate sound. For some people it is much more difficult than for others. Poor hearing often has a great deal to do with poor pronunciation. The younger you are when you learn a language, the greater will be the probability of

your being able to imitate the sounds well. Pay careful attention to enunciation, especially in the beginning, because habits learned at that time are likely to remain, whether good or bad. Do not think that, because you do well in reading and writing and in understanding a foreign language, or because you get high marks, you are going to be able to speak it well. The real test of your speaking is whether or not strangers can easily understand what you are saying, the first time you say it. Speech requires constant attention if one is to succeed in enunciating well. To make the sounds required in a new language means the changing of your usual way of speaking. This change involves altering the habits of the muscles of your lips, tongue, and throat and requires careful practice and observation of how those who speak the language do it.

Imitate not only the sounds of good speakers but also the wording of their expressions. Every language has its own peculiar expressions. If we translate these literally into another language, they sound strange. One reason why people, particularly illiterate people, find it difficult to understand foreigners, even though the foreigners have learned the local language and use very nearly the same words they do, is because they do not use the words in exactly the same way. Therefore note the exact word-order people use. A good verbal memory is of great value here. Do not think out your own way of saying the common things of conversation, but remember the expressions used by those speaking their mother-tongue. In the learning of a language, memory and imitation are more valuable than thinking.

It has been found that most of the language needed in ordinary conversation is contained in about 300 ready-made phrases or sentences, such as 'How are you?', 'Where are you going?', 'Where do you live?', 'What kind of work do you do?'. A list of 300 such expressions stressed, repeated, and memorized in the beginning of a language course will not give you real control over a language but it will give you that start in speaking which is so important if you are to build up self-confidence and overcome hesitation in speaking. During the last war the American army soldiers were taught by this method, so that they could quickly help themselves by speaking to the people in the country to which they were sent. Over fifty languages were taught in this way, with very considerable success.

Volumes could be written on the subject of grammar. There is a great deal of difference of opinion as to how helpful grammar is in the learning of a language. It is of much greater value to mature and well-educated persons than to younger and less-educated people. Well-educated people sometimes make poor progress in speaking a language because they are too grammar-conscious. They are afraid of making mistakes. As a result, they go very carefully, and therefore hesitatingly. Some of them develop a hesitant manner in speaking, which remains with them as a bad habit for life. In speaking you must go so fast that you simply cannot take time to think of your grammar. Memory of the fitting expression is far more successful. The most natural way to learn a language is by imitation in childhood. Children know and understand no grammar.

The Landour Language School for Missionaries has

worked out a series of short sentences, with translations, which all students are required to memorize. Each sentence is printed on a little card with its translation on the back. Each card contains only one sentence. These cards are shuffled so that the sentences never come up in the same order. The student takes one card at a time; then looking at one side, he must give from memory, in a fraction of a second, the translation as written on the other side. These model sentences include all the principal verb forms. When memorized these sentences serve as formulae. Without having to calculate the proper form for gender, tense, and person, the sentence-formula springs into memory and gives the proper form.

These sentences are being used by adults whose mother-tongue is English in learning to speak Hindi and Urdu. Practically all of them are college graduates who have studied several languages. Yet they find this memory method of much greater value than a 'thinking-out' method. Memorizing these sentences may seem child's play, but it has proved very useful, as those who have tried it can testify. We have used the same method of teaching English to Hindi-speaking boys and girls in Madhya Pradesh. Wherever these model sentences have been well-drilled, they have proved useful. There is hardly a high school student, or college man or woman, studying a foreign language, who will not greatly profit from this method of memorization. The proper grammatical forms are automatically recalled through memorization of sentences used as formulae.

Here is a list of the sentences. If you are a woman, use feminine forms. Run through the sentences; using

plural pronouns as well as singular, and first or second person as well as third person. This exercise is excellent drill work for you.

English	*Hindi*
Do it.	Karo.
To do it.	Karna.
Having done it.	Karke, or karkar.
Please do it.	Kijiye.
He will do it.	Wuh karega.
If he should do it I would do it.	Agar wuh kare to main karun.
He is doing it.	Wuh karta hai.
He was doing it.	Wuh karta tha.
If he had done it I would not have done it.	Agar wuh karta to main na karta.
He must be doing it.	Wuh karta hoga.
If he should be doing it, do not call him.	Agur wuh karta ho, to mat bulana.
He did it.	Us ne kiya.
He has done it.	Us ne kiya hai.
He had done it.	Us ne kiya tha.
He must have done it.	Us ne kiya hoga.
If he has done it, it will become known.	Agar us ne kiya ho, to malum ho jaega.
He has already done it.	Wuh kar chuka hai.
He wants to do it.	Wuh karna chahta hai.
He ought to do it.	Us ko karna chahiye.
He will have to do it.	Us ko karna hoga.
He is in the act of doing it.	Wuh kar raha hai.
He began to do it.	Wuh karne laga.
He is able to do it.	Wuh kar sakta hai.
It will be done.	Kiya jaega.
Until he does it I will not do it.	Jab tak wuh na kare main na karunga.

After he does it you do it.	Us ke karne ke bad tum karo.
He is about to do it.	Wuh karne ko hai. Wuh kiya chahta hai.
I saw him doing it.	Main ne us ko karte dekha.
He used to do it.	Wuh kiya karta tha.
Don't you do it, lest he do it.	Tum mat karo, aisa na ho ki wuh kare.
He tried to do it.	Us ne karne ki koshish ki.
He kept on doing it.	Wuh karta raha.
He went on doing it.	Wuh karta gaya.
He had to do it.	Us ko karna para.
He knows how to do it.	Wuh karna janta hai.
He let him do it.	Us ne us ko karne diya.
He did not manage to do it.	Wuh nahin karne paya.
He caused it to be done.	Us ne karaya.

5. Increase your vocabulary. You are bound both in your expression and in your comprehension by the number of words you know. Learning words is the most tedious and exasperating part of learning a language. You can learn a list in a very mechanical way as for example:

The Hindi word for dog is kutta.
The Hindi word for cat is billi.
The Hindi word for go is jao.

A certain amount of learning has to be done in this way. But this kind of learning does not stick. It gives a good start in learning words, but the words will not stick until you use them, read them, and employ them in conversation and writing. You must always use them in combination not in isolation. Learn as many as you can in short sentences.

Chapter 14 'Power with Words' was written with the mother-tongue in mind. But the method of acquiring a vocabulary in a foreign language is practically the same as in the mother-tongue. New words are new words whether foreign or domestic. Wherever you can recognize the root of the word, you have practically learned the word. When you know the grammatical inflections, the prefixes and the suffixes, you are not fooled by strange forms obscuring familiar roots. Words that you meet once or twice in a literary selection will not become a part of your usable vocabulary. You have to work with a word and see and use it in many places before it is yours.

6. Read much. There is nothing that will increase your vocabulary as much as reading books and papers that contain only a *few* new words. That statement may seem contradictory. It would appear logical that you learn more new words when you read material that contains many new words. But that is not true. In the first place, when there are many new words you read very little. In the second place, you do not get enough practice with the new words to make your acquaintance with them a permanent one, and their use an accurate one. An excess of new words confuses you. You can guess the meaning of new words when there are only a few but not when there are many. Most students who try to read a foreign language make the mistake of reading material that is too difficult. The reading of much easy material gives you a fluent understanding and mastery of what you read. The reading of difficult matter remains a matter of difficulty for you; therefore, confusion and lack of clarity abound when there should be comprehension and

command. Constant use of easy material makes you at home in the language, whereas the use of difficult matter makes the language continue to appear foreign. Of course, the difficulty of the matter you read needs to be increased gradually. That comes of itself, without your noticing it, because even difficult matter gradually appears to become easy. When you are used to reading much, you begin to read anything interesting you can get hold of, and it is hardly likely that much of this will be so easy that you cannot learn from reading it.

