

Education as engineering

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John Dewey's short essay, 'Education as engineering' was first published in 1922. It is followed here by four commentaries discussing the contemporary relevance of its argument that a science of education cannot advance education in the absence of pioneering developments on the ground of the schools.

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Mrs Mary Austin in her illuminating article on 'The need for a new social concept' (Austin 1922) gives an apt expression of the contrast in contemporary behaviour between our power in physical engineering and in basic human concerns. We can, as she points out, easily construct a new type of bridge; we cannot create a new type of education. It would be a comparatively simple matter if schools were destroyed to restore them out of a denuded social consciousness; it would be very difficult under like circumstances to recover the ability to make a modern bridge. 'The reason is that we have been thinking about education long enough to form a pattern in our minds but not long enough for the multitudinous processes involved in the building of steel bridges'.

The meaning is clear, and there is nothing to be gained by a meticulous critique of words. However, for radical renovation of the school system, a revision, almost a reversal, of wording would seem to be required. Instead of saying that we have thought so long about education—if thinking means anything intellectual—it would be closer to the realities of the situation to say we have only just begun to think about it. The school system represents not thinking but the domination of thought by the inertia of immemorial customs. Modern bridge-building, on the other hand, is quite inconceivable apart from the use of materials determined by purely intellectual methods. Our steel cantilever bridges represent precisely the kind of thing that custom unmodified by thought could never achieve no matter how far it was carried. Because bridge-building is dependent upon thinking it is easy for thinking to change the mode; because education depends upon habits which arose before there was scientific method, thinking with great difficulty makes even a little dent.

Consequently if our school system were destroyed, we should not have to recover our 'minds'—our intellectual equipment—to restore our schools.

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It would be enough if we retained our habits. To restore modern bridges we could dispense with formed habits provided we retained our intellectual technique. There is an ambiguity in referring to a 'mental pattern' in connection with schools. The pattern is not mental, if we mean a pattern formed *by* mind. There is doubtless a pattern *in* our minds, but that signifies only a sense of a comfortable scheme of action which has been deposited by wont and use. The pattern is so deep-seated and clearly outlined that the ease of its recognition gives rise to a deceptive sense that there is something intellectual in the pattern itself. In engineering the pattern is mental in quite a different way. It summarizes a distinctively intellectual type of behaviour.

A sense of this contrast seems essential to adequate reflection on the question of how educational procedure is to become a form of constructive engineering. William James said that anyone grasps the significance of a generalization only in the degree in which he is familiar with the detail covered by it. Now detail means things in concrete existence. We are familiar only with things which specifically enter into our lives and with which we steadily reckon and deal. All concepts, theories, general ideas are thin, meager, and ineffectual in the degree in which they are not reflective expressions of acts and events already embodied, achieved, in experience. New conceptions in education will not of themselves carry us far in modifying schools, for until the schools are modified the new conceptions will be themselves pale, remote, vague, formal. They will become thick, substantial, only in the degree in which they are not indispensably required. For they will offer precise and definite modes of thinking only when new meanings and values have become embodied in concrete life-experiences and are thus sustained by them. Until that time arrives the importance of new concepts is mainly negative and critical. They enable us to criticize existing modes of practice; they point out to us the fact that concrete detail of the right sort does not exist. Their positive function is to inspire experimental action rather than to give information as to how to execute it.

There was, I take it, no definite art or science of modern bridge-building until after bridges of the new sort had been constructed. It was impossible that the new art should precede the new achievement. The formulae for construction, the rules of specific procedure, the specific classification of types of problems and solutions had to wait upon presentation of appropriate concrete material, that is upon successful experimentation. Nevertheless the pioneers had something to go upon and go ahead with, even if they had no specified art of bridge-building to rely upon. They had a certain amount of dependable knowledge in mathematics and physics. The difficulty they suffered from was that no one before them had employed this knowledge in building the kind of bridge that new social conditions called for. When they tried to imagine a new type, the minds of all but a few were surely held in bondage by habituation to what was already familiar.

The essential need was thus human rather than scientific. Someone had to have the imagination to get away from the 'thought' of the existing easily recognized pattern. This took daring, the courage to think out of line with convention and custom; it took inventiveness in using existing scientific material in a new way, for new consequences. It took intellectual initiative to conduct experiment against almost universal indifference or reprobation; it

took intellectual honesty to learn from failure as well as from success in experimentation. The pioneer succeeded in making his bridge—and ultimately making a new art or scientific technique—because he had the courage of a creative mind. Consider the history of any significant invention or discovery, and you will find a period when there was enough knowledge to make a new mode of action or observation possible but no definite information or instruction as to how to make it actual. Every time it was a courageous imagination, a quality which is personal, human, moral, rather than scientific or technical, which built the bridge—in every sense of the word bridge.

