

PATNA UNIVERSITY
ANNUAL CONVOCATION

CONVOCATION ADDRESS

BY

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I much appreciate the honour of being able to participate in this convocation. Such occasions help me, among other things, to retain my academic contacts with the Universities, which I most cherish. The University is the ultimate fountainhead from which we draw our inspiration, and our sustenance too. It is the stature of our Universities that ultimately determines also the extent of all our major advances in the country. I wish this were generally realized. Otherwise, we shall be in the position of my favourite philosopher, who poses the question, "Which is the more useful, the sun or the moon?", and himself supplies the ready answer, "Of course the moon, because it gives us light during the night when we most need it."

Realizing the basic importance of the Universities in any national advancement, it has become almost a fashion, not only in convocation addresses, but also on many similar occasions, to deplore the present unsatisfactory academic atmosphere in many of our

Universities—with which one would be inclined to agree—but also to suggest simple cures for the many ills of our Universities. I have been a teacher for nearly thirty-eight years, and I have been a serious student for a considerably longer period. Even so I can only realize the magnitude of the problems that confront the Universities to-day, and would feel greatly diffident in suggesting solutions to the problems. I hope that you will, therefore, forgive me if I do not play the conventional role of philosopher and guide in this convocation address. The problems are so varied that they would need all the resources of our educationists to solve, and I would not complicate them by a layman's approach.

But as a student of science I also know that even a proper posing of problems would be helpful. I therefore approach some of these problems only in the spirit of an enquirer.

One would like to know, for example, how far the present defects in University education are due to an unsatisfactory educational system, as many of our critics would have us believe, and in what measure to the extremely unfavourable conditions under which the present system is being worked. It is not merely sufficient to identify the symptoms, but it is even more important to diagnose the basic disabilities

correctly. This is particularly desirable when we are proposing major changes in our educational system.

I would recall here an observation made by Maxwell, who was one of the most original thinkers, even in a generation of giants. He was writing his "Treatise on Electricity and Magnetism", which has since become a classic. When he was asked to use vectorial algebra in his book, his characteristic reply was that he did not want the difficulty of understanding a new subject to be confused with the difficulty of following a new technique of presentation.

If our present weakness is due to our not being able to work the present system of education satisfactorily, obviously any change in the system will not by itself rectify the weakness.

Take again the question of University examinations. It is of vital significance for us to know whether the hard words that have been used against them from many a platform are against the system of examinations as such, or against the present methods of organizing and conducting examinations. Granting, as some of us might do readily, that the University examinations, as at present conducted, might not enable us to apprise correctly the proficiency or the competence of the candidate, it is pertinent to ask

whether it is due to the test's not having been properly designed for the purpose, or the test's not being applied properly. When I listen to critics who complain about the impropriety of judging or apprising a candidate on the basis of an examination of a few hours' duration, or a *viva voce* examination which is even shorter, it is rarely that I can get from the critics the moral that they wish to draw from it: whether they would insist on more frequent and more extended examinations, or they would abolish examinations altogether. The words of my old teacher of "Rhetoric and literary criticism" still ring in my ears, "It is dangerous to condemn a literary piece, even when it deserves condemnation, for wrong reasons."

Take again the question of organizing evening classes for those who are employed during the day, and who wish to avail themselves of University education. When one listens to an expert expounding on the many academic disabilities of the part-time student, that he is denied the privileges of the extracurricular activities, that he is unable to participate in games, that he is denied the many advantages of the corporate life in the University campus—the expert adds many more such reasons for his not encouraging the organization of evening University

classes for the employed—one feels very uncomfortable. What percentage of the whole-time day students in a University, one is tempted to ask, are provided these advantages, or avail themselves of them? Think of the thousands of University students who crowd into our colleges in some of the large cities. What is the corporate life which they are supposed to live which the evening students cannot? Does not the present unrest among our students indicate the absence of such a corporate life ?

When we face the problem of languages, even the posing of the problem presents difficulties. There seems to be a feeling that when once we have coined the equivalents in the Indian languages, of all the technical terms, then we automatically ensure a continuous flow of scientific and other literature in these languages. I have been an enthusiast, and for a long time, in writing on scientific subjects in one of the Indian languages. I even wrote one of my research papers in it. If I do not write more frequently in that language it is not merely the inadequacy of the language for expressing modern scientific thought, but the meagre audience that is likely to be interested in such publications at present. We have to advance very much more in our many academic pursuits,

apart from developing the languages, before we can provide such an audience.