What is printed is more apt to be correct language than what you hear. Therefore, reading is more apt to teach us correct expression than conversation. However, you need both to read and to hear. You need all the practice you can get. The impressions of both the eye and ear must supplement each other.

Simple prose is considerably more helpful in teaching us correct expression than subtle and more highly literary forms. After reading many English compositions written by Indian students, I have come to the conclusion that the language expression of very many students has been utterly ruined by the students having to study subtle literary forms in the English textbooks and supplementary readers. The student tries to imitate these forms to his grief. Neither Shakespeare, Robert Louis Stevenson, Goldsmith, nor Dickens is a good model of expression for you. In the first place, their language is of a different historical period, and in the second place, you simply cannot succeed in imitating them without producing language which is confused, and which impresses people as laughable rather than finished. You are still a learner, and have not progressed far

enough to imitate them. If you insist on imitating them, you are like a beginner in music who refuses to play the simpler compositions that are suited to his accomplishment and instead tries to play the most difficult works of the masters. Not only is the music he produces under such circumstances not good, but he establishes habits of playing which make clean and precise performance impossible. The simplest modern writers are more appropriate for your imitation than the masters of literary elegance. How much more true this is when you are dealing with a foreign language.

The writers of the present syllabuses in English have been far too ambitious. In their haste to introduce students to the literary masters they have ignored the fact that the acquisition of mechanical skill in the understanding and expression of a foreign language is a long process, and that the understanding and use of the simple basic forms must be thoroughly mastered before a student is ready for the subtler aspects of the language.

7. *Try* to write. Your faults are never quite so well revealed and understood as in your written work. Here you have a permanent record which can be corrected, and the corrections can be referred to again and again.

How well can you write? We mean this in a very limited sense. How well can you say what you want to say through the medium of the English language? We can measure your ability to express yourself through writing. First, write a composition on any subject which interests you. The more the subject interests you, the better. Do the best you can. Correct all you want to, but in making the corrections take no

help whatever from anyone. Let this particular composition be absolutely your own. Then take your composition and this book to your teacher, or to anyone else who is very good in English. Turn to the English Composition Scale for High School Students, Appendix C, in this book, and ask your guide to compare the language used in your composition with the various samples given. When he has decided which sample is on the same level of ability as your own, you need only to turn to the norms given to see how you compare with other students. You may appeal to more judges than one. The more the better. One judge may judge you too severely or too leniently. The judgement of several people is more reliable.

This composition scale was made with high school students in mind, but it will be helpful to most college students as well, for the best examples in the scale are college level while the lowest are middle school level. Few college students will do much better than the best sample.

The teacher of English will find the book entitled *The Teaching of English Abroad*,[1] by F. G. French, of great help.

[1] Oxford University Press.

17. Extra-curricular Activities

By extra-curricular activities we mean more than just debating and oratorical contests, dramas, scouting, sports, and those activities organized by the school. We mean all activities outside the classroom, whether on the school grounds, at home, or anywhere else. What you do outside the school is as important in your education as what you do in the school itself. We need to learn through the hands as well as through the eye, from life as well as from books, from those who are not our teachers as well as from those who are our teachers.

I have seen students fail in arithmetic because they have no idea how buying and selling is done in the bazaar and in the grain market. I have seen students fail in physics because they do not know how to handle the most common tools of carpenters and mechanics. I have seen them fail in language because their only experiences were home routine and school routine, with both routines being very confined in atmosphere. It takes more than book learning to make an education. Our knowledge and experience of life are as important as classroom work for giving us that rounded-out view, so necessary if we are to get the most out of an education.

We must remember that the educational system of India below the college grade is still backward. It is based on a European system not of the twentieth

century, but of the eighteenth and nineteenth centuries. The curriculum is still very limited and textbookish. Moreover, the communal life is so constructed that Indian boys and girls do not have the opportunity of doing the many practical things English and American boys and girls do. This fact is generally recognized in this country. The Basic Scheme of Education attempts to remedy this situation by relating the work of the school more closely to the practical problems of life. It has been found that scholarship does not suffer, but rather is greatly benefited when people are clever in the work of their hands, informed in the facts of life, and experienced in the ways of life. The best scholar is a clever and practical all-around man, or woman, who can turn his mind and hand to a large variety of activities.

In India the number of courses offered in high school and college is very limited. This narrow curriculum gives the impression that there are relatively few matters which belong to an education. At one time people in Europe thought that proficiency in Latin, mathematics, philosophy, theology, and literature was all that one should expect of an educated man. There was not even a healthy interest in the mother-tongue. The study of science, engineering, and even medicine was looked down upon. The practical aspects of life were left to artisans, who were in reality but a little higher than the menial class. Even art was left to those regarded as workmen rather than to people of education and culture. Indian tradition is not greatly different. The pundit has not been a man who has shown interest in all phenomena, but usually only in strictly literary pursuits.

We have a much broader idea of education today, and we recognize that knowledge must embrace everything, that art and culture have many ways of expressing themselves. We recognize that life is short and knowledge and art are long; consequently we concede that even the best of us can know and do only an infinitesimal part of that which needs to be done. We realize that the few traditional school subjects have no right to monopoly of the curriculum, that there are many spheres in which educated people should be working, and in order to live a full life we need to know and do many things besides those offered in the typical arts and science courses in India. Schooling is not the end but only the beginning of education. It is not the completed product of education. It is only meant to give a good start in learning. This idea of schooling is true even for the M.A., M.Sc., and Ph.D. courses.

In America two students rarely take exactly the same courses. Half of the subjects are compulsory and half may be chosen according to interest. This arrangement is much better than one in which there is a strong similarity in the course everyone takes. An Indian student in an arts college gets very little opportunity to study science, and science students get little opportunity to study the liberal arts. The science and art subjects are very limited. And yet no one can be said to have a rounded-out view unless he has studied both science and art. Life does not consist of disconnected compartments; neither does knowledge consist of unrelated branches of learning. We divide knowledge into different subjects, but it is an artificial division, for the sake of convenience only. Do not

think for a moment that literature, nature study, mechanics, philosophy, music, history, economics, religion, astronomy, chemistry, art, sociology, psychology, etc., are not dependent on each other. You cannot know any one of them thoroughly without some understanding of all of them, or without some understanding of the practical affairs of life.

In America one can take such courses as typewriting, commerce, music, music appreciation, metal work, aesthetics, dancing, public speaking, photography, painting, acrobatics, marriage counseling, dramatics, swimming, etc., in high school or college, and get credit for these toward a certificate or degree. Such subjects are taught in special schools, in the same way as they are in India, for those who wish to specialize in them, but some of them are also taught in practically every high school and college, on the assumption that a B.A. or B.Sc. student needs to know something about these sides of richer living, even though he may not need them for his profession. American educational institutions are often criticized for permitting the student to try too many things, without giving thoroughness in any one thing. The answer to this criticism is that a specialist who knows only his own field cannot even see that in its true perspective. A school cannot complete an education or a training but can only advance the student to the place from which he needs to plunge into the practical side of learning through first-hand experience. With experience in life, the theoretical and academic sides also achieve for the students who are lacking practical experience an importance which they never do achieve in the classroom. Real study requires much thought besides that

prescribed by a narrowly academic syllabus. The school does its best work when it teaches us how we can keep on learning after we leave school. We learn best the things in which we are really interested. Unfortunately, the narrow limits of high school and college courses in India allow little room for the individual's interests. Either you fit into the mould or gain nothing.

No student can study everything. He must leave out a great deal. But he should have at least some opportunity to choose subjects of special interest to him. We are not all alike in our tastes or abilities, and what is a pleasure to one may well be a drudgery to another. There is no virtue in forcing students to take subjects they do not like instead of those they do like, except those few subjects which are necessary as a foundation for a good education. These few can be made compulsory subjects, leaving the electives to suit individual interests. Students must of course be helped in their choice by the teachers for if subjects are chosen merely because they are considered simpler to study, the student will get no benefit from them.

The choice of a large variety of courses in the schools is not the only opportunity a student has for enlarging his educational experience. One can, after all, take only a certain number of courses in a year. There are also opportunities of learning outside the classroom. We refer to extra-curricular activities.

Through sports one does not actually learn much that helps directly in one's studies, but one can learn certain things which are valuable in life, such as teamwork, fair play, giving everyone his opportunity, taking defeat with a smile, standing up to one's opponents

manfully when outmatched, learning that others besides oneself are able, and some are far more able, and the realization that if one wants to win one has to work for it. All these things *may* be learned, and they are exceedingly valuable for all of us to learn; but if we play selfishly, seeking glory for ourselves rather than victory for the team, if we play unfairly and show poor sportsmanship, we are not learning valuable life-lessons but are wrecking our character and personality. Through sports we strengthen our bodies, increase our physical skill and ability, and keep ourselves in better physical condition. One does not have to be a champion or get into the first team to benefit from sports. Even ordinary and mediocre players can develop the moral and physical qualities one gets through fair play and good sportsmanship.

Dramatic societies, debating teams, scout and similar organizations, literary or natural history clubs, all make contributions in so far as they improve you in some of the things you should learn in the classroom, besides going beyond the classroom to teach you things you will not get there. When you enter a debate or an oratorical contest, you have an incentive for good work that you hardly ever get in regular assignments. When you write for the school paper, you put more into it than you are likely to put into a composition required by the teacher. Debating and oratorical contests in this country can be greatly improved. Most of the debates, that I have heard, lack proper study and team work. Students get up and voice their opinions but do not support their opinions with facts. So many of them evidently have not taken the trouble to look up facts, but simply repeat what they may have heard.

Sometimes all the members of one team say just about the same thing, and say it without giving convincing facts, instead of dividing up the subject-matter so that each can do a thorough job of presenting the facts entrusted to him for discussion. Oratorical contests also reveal that students are more anxious to talk than to present something really worth talking about.

When a geography club makes a sundial, charts out the changing course of a river, or gathers facts and pictures about the effects of the Assam earthquake, each member gains something from the activity he has engaged in. When students' clubs meet and conduct their business in an orderly, parliamentary way, the members are learning how to live and work in a democracy. Student-government teaches citizenship in a way no textbook can. Acting as president or secretary or some other officer of a society develops powers of leadership and responsibility, if it is done right. If it is done in a slipshod way, you are learning bad citizenship. Much care is needed to do the extra-curricular activities correctly, for failure in classroom work will be shown on your report card only, while failure in these activities will be evident in your adult life.

The way you get along with your fellow students and teachers is extremely important. It may not better your marks in the examination, but you may be made into a social misfit or into an asset to the community in which you will later live. You should come out of high school and college as a young man or woman who can move with confidence amongst his fellow men, who commands respect because of ability and personality, who can be entrusted with responsibility, and who is agreeable. Failing in this you have missed the

most valuable assets of a good education. You should come out of school minus the shyness and self-consciousness which make you feel helpless and ill-at-ease among people of importance. There is more to be learned in school than what is found in books, namely, such qualities as leadership, co-operation, politeness, agreeability, a sense of responsibility, appreciativeness, fairness, honesty, etc. These qualities too must be studied if they are to be developed; they are not studied from books but rather through participation and the right sort of experience. Extra-curricular activities offer a good field for their practice.

What do you do in your spare hours away from school? What you do with that time is very important. Have you any hobbies? Collecting stamps or coins is a good hobby, and there are many, many others that are even more valuable. The scouting programme lists and suggests a large number of helpful ones. However, you can easily go far beyond what the Scout Manual shows. These lists were prepared mostly for younger boys and girls; certainly high school and college students can go much farther. To know the birds and animals, the trees, the rocks and soil of your area is valuable. So is working with electricity, with machinery, with tools of any sort. It is good to know how to ride a bicycle, but it is much better to be able to repair a bicycle. Any boy who does not know how to use a saw, hammer, spanner, screwdriver, wrench, etc., is not prepared to study science. Knowing how to repair and to make simple mechanical or household objects teaches you a good deal about physics. It does little good to know how to pick a flower apart in the botany class if you are blind to the thousands of plants about

you everywhere. You can never understand the social problem of the country unless you yourself have perspired with farmers, or artisans, or factory hands, and know how hard it is to make a living with your hands. You need to have walked through the country observing drainage, erosion, the effect of vegetation and grazing, the change of seasons, the effect of dryness and moisture, the differences of villages according to the soil and vegetational conditions of the country about them, the effect of their social institutions.

You need to be a student of your surroundings as well as of books. You need to be a student of human behaviour and human nature, in order to understand literature. You need to observe ordinary physical phenomena in order to understand science. You need to know how men act, to understand history and economics. You need to know your own body to understand physiology; you need to be an active co-operating part of your family, school, and community and a cheerful member of any group you happen to be thrown into if you are to understand civics, history, and philosophy. Books and lectures, illustrations and explanations cannot give you that maturity which only living and doing can give you. A child can read everything and understand the mere informational parts, but there are a good many things a child cannot understand, because he is lacking those emotions and reactions which come only to those who have had to face life with its joys and sorrows, successes and disappointments. The child has not had time to achieve that understanding which finds its way into the human system only after hands, heart, and mind have worked together to discover certain

facts of life through practical experiences.

It takes a definite amount of living to make a mature person, and only a mature person can have adequate understanding. Not only the number of years since your birth, but also the actual amount of correct living, makes you a mature human being. Some people are far more mature at eighteen than others are at thirty; some are mentally and socially more mature at fifteen than others at twenty-five. Some people never grow up. This statement does not mean that they like to play and enjoy themselves with the gleeful abandon of a child, although this is a noteworthy quality, but that they lack the serious insight and power to adapt themselves to situations one expects an experienced adult to have. In other words, their reactions in serious moments and their outlook are childish. They act as if they have not had the experience of growing up and facing responsibility.

It takes a certain amount of maturity to make a good student. You get this maturity through having a wide experience with people, through facing difficulties, through having had to shoulder responsibility and living up to it, through having done a large variety of things, and through having broadened and enlarged your experience in many ways. As a rule the person who has tried most, and has pushed most, toward success is the most mature. A mature person has to have the capacity to learn from the experience of others as well as from his own.