In the background of the sad neglect of our classic scholars, and the large disparity in the treatment accorded them and that accorded to specialists in other fields, the enthusiasm that we express for the Indian languages sounds a little unrealistic.

We occasionally hear murmurs from some of the veteran educationists that the emphasis in our education is shifting a little too rapidly towards the scientific and the technological faculties. Their concern is regarding the possible weakening of the humanizing influence of the other faculties on science.

I wish just to say this in reply: that as a means of acquiring a truly liberal education, the cultivation of the sciences would be just as important as the study of the classics. For acquiring a really scientific or philosophical outlook, by which I mean the willingness to face facts squarely, to draw logical conclusions from them, to accept them without mental reservations, and to act in accordance with them, such an outlook can be acquired through any of the different disciplines, but probably most effectively through the cultivation of the sciences. I would not, therefore, underestimate the cultural value of science. Indeed Nature is the best teacher,

and when we draw wrong conclusions, as any scientific worker knows, he is forced to realize it almost immediately, and Nature puts him back on the right track. As Einstein once remarked, Nature may be profound, but she does not cheat; that is, she conforms strictly to the rules of the game. Take, for example, the development of the theory of relativity. Numerous experiments were devised to detect the absolute motion of the earth through space. When the experiments were actually tried they yielded consistently negative results. In each case an *ad hoc* explanation was proposed, and the experiment was suitably modified in order to rectify the defect exposed by the *ad hoc* explanation. The result was still negative. This was the case with many different types of experiments, until finally Einstein realized that we are presumably trying to detect something which is inherently unobservable, namely absolute motion through space. The result was the formulation of the well-known special theory of relativity, with many epoch-making consequences. The possibility of deriving energy from suitable atomic fuel is one of them. There are many similar examples in the history of physics where such extraneous concepts when they get into physics create anomalous situations, which can be rectified only by throwing out such extraneous concepts, which

are appropriately described as "unobservables." These are quantities that cannot be observed even in an idealized experiment in thought in which the defects of our instruments, and of our techniques, are eliminated. *Absolute* motion through space is one such quantity.

To take another example, many physical quantities in Nature are paired off in such a manner that any attempt at measuring accurately even in an idealized-experiment in thought, one of the conjugates, carries with it automatically a mechanism which spoils completely any chance of measuring the other conjugate at the same time. Hence the concept of being able to measure both the conjugates accurately at the same time, had to be discarded before the many anomalies could be rectified.

On the other hand, though nobody has yet seen the other side of the moon, one can design in thought an experiment which does not break any of the physical laws, by which he could obtain information about the other side of the moon. He could in principle send a rocket round the moon which would photograph the remote face and return to the earth. Hence the other side of the moon would not be one of the unobservables.

I am giving these examples merely to illustrate how dependable Nature is as a teacher, and how invariably she puts back the investigator on the right track when he goes wrong. Hence arises the disciplinary and educative value of the sciences.

Indeed, more revolutions have been wrought by scientific advances like the theory of Evolution or of Relativity than by the conventional revolutionaries.

I am not here pleading for the cultivation of the sciences taking precedence over the other disciplines in a University. Indeed it would be undesirable if it did happen. The different disciplines supply the necessary correctives to one another, and in any properly organized University there is need for all of them, and even the name University would not be justifiable otherwise. Single-faculty Universities would obviously have many disadvantages.

Indeed I cannot conceive of any well-organized University education which is not firmly based on our past traditions, particularly the classics. The taller the edifice, the deeper would have to be the roots.

Most people who concede readily the cultural value of the pure sciences may not be willing to extend it to the applied sciences or to technology. The prejudice against the applied sciences is an old one, and dates back to the old Greeks, and traditionally

to Plato in particular. I am deeply aware of the immense services which the Platonic ideal of "knowledge for its own sake" has rendered in the cause of liberal education. Disinterested curiosity has been the basis of all creative work. The well-known toast for mathematics "May it be no use to anybody at any time" is a typical illustration of this ideal. The great mathematician Gauss, who will rank with Archimedes and Newton as one of the three greatest mathematicians the world has ever produced, is reported to have said, "If Mathematics may be regarded as the Queen of the Sciences, Arithmetic (by which he meant the Theory of Numbers) should be regarded as the Queen of Mathematics, "because", he added, "it is the least useful." "*Sa vidya ya vimuktaye: vidyanya silpa naipunam*. That is real education which liberates the mind. All other learning is just crafts manship", also illustrates just the same attitude. Indeed till recently the distinction between the pure and the applied sciences was nearly as sharp as the distinction between the Gentlemen and the Players at the Lord's.