The reason why all this discussion of extra-curricular activities is mentioned in a book intended as a guide to study for students is that it is necessary to show the student that he develops understanding and wisdom

not only through the study of books and 'doing of lessons', but through everything he does outside the schoolroom. There are certain extra-curricular activities in the school which are as necessary for our development as classroom work, but even this is not the limit to what is demanded of him who wants to grow in understanding. You have had countless opportunities to learn from the beginning of your life and still have these opportunities. You can learn from everything you see, hear, and do. But very many people learn almost nothing from their everyday experience. Two men may work at a carpenter's bench doing the same thing. The one never does anything but drudgery. The other becomes a philosopher even while sawing, hammering, and planing. Or two people may be required to take a long walk over a forest road. One sees nothing but a dusty road, and experiences nothing but the fatigue of walking a long distance. The other sees a hundred interesting plants, dozens of charming birds, many insects, notices the flow of streams and the kind of soil, passes interesting men and women and smiling children, notes the condition of the fields and forests and the industries of men. Indeed, you cannot be a real student until you see and take part in the world of nature and enter into the experiences of the men, women and children about you. Living a full life, having rich experiences, and doing a large variety of things are also study, and happen to be that part of study which helps you understand the deeper meaning of what is in your books.

We have said a great deal about the ineffectiveness of your learning if you are depending only on what the books give you. What we now say may seem to

be the opposite, but it is not; your learning depends not on books alone but on experience plus books. You can actually greatly increase your experience by sharing the experience of people who have written the books, or the experience of the characters portrayed in the books. Your own firsthand experience helps you a great deal to see and feel what the author is telling you. The world's greatest experiences are described in books, and you can share these if you read with understanding.

What do you read outside of school hours for your own pleasure? In the answer to this question lies the secret of why some students profit so little from their studies, and why others in the same class profit so much. Your outside reading that goes beyond mere school requirements reveals whether you are a true student with the capacity for self-improvement, or just a student in name and by compulsion only. Similarly what you do with your hands outside school hours reveals whether you are a real learner in life, or a mere plodder, who seeks to get through with the least effort. Both hand and brain need more exercise than the teacher can demand of you in the lesson assignments.

18. The Personal Side of Study

Coming to the end of this book, you will probably say to yourself, 'This book talks a great deal about study, but it still hasn't told me how to do it.' Study can be learned only by doing, and that is up to you.

There are many kinds of study, and not all of it is useful. Some is actually harmful. There are some kinds of study that never will be pleasant, and there are some kinds which make you sorry when it is time to stop. But whether you will ever find the kind of study that is as much fun as attending a football match or watching a drama, depends upon you. It depends upon how intelligently you apply yourself and whether you have any real interests. Moreover, the chances are you will never learn to study properly if you are a student only because your parents make you go to school, or if you are seeking a school certificate only to improve your earning capacity.

The kind of study which consists of memorizing the textbook or notes given by the teacher is always a drudgery. No wonder, for it is the painful cramming and ramming into your distracted brain of information which interests you only by necessity. It takes the fear of an approaching examination to get you to do that kind of study, and naturally you put it off as long as possible. Often you fail to get down to doing it at all. Perhaps the ambition of making a high mark or winning some such advantage as a scholarship or post

spurs you on, but even that kind of ambition will never make your study a pleasure or make it worth while. Little can be done to help the student who does his studying through mere memory rather than thinking and working out problems. That student is hopeless as far as study is concerned. He will always remain a student in name only, never in fact.

You cannot be a student without at times having to force yourself to work when you would rather be doing something else. There are times when study is painful and unless you have the will power to go ahead in spite of your lack of interest in study, you will not get far. On the other hand, it is not true that all or even most study is painful and hard work. It may be hard work whenever you really apply yourself but, be assured, it can be fun at the same time. Playing an exciting game of badminton or tennis is hard work in one sense. You have to strain and exert yourself. But you would not consider it hard work in the sense that you have to force yourself to go after the ball or shuttlecock. The excitement carries you along so that even when you are physically tired, your ambition spurs you on to try to defeat your opponent. The hardest game to play is the slow, unexciting game in which the players are too lazy to play with a will. Study is one of the most exciting sports you can possibly think of if you are going after something you really want. Informational books are actually more exciting than story books, once you really want the information. A knotty problem can be fun, even though it may annoy you considerably because you cannot solve it, and it may be necessary to try and try again. For the time being it may not appear to be fun because it

is annoying, but when at last you get the answer, you look back and realize that you had a very good time going after it. It is not the games easily won but the hard-fought games that give us the real pleasure. Similarly, study which becomes a pleasure will in the end give you the most learning. It is untrue that the most painful study is the best. It is far more often true that you learn in proportion to the enjoyment you have had while studying.

You will never get this good time out of your studies until you apply yourself with your whole mind. And you cannot apply yourself with a whole mind as long as you have all sorts of other things on your mind. Forget the clock, forget your friends and the football match and the cinema and the gossip and everything else. Forgetting is not easy for the beginner, but it comes easy once you really get absorbed in your problem.

It is the first minutes of study that are usually the most important. If you can get started, continuing is not so difficult. The job is to get started. It is the same as when you go swimming and find the water cold. You do not like to go into it. But once you are in the water, and your body has adjusted itself to the temperature, you have a wonderful time.

When you first sit down at the desk, you often think of everything else besides the work in hand. You decide to do a little of this, and a little of that first before starting on the big job. The longer you put the real work off, the harder it is to get started. Therefore, start on the important thing at once. Make it a habit never to sit and dawdle before you start. Start right in.

Here we come to the question of where to study. If we try to study in a place where there are people talking, and all sorts of distractions going on, it is doubly difficult to get started. And even though we may get started, once our thought processes are disturbed, it is difficult to get back to work. There is no better aid to study than finding the right place, where no one is talking and where you do not hear and see things unrelated to the task in hand. To study well you should be alone, not necessarily in a physical sense but at least in the sense that you are alone with your thoughts. The more you are interested in your subject the less outside distractions bother you; but since you cannot count on keen interest at all times you should try by all means to get away from distraction as much as possible. Experience will prove it is not the amount of time you put into your studies, but the amount of attention you give that counts.

How are your eyes? Can you see well? Some people find difficulty in reading because they have poor eyesight and need glasses. Very often the people who have poor eyesight do not realize it; nevertheless, they are handicapped just the same. If you get headaches from reading, or if the print does not appear clear, and is not easy to look at, you need to have your eyes examined. By 'clear' we mean that you do not have to strain to see what the letters are. When you see well, entire words and groups of words jump into clear recognition just as soon as you look at them.

The more comfortable you are the less you will be distracted. When you go to study, take along everything you need to begin with. When you have to jump up to go into the next room, or into the house, to

get something you forgot to bring along, you are likely to be distracted.

Unless your work is a reading assignment, begin writing as soon as possible. Write what? Make a few notes or an outline, following through systematically as you do when working out an arithmetic problem. Particularly, if you have a composition or report to write, begin writing soon. That does not mean starting to write the actual composition, for often the exact wording needs to come much later. Rather it means jotting down a few notes. When you sit down and just think you usually end up dreaming. So, unless you put down notes, and begin to frame an outline, you go over the same ground again and again. Writing something down at least reminds you that you have been at a certain point before and that now you should go to the next step. As a result you are less apt to dream.

It is important for you to know the difference between study and reviewing. Reviewing is a kind of studying, but by study we usually mean more than just a circumstantial strengthening of memory as in reviewing. Study is more a learning process than a remembering process. It is the effort put forth to understand and organize.

You do very little studying in the last month before the examination. Your work for the examination is mostly review work. There is some organization in it, but the purpose of this organization is mostly for the sake of remembering. To be really effective the actual learning must be done before this stage.

Most real study needs to be done at the beginning and middle of the school term. That is the time when

the real construction work is done. As you near the examination, it should be necessary for you only to put the final finishing touches to your learning. Examination time is nothing more than an exhibition of your learning.

Examinations are desirable not only for determining who has been doing acceptable work and who has not, but for helping you to reorganize and review. From time to time it is necessary for us to stop going ahead, and to consolidate what we have learned. It is necessary to look and bring together the various parts of what we have been learning piece by piece into a connected relationship. This process is like that of a carpenter making a chair. First, he makes the parts. Then the time comes for putting the chair together, but even when he has the parts fitted properly together, his work is not over. He needs to smooth down the wood and apply the polish.

During the beginning and middle part of the term we take up one new item of work after the other. Near the end we need to put them together. And it is during this process that we see that no part fits perfectly, but each needs readjustment. In fact, considerable readjustment is necessary because we now know much more about the subject; likewise, smoothing down rough ideas and imperfections is necessary. When we have our material reorganized in this manner we are ready to review it in such a way that we can recall, not only the general organization of the subject, but the details as well, which fit in under the proper subdivisions. If you really know where your facts belong in relationship to the main principles and organization of the subject, you will not have great difficulty in remembering them.

And if you forget a certain number of them, it does not matter much, since you have clearly in mind the outline of the course with its important principles.

Many students try to keep only details in mind as they prepare for an examination, and as a result their minds are cluttered up with a large number of unrelated facts which confuse them. It is the connexions between important facts that are more important than a long list of facts, remembered without an understanding of their relationship to other facts. When you can see the relationships, one fact recalls another. When you do not, you have no command of facts that will enable you to remember them for long. Therefore, do not go into an examination with your weary head crammed full of facts. Rather seek to have the outline clearly in mind, and then you will have something to hang your facts on.

Many students have exactly the wrong approach to a long series of examinations. They cram and worry until they are almost nervous wrecks. But how different one's approach should be. You need to go into an examination hall calm and confident. And you can do so, if you understand the main principles of the course; but if you are frantically struggling to remember details that you do not understand, you are bound to fail. You need to go into the hall, having had sufficient sleep and with your digestion in order. Studying very late, and getting up unusually early, not only makes you tired but also nervous. At examination time what you need is confidence and calmness.

No one learns anything much that is helpful the month before the examination. The real learning has to be done long before that. But you can benefit greatly

from systematizing and reviewing what you know just before the examination. This review does not take a great deal of time. When you are in need of a great deal of time to get ready for an examination, it shows that your work during the early part of the course was not satisfactory. What you lack at examination time you cannot make up in the last few days, but if you have done your best right along, you will no doubt do your best in the examination also. There is nothing more for you to do. Simply determine to do your best without frantic and useless nerve-racking, last-minute cramming, and calmly await the result.

If you have done your duty from day to day, during the school term, getting ready for an examination is not such a big job, but it is an exasperating and hopeless job if you expect to do in one month what you should have been doing for three months or eight months. The state of mind you are in is far from helpful when the work has been left to the last. You cannot get genuine education that endures in the last month. It has to be obtained much earlier in the year. The last month gives you only the superficial part, which is quickly forgotten and never really sticks in your mind.

At all times in the year get sufficient recreation and exercise. 'All work and no play makes Jack a dull boy.' Your mind is never quite healthy when your body is not in good fettle. During the examination days especially, you should be playing volleyball, badminton, hockey or whatever your favourite sport is; you should go swimming or walking in your free moments. To be sure, you should not play as strenuously and long as you do in a tournament, but you should play with pleasure, at least for half-an-hour or an hour. One of

the most important things to do during examination-time is to get your mind off the examination. Talking and joking are good ways of diverting your attention, likewise anything that keeps your mind calm and normal and free from the nerve-racking effect of thinking continuously, 'It's examination time, I must study, study, study. I must not fail. I must put every minute into it so that I will pass.' Nothing will defeat you more than that attitude. Let your body be alert and vigorous, for, with sufficient rest, recreation, and exercise, and with a mind keen, fresh, and rested, you will do far better than if you have driven yourself until nothing more can enter that tense and jaded brain. You will have approached the examination in the wrong frame of mind if you feel jittery. You will have worked when you should have taken it calmly, and will have been lazy when you should have been working. Let us review a few useful personal habits of study.

1. Find a quiet place to work.
2. Build a schedule for work, study and pleasure.
3. Be sure that lighting conditions are proper, and that the place you work in is comfortable.
4. Establish regular hours of sleep.
5. Get a sufficient amount of exercise regularly.
6. Have your eyes examined if necessary, also get a physical examination every year. You need to keep in good health.
7. Take part in a variety of activities — physical, mental, spiritual and handicraft. A wide experience and a keen interest in sports, nature, art, music, reading, and life in general gives you the background necessary for becoming a real student. You need to become a student of life as well as a schoolboy and student of books.

In conclusion I wish to include a set of 'Rules of Study' which I think everyone will find helpful if they will observe them. These rules constitute a sort of summary of this book:

1. Concentrate. Concentration is a matter of will-power and strong desire. If you catch your mind wandering, concentrate again.

2. At the beginning of each study period, think over what you know on the subject. Anticipate what the text is going to say on the new topic.

3. Read the assignment straight through, to get a general idea of the subject-matter.

4. Review what you have read, picking out the main points and rereading any parts that were not clearly understood at the first reading. If you have acquired enough proficiency to carry this outline in your mind, fix it there by careful thought. If not, make a written outline.

5. Study any graphs, diagrams, or pictures carefully. These are very expensive to construct, and are put in the book only because they have a real significance.

6. Do every day's assignment carefully. You will then have to face examinations with only a few hours' review instead of a great deal of cramming. Make a summary or revised outline of your work, and then relax your mind until time for the test.

7. Make a daily programme for study and stick to it. See that it gives you time for exercise—at least an hour a day—and eight hours of sleep.

8. Master the meanings of words. They are the tools of your thought. If, as you read, you do not get a clear, satisfactory meaning of a new term, look it up in the dictionary. Words are your assistants. Make them work.

9. When you read a story that is worth thinking about, make a synopsis of it. Retell the story in brief form,

including those aspects that have most meaning. If the book is a long story let your synopsis consist of one short paragraph for each chapter.

10. Drill yourself freely and frequently on such subjects as grammar, foreign language vocabularies, mathematical formulas, etc. Say them over aloud at intervals until the right forms become familiar to your eye. Such repetition establishes the desired thought-habit.

11. At all times be confident. Develop your self-respect by doing neat work, by giving full measure, by working for yourself, not the teacher, by working with as little help as possible, by taking a positive attitude toward every course, and, above all, by never giving up.[1]

And finally remember the importance of language.