Though, all through the ages, we were aware of the immense usefulness of technology, even the most liberal among the educationists were reluctant to concede any cultural value to its cultivation which

is not surprising. It may therefore interest many of you to know that the place of technology in liberal education has been very ably discussed in several essays by the late Professor Alfred North Whitehead. As most of you know, he was a great mathematician who collaborated with Bertrand Russell in the classic work *Principia Mathematica*. He was even greater as a philosopher. But it is not so well known that he spent considerable time and thought on problems of education. Indeed he has exercised more influence over education in American Universities in particular than any other single person. His essays on the subject have been collected together and published under the title "Aims of Education". Any contribution from such an eminent thinker is naturally very refreshing. But the most refreshing, in my opinion, is the thesis, which he ably defends in two or three essays, that independently of its usefulness, and purely for its educative value, the study of technology is superior to the other disciplines. The thesis may appear at first sight exaggerated. But surely Whitehead, as a mathematician and philosopher, cannot be suspected of any special weakness for technology, and coming from him the thesis has a special significance. As a complement to the Platonic ideal of knowledge

for its own sake, Whitehead develops the Benedictine ideal of the joy of useful work, and technical education, according to him, is a marriage of the two, which ensures the co-ordination between thought and action, which is essential for the development of an intergrated personality. "There can be no adequate technical education which is not liberal." says Whitehead, "and no liberal education which is not technical: that is, no education which does not impart both technique and intellectual vision. In simpler language, education should turn out the pupil with something he knows well, and something he can do well. This intimate union of practice and theory aids both."

All that is very refreshing. It fits also with his idea of a University. He does not pose the conventional question whether the function of a University is to educate or to promote learning, but states with a certain freshness, characteristic of him, that the justification for a University is that it preserves the connection between knowledge and the zest of of life, by uniting the young and the old in the imaginative consideration of learning." He returns repeatedly in his essays to the problem of keeping knowledge alive, of preventing it from becoming inert, which according to him is the central problem of all

education.” “For successful education there must always be a certain freshness in the knowledge dealt with” and he adds with some sarcasm, which, however, seems appropriate, “that knowledge does not keep any more than fish.”

As a student of science who has spent most part of his life in scientific research, I find close parallels between the different stages in scientific research and in education.

The first stage in scientific research, particularly when the researcher enters a new field, is, what Whitehead would call, the stage of romance. It is distinterested curiosity that takes the researcher into the unexplored new region. He may not be able to see the wood, but every tree evinces in him a feeling of wonder and curiosity. He accumulates incidentally a very extensive experience, and collects a wide variety of new facts. The experience, however, is mostly empirical, with many different disjointed pieces, but each beautiful on its own, and captivating the attention of the researcher.

The next stage is one of trying to find a simple and elegant pattern into which all the data can be fitted. Naturally one imposes on himself a certain rigorous discipline at this stage, and the facts are now refined and made more precise. It is the stage

of more accurate measurements, checking, and looking for odd facts that are needed to fill in the pattern. He begins now to see the wood as distinguished from the trees.

The third stage would be one of generalization, when the researcher finds to his great satisfaction, that the ultimate pattern that he has formulated, not only fits well with his own observations, but can predict many new results, and can accommodate elegantly quite new sets of facts from entirely different fields. Nothing is so gratifying to a researcher than to find that the pattern which he formulated to fit his small area of experience has a much wider connotation. This is the stage when he can be much freer than before, when he can afford not only to forget the details, but even finds it necessary to do so. It is the stage of maturity and of wisdom, as distinguished from mere knowledge as in the earlier stages. The ideas now become very much alive.

There is a close parallelism between the education of the child in the kindergarten, the primary and secondary schools, and the stage of romance and of precision in scientific research. There is again a very close parallel between University education and the stage of generalization in scientific research. It is this living aspect of knowledge that makes University

education so exciting and realistic, and to which Whitehead attaches such great importance.

These findings of Whitehead are of topical interest to us in India to-day, when things are moving so rapidly, and there is so much to do for all of us. An education tuned to harmonize with the rapidly changing conditions in the country, would alone be entitled to be called liberal education according to Whitehead. If science and technology, which are so essential and so useful in our modern set-up, can also help towards the ideal of a liberal education, it almost sounds like being conceded the best of both the worlds. You, the young graduates, are the beneficiaries, and you have my best wishes.

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