A man who does not know his mother-tongue thoroughly is not more than half-educated. Language is the only medium of thought that amounts to much; and whoever has no command over that medium dooms himself to think unclearly and to miss many of life's richest experiences, as these are transmitted to him through the news reports, scientific books, poems, plays, and novels of his own day and of past ages.[2]

[1] Salisbury, Rachel, *Better Work Habits* (Scott, Foresman & Co., New York), p. 218.

[2] Pitkin, W. P., Newton, C. G. and Langham, O. P., *Learning How to Learn* (McGraw-Hill Book Co., Inc., New York and London).

Appendix A

READING TEST

I

Read this story in 3½ minutes and then answer the questions without looking at the story again.

A Village Boy Who Became One of the Great Men of India

In a small village of Ratnagiri a boy named Gopal Krishna Gokhale was born in humble circumstances. That was 9 May 1866. This boy was destined to become one of the great men of this country. His name is honoured in foreign countries as well as at home.

As a boy he liked to play and roam about just as other village boys do. Due to the great poverty of his family he had to face difficulties which made him a friend of the poor to the end of his life.

At the age of ten he and his elder brother, Govind, were sent to school in Kolhapur. But their poverty was such that it was difficult for them to continue school. When their father died the condition of their family was even worse. Govind had to leave school.

Govind got a job at Rs 15 per month in a neighbouring village, and took his mother and four sisters with him. Half of his salary was used for support of the home. The other half was sent to Gopal so that he could continue school.

Gopal was not happy under such conditions for he was often without food for the whole day. The thought of the sacrifice the family had to make to keep him in school was even more distressing. At night he would study in the street, using the light of the lamp-posts, for he could not afford a lamp and oil. In spite of such difficulties, he succeeded in passing his matriculation examination at the age of fifteen. He succeeded in winning a scholarship of Rs 20 per month in the Rajaram College in Kolhapur. Thus, he could continue his education and also become independent of his brother.

At nineteen years of age he received his B.A. He had been such a brilliant student that he could have got a well-paid post. But he put thoughts of a lucrative post aside, and decided to devote himself to the service of his fellow countrymen. He took a position as teacher at a very modest salary.

He received no increment for twenty years. His inner voice had called him to devote himself to the education of young men and women, and he remained faithful to this call. His conscientiousness, and the energy with which he worked, were an inspiration to his pupils and colleagues alike.

After twenty years of service as a teacher he felt himself called to broader public service. He became a fearless and tireless champion for the truth. His motto became 'Do not shun the difficult and dangerous'. He fought for educational opportunities for the poor and for the Harijans.

During the last ten years of his life he organized and promoted the Servants of India Society. This society contained many learned men and women who

consecrated their abilities and service to the public good. This society is a fitting memorial to Gopal Krishna Gokhale.

We see that a small village boy, from one of the poorest of homes, taught many to give their lives in unselfish service to their country.

1. Into what kind of a home was Gokhale born? .....
2. Why did Gokhale have such great love for those who faced poverty? .....
   .....
3. Who made it possible for him to continue his high school education after his father's death? .....
4. What vocation did he choose after his education was completed? .....
   .....
5. What kind of a salary did he receive for twenty years? .....
   .....
6. What did he do after leaving the teaching profession? .....
7. Of what great organization is he the founder? .....

II

Read this story in two minutes and answer the questions without looking at the story again.

Many years ago there lived in East Arabia a cheat named Hasan. He thought of a clever trick to get

money. He made a wooden sword, put it in a leather sheath, and started towards West Arabia to sell it for a high price.

In West Arabia there was another notorious cheat named Imamu. He also thought of a clever trick to get money by deception. He filled with sand a tin can with a label on it saying 'ghee'. He sealed the tin and set out towards East Arabia to sell it.

Hasan and Imamu met in Central Arabia. Hasan said to Imamu, 'Friend, what brought you to this part of the country?'

Imamu answered, 'Dear Brother, I have a can of pure ghee which I am going to sell in East Arabia.'

Hasan said, 'I have a wonderful sword to sell. Let us exchange bargains.'

Both agreed and exchanged their wares. Both of them were very much pleased with the exchange, for they thought they had received something valuable in return for something worthless. They were pleased at their own cleverness in cheating the other.

When they arrived home, both were keenly disappointed. 'Whatsoever ye would that men do to you, even so do ye to them,' they murmured. They heaved sighs of grief and promised never to practise deception again.

1. How did Hasan try to practise deception?
   .....
2. How did Imamu try to practise deception?
   .....
3. Where did Hasan and Imamu meet?
   .....
4. What was the outcome of their meeting?
   .....

5. What did they find out when they arrived home? .....
6. What promise did they make? .....
.....

III

Read this story in three minutes and answer the questions without looking at the story again.

During the so-called Middle Ages (the years between about 800 A.D. and 1500 A.D.) there was very little progress in science. In fact, less was known of science than had been known 1000 years before. There were several reasons for this. In the first place there were very few educated people, and the few that there were, lived in monasteries. A monastery is a sort of ashram, where the interest was more that of *sanyasis* than of people who are interested in the world in which they live. There was also a peculiar idea that science has to be learned from old books rather than from nature. Books can tell only what scientific discoveries were made by others. They never make a scientist because a scientist must learn from nature. Science deals with nature and the study of science is sterile unless we study nature itself. Books are only a help. At that time people were very superstitious. They believed in magic more than in science. They thought scientists were magicians. They would not permit the doctors to cut up the bodies of dead people to find out how the human body works, and so doctors knew little about the human body. Finally it must be said that many wars had made people so poor, afraid, disease-stricken,

and unsafe in their living that they had little time or desire to study and find out the truth. They were hardly civilized any more. Under such conditions there can be little progress of scientific questioning and study.

1. What was the state of progress of science in the Middle Ages? .....
2. Why cannot science be learned only from books? .....
3. Why did doctors know so little about the human body? .....
4. What condition made the people too poor and afraid to be interested in scientific questions? .....
5. What type of education are the Middle Ages noted for? .....
6. How common was education in the Middle Ages? .....
7. With whom were scientists commonly confused? .....

IV

Read this story in 5 minutes and answer the questions without looking at the story again.

It cannot be said that the largest animals are always the strongest and ablest.

As a rule, the larger an animal is, the stronger it happens to be. But you cannot say that the larger animals are always the ablest. A living creature needs a good many qualities besides strength in order to survive and thrive.

The kite is several times larger than the king-crow. And yet the king-crow chases the kite whither he wills. The king-crow (drongo) is so much faster than the kite that he manoeuvres about him and puts him to flight. The superior strength of the kite is not allowed to come into play because of the superior speed of his smaller antagonist.

The mammoth, a much larger creature than his present-day relative, the elephant, is extinct. In the so-called age of the reptiles, immense lizards of many kinds were abundant. They weighed up to ten tons and even more, but the only trace of them today is their fossilized bones. They lost completely in the evolutionary process. Smaller animals have proved to be more fit for survival.

A large cow requires more grass than a small one. As long as there is sufficient grass all the year around the large cow appears to be the better animal. But if there is a scarcity of grass during even a part of the year, the small cow has a better chance to remain alive. The size and weight of cattle, sheep, goats, fowls, and other domestic animals can be increased, so also the pulling strength, and the milk and egg production of certain ones, as long as man feeds them well. But as soon as they have to seek their own food, smaller and less productive animals become more common. Long after the tiger disappears from the face of the earth as a wild animal, the small jungle cat will continue to be able to catch all it needs to remain fat and sleek.

The tiger is undoubtedly superior to the wild dog in fighting strength. But wild dogs bring down and chew to pieces the lordly tiger. That is because wild dogs hunt in packs. 'In union there is strength.' No

other animal of the Indian jungle makes himself feared like the insignificant-looking dhole or wild dog.

No animal has infested almost every corner of the world like the rat. From the standpoint of ability to make a living, the rat is the ablest of all animals. He adapts himself to all climates, and all types of country. He can fight, and he can run, and he can hide. He eats everything. He can gnaw or dig his way into your house, unless it is built of hard brick or stone or cement, and make himself a house in the walls of your house. He is clever, he is agile, he is fast. He rides on our ships to distant countries, he takes our food away from us, he undermines our houses. Long after other wild animals have gone the rat will still remain with us.

The largest of all living animals is the whale. He has magnificent strength but even if you gave him legs he could hardly move on land. He has such tremendous weight that he can live only in the sea where the water supports his weight.

The ablest creature that has ever existed on this earth is man. His strength is insignificant beside that of some of the animals he has had to defeat in order to control the jungle, but he has learned to strike with swords and arrows and even firearms. He can strike from a distance with almost no danger to himself. He traps the animals and outwits them. They cannot compete with him, nor can any large animal even survive, except by hiding or by permitting himself to be made useful to man. In the struggle for existence victory is by no means assured to the one with the greatest brute strength.

1. How does the king-crow succeed in chasing the stronger kite? .....
.....
2. What does this story tell about a larger relative of the elephant? .....
.....
3. When has the small cow a better chance to live than the larger cow? .....
.....
4. Why do the domestic fowl, ducks, sheep, etc., outlive their wild relatives? .....
.....
5. Why is the wild dog able to defeat the tiger? .....
.....
6. Give three reasons why the number of rats increases while the number of other wild animals decreases. .....
.....
7. Which is the most able of all living creatures? .....
.....
8. Which creature is the greatest destroyer of wild animals? .....
.....
9. Why is great weight a greater disadvantage to land animals than to animals living in the water? .....
.....
10. Underline the title which you think is most fitting for the passage you have just read.
(*a*) The largest and smallest terrestrial animals.

(*b*) It takes more than strength to enable an animal to survive.
(*c*) Why elephants are big.
(*d*) How a tiger does his hunting.
(*e*) How large animals get their food.

ANSWERS TO QUESTIONS (pp. 240-6)

Your answers are not expected to be literally the same as those below but must be the same in substance.

I (p. 240)

1. A very humble home.
2. Because he too had experienced poverty.
3. His brother.
4. Teaching.
5. A small salary with no increment.
6. Public service.
7. Servants of India Society.

II (p. 241)

1. By trying to sell a wooden sword as a steel sword.
2. By trying to sell sand as ghee.
3. In Central Arabia.
4. They exchanged wares.
5. They each had cheated the other.
6. Not to cheat again.

III (p. 243)

1. Very backward.
2. It must be learned from nature.

3. They did not dissect the body.
4. Continuous wars.
5. Bookish education.
6. Very few people were educated.
7. Magicians.

IV (p. 246)

1. By flying faster and manoeuvring around him.
2. The mammoth became extinct.
3. When there is very little food.
4. Because they are fed and protected by man.
5. He hunts in packs. 'In union there is strength.'
6. He is adaptable, fights well, can hide, can run, eats everything, etc.
7. Man.
8. Man.
9. They have to support a great weight. In water the water supports their weight.
10. It takes more than strength to enable an animal to survive.

If you read English better than any other language you should be able to answer twenty out of the thirty questions. If you do not understand English well you will not get so many correct. A first-year high school student should be able to answer correctly fifteen out of thirty questions in his mother-tongue.

Appendix B

MECHANICAL ARITHMETIC

You should get three out of each group of four right. See if you can finish in forty minutes.

1. ADD

4087	70754	167	5981.234
16736	7879	426	.126
5004	25318	99	91.823
35027	99000	642	8.005
8753	4270	759	
		370	

2. SUBTRACT

20097	40561	29123	8.67
— 17432	— 9072	— 20241	— 4.703

3. MULTIPLY

3906	452	5048	2463
× 28	× 279	× 760	× 179

4. DIVIDE

53)87931	28)30078	367)24310	90)423519

5.

Rs.	as.	ps.
23	3	3
16	4	0
9	3	6
+ 10	0	0

Yd.	ft.	ins.
17	1	4
— 12	2	8

Rs.	as.	ps.
14	8	6
		× 9

8) 81 maunds 20 seers

6. Insert the decimal point in the answer adding zeros where necessary.

300.15 × 1.005 = 30165075

2.00175 × .002 = 400350

.005) 65.65 (1313

10.1) 202.202 (200200

7. $\frac{4}{5} + \frac{1}{10} - \frac{1}{2} =$

$\frac{7}{12} + \frac{5}{6} - 1\frac{1}{3} =$

$16\frac{7}{8}$
$4\frac{1}{4}$
$+ 5\frac{1}{2}$

$13\frac{3}{16}$
$- 9\frac{3}{4}$

8. $25 \times 33\frac{1}{3}$

$40\frac{1}{2} \times 10\frac{1}{4}$

$3\frac{1}{3} \times 4\frac{5}{6} =$

$12\frac{1}{2} \times 2\frac{1}{5} =$

9. $4\frac{1}{3} \div \frac{5}{12} =$

$5\frac{1}{7} \div 2\frac{5}{14} =$

$10\frac{1}{2} \div 1\frac{1}{2} =$

$8\frac{2}{5} \div 2\frac{1}{10} =$

10. 4 : 36 : : — : 144

7.5 : 30 : : 3 : —

1¼ : 50 : : — : 56

1.25 : 10 : : 3 : —

11. What per cent is 8 of 100? .....

$1\frac{1}{3}$ per cent of 75 is .....

What per cent is 136 of 200? .....

What is $\frac{1}{2}$ of a $66\frac{2}{3}$ per cent share? .....

12. What is the divisor in the following examples?

.....)8019(501 .....)4500(12

3

.....)4052(8 .....)48000(3000

20

Appendix C

A SCALE FOR MEASURING ENGLISH EXPRESSION[1]

(Senior High School Level)

By use of this scale, it can quickly be seen how good a student is in expressing himself in written English. The scale does not attempt to evaluate thought or organization except as this shows up in individual paragraphs. The emphasis is not on thought or composition but on elementary expressional ability in English.

The way to use the scale is this:

Take a sample of the student's written work and put it beside the sample 8 in the scale. Ask yourself, 'Is the command of the language of the writer as good as in this example?' If not, pass down to the next specimen and ask, 'Is it as good as the English in this?' If not, pass on to the third specimen. Perhaps you are doubtful, thinking that it is as good or almost as good, but you are not sure. So compare it with the fourth specimen. This time you may feel that it is at least as good if not better. Then compare it again with the specimen above and decide which one it compares with better. The number of the specimen which you think it resembles most in expressional ability is the mark you give to the student's work. The number in front of each specimen signifies the score to be given to the

[1] *Teaching*, September 1948.

pupil's work adjudged equal in value. Thus you get a number value for each student's work.

Sample Compositions

8. Eighty per cent out of forty crores of Indians are engaged in agriculture and twenty per cent work in offices and factories or do some other kind of work.

Fragmentation of land is largely responsible for the poverty of the Indian farmer. Suppose a farmer had 100 acres of land. When he died, his land was divided among his five sons and each got 20 acres of land. Again each son had five sons and the land was again subdivided among his sons, each getting only 4 (four) acres of land. And these acres are not at one place. One strip of land is here and another there. Due to this subdivision the fields becomes so narrow the farmers can hardly turn their bullocks around. A farmer with such small land has to maintain his family of five and two bullocks. He receives only Rs 120 a year from which he has to pay interest on his loan which he took from a Mahajan and live with the money left to him. So we find that in spite of the vastness of the country, there is not enough land for the farmers for agriculture.

CHARACTERISTICS: Meaning clear. Thoughts well stated. Sentences varied enough for smooth expression. Sentence structure correct. Words well chosen. Idiomatic use of prepositions and infinitives. Grammar correct. Correct use of tenses.

7. Family is an eternal school of social life. The different virtues, obedience, self-sacrifice, service

co-operation, division of labour are learnt in the family. They are necessary for orderly and sysmatic growth of social life.

Family is a combination of man, woman and children. They work together for the welfare of the family. In the family the father earns, governs and mother keeps the members of the family together. She is like a link between the children and the father. Hence she is of great importance.

As soon as a child is born, he comes in contract with the mother. From babyhood, the child tries to follow the mother. If the mother is illiterate, wears dirty clothes, the child will follow her, because all the twenty-four hours he lives with her. He will learn the dirty habits os his mother. On the other hand if the mother is qualified, she will brought us the boy in a good way. He will learn how to talk with elderly people. A right kind of mother gives right kind of training to her son, etc.

CHARACTERISTICS: Thoughts fairly well stated. Very good sentence structure and variety. Good use of qualifying adjectives and adverbs. Occasional faulty grammar and spelling but these do not detract from clarity. Occasional use of wrong words. Correct use of tenses.

6. In the past times our ancestors had a question what to read and nowadays we have a question what we should not read. It is because in those days there were no papers and printing machines. People used to write on the leaves of palm and such books were very costly and were kept very carefully. Nowadays the books are very cheep.

The abundence of books provoked education. There is a large number of students in the world but in those days the number of students was very rare. Books are the best help of education.

We must remember that every book is not educational. There are books which raiso our spirit at good things and there are books which poison our mind by filling bad thoughts in it. A book effects much the mind of a student.

CHARACTERISTICS: Meaning fairly clear. Sentences complete with fair variety. Frequent misuse of words and grammatical and spelling errors. Position of adverbs and prepositions frequently unidiomatic. Correct use of tenses.

5. The appointed teacher of our class came with a ragistar in his hand. He took his sit on the chair placed before us behind the table. He opened the ragistar and read out the names of the admitted boys. Alas: my name was not their. I was much anxious about the matter because I had already paid my fee in the office and taken my admission. I reached the Headmaster with awe and wonder and stated the matter in Hindi as was innocent in English. The headmaster consulted the clerk and reached my class teacher and told him that I was admitted.

The teacher was a good man he behaved the boys as he behaved with his son. He was an experienced teacher so he know the law and the regulations of the school, so he began to tell them to the boys. We heard his speech. The school bell rang.

CHARACTERISTICS: Meaning fairly clear. Some sentences run together. Little variety in the way in which sentences are begun and ended. Monotonous. Wrong meaning ascribed to words. Frequent grammar and spelling mistakes. Correct use of tenses.

4. Games makes us healthy and strong. They harden our mucles, strength our nerves and build up our constitution. A healthy man can bear great difficulty and any kind of disease can not attach him where as a man to who leads a life of unactivities becomes a victim of untold suffering and illness (disease). Such a person has more often than not a peevish temper. He did not takes any interest in a joke and killjoy produce a chilling effect on society.

CHARACTERISTICS: Meaning only partly clear. Wrong use of tenses. Poor grammar and spelling. Wrong use of words. Sentences complete but structure poor.

4a. The name of my town is Ripur. It is situated near the Kharun river in the Central Provinces. The population of my town is nearly one lak. It is a business town. Men from all parts of India is settled here.

This is a beautiful town. The Sadar Bazaar is most beautiful part of the town. There are three cinema-houses for the entertainment of public. There are five High schools and two Colleges. There are many gardens and temples. Dudadhari temple is biggest of all temples. There are two courts, criminal and the civil. There are many hospitals. Silver Jubilee Hospital is the biggest of all the hospitals. There are electricity.

It is a big railway junction. It is a good place.

There are many rich men. Its area is big. It is a big town. It is the centre place of India.

I live in Raipur, therefore, I love this city. This place is good in my opinion.

CHARACTERISTICS: Theme and treatment stereotyped. Grammatical and spelling mistakes less than in No. 4 but sentences are monotonous and undeveloped. No thought development but simply a list of what is found in the city.

3. In this year so may strikes are celebrated we make strikes for the memory of the good Neta, or our great political leaders and freedom.

Before one day we heard that tomorrow is strike. On that day shops are not open and we do not our any work. On strike we went to solve our difficulties on that day we go to our friends and say to him that you also make strike. They also make strike, and we all want schools and colleges and we say also them. We all geathered and makeing a line. We go around the town with prosession we all go to the Ghandi Choak and there is a lacture. The lacture was about strike. Why strike is made and its profit. There is one president and secratary.

CHARACTERISTICS: Meaning obscure. Poor sentence sense. Use of verb forms chaotic. Use of words inaccurate. Words and phrases badly jumbled.

3a. There are three seasons in India. The rainy season is the most important. Because if we did not have a rainy season, our food plants would not grow, and we should have no food to eat.

This season comes after the summer. The rainy season starts on June 15 and last in Oct. 15. In some places rainy season comes sooner. In some places it stops sooner. During this season the sky is clouded and rain heavily.

This season is the most beautiful in India. In this season the farmers become glad. In this season the birds become glad also. All trees become green in the rainy season. The rivers become full and some wash away their banks. The tanks become full.

This season is the most useful season. We can get many kinds of our food in this season.

CHARACTERISTICS: Theme and treatment stereotyped. More grammatical mistakes than in 4a and equally monotonous and lacking in development. The word 'season' occurs in nearly every sentence.

2. Game is very good exercise. It make very good health. About all people different games like in America, Japan, China. So they are strong.

In India some peoples play games and other is not play. So they gets very much weak because they not play games. Games is best exercise of all exercising. I must advice to our Indian to play much games so their health will be much strong.

CHARACTERISTICS: Meaning quite obscure. No attempt at proper word forms. Little command of English other than to throw words and phrases together in a poorly connected way.

2a. A cow is a domastic animal. It has four legs,

two ears, two eyes, two horn one tail and a stomach.

It gives us milk for drink, it gives gee. It eats green grass and hay. It is a very faithful animal.

I have a cow. It gives gobar. We make conda.

After many years the cow is called God. Once upon a time the man worship the cow. So the cow is very useful animal.

CHARACTERISTICS: Utterly stereotyped. Sentences like those of a small child, almost too simple to point out many mistakes.

Note: 4a, 3a, and 2a have the same evaluations as 4, 3, and 2 respectively.

A scale for measuring English expression in middle schools was published in *Teaching* (Oxford University Press) in March 1949.

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