There is at present no art of educational engineering. There will not be any such art until considerable progress has been made in creating new modes of education in the home and school. However, there does already exist a considerable body of observations and ideas in biology, psychology, and the like which serves to criticize and condemn much of our existing practice, and to suggest to a mind not weighed down by fear the possibility of new leads and openings. Given imagination, courage and the desire to experiment and to learn from its results, there is a push toward, a momentum for creative work. Its concrete consequences if subjected to honest or discriminating reflection will afford material for the elaboration of an art, a fairly definite body of suggestions and instructions for the later intelligent conduct of an educative art. However, this technique will be largely *ex post facto*. It is equally fatal to postpone effort until we have the art and to try to deduce the art in advance from the scientific knowledge in biology, psychology, and sociology we actually possess. If earlier mathematicians and physicists had attempted to anticipate the result of inventive experimentation in bridge-building by deducing from their sciences the rules of the new art, it is certain that they would have arrived only at improved rules for making the old and familiar type of bridge; they would have retarded the day of the new type; they would have concealed from view the necessity of the indispensable human factor—emancipation from routine and timidity. The case is the same with the creation of new types of schools and the ulterior development of an art of education.

There is no question that would-be pioneers in the educational field need an extensive and severe intellectual equipment. Experimentation is something other than blindly trying one's luck or messing around in the hope that something nice will be the result. Teachers who are to develop a new type of education need more exacting and comprehensive training in science, philosophy and history than teachers who follow conventionally safe lines. However, they do not at present need a translation of this knowledge into a science and art of education. They do not need it because it cannot be had and the pretence of supplying it makes conditions worse rather than better. When, for example, psychology is employed simply to improve the existing teaching of arithmetic or spelling for pre-existing ends, or to measure the technical results of such teaching, let that fact be clearly acknowledged. Let it not be supposed that there is really any advance in the science of education merely because there is a technical improvement in the tools of managing an educational scheme conspicuous for its formation prior to the rise of science. Such 'science' only rationalizes old, customary

education while improving it in minor details. Given the required intellectual equipment, the further immediate demand is for human qualities of honesty, courage, and invention which will enable one to go ahead without the props of custom or the specious pretensions of custom masquerading in the terminology of science.

At present we are still largely in the 'rationalizing' stage. Consequently, as was pointed out in an earlier article on 'Education as a religion' (Dewey 1983), educational concepts nominally as diverse as culture, discipline, social serviceableness work out in practice to mean only a little more of this or that study. The scope of our rationalizing is seen in the fact that educational theory as taught in our teachers' training schools has been revolutionized in the last generation, largely in a decade. However, where is the evidence of any corresponding change in practice? The most optimistic soul, if candid, will admit that we are mostly doing the old things with new names attached. The change makes little difference—except for advertising purposes. We used to lay out a course prescribed by authority for the improvement of the minds of the young. Now we initiate them into their cultural heritage. The staples used to be taught in certain ways on the ground that the crude and lawless minds of the young needed to be chastened by discipline in things above and beyond them. Now we appeal to 'inner motivation'. However, we teach much the same topics, only in a more gracious, less repellent way. Strange, though, that the opposed needs of external discipline and of inner purpose should be met by so nearly the same subjects and topics!

I am not insinuating that there is personal insincerity in this state of affairs. In part it is due to the fact that docility has been emphasized in education, plus the fact that in the main the most docile among the young are the ones who become teachers when they are adults. Consequently they still listen docilely to the voice of authority. More fundamentally the outcome is due to the fact that a premature attempt is being made to lay down a procedure, definite proper courses of subjects and methods, by which teachers may guide themselves, the procedure being nominally derived from our new knowledge in biology, psychology, etc. However, as we have seen, this cannot be done; no results so definite as this can be reached until after the change in educational practice is well under way. When the attempt is made in advance to answer specific questions which will arise in the course of employing the new knowledge, to supply in advance definite suggestions as to courses of procedure, it is inevitable that the minds of both 'authorities' and of students intending to teach should fall back upon just the old practices which they are nominally striving to get away from. For here alone is there material concrete enough to permit the formulation of definite problems, answers, and steps to be undertaken.

In short, at present, both students and teachers of education are excessively concerned with trying to evolve a body of definite, usable, educational directions out of the new body of science. The attempt is only too natural. But it is pathetic. The endeavour to forestall experiment and its failures and achievements, the attempt to tell in advance how successfully to do a new kind of thing at most, in a rectification of old ways and results plus a complacent assurance that the best methods of modern science are

employed and sanction what is done. This sense of being scientifically up-to-date does endless harm. It retards the creation of a new type of education, because it obscures the one thing deeply needful: a new personal attitude in which a teacher shall be an inventive pioneer in use of what is known, and shall earn in the process of experience to formulate and deal with those problems which a premature 'science' of education now tries to state and solve in advance of experience.

I do not under-estimate the value of the guidance which some time in the future individuals may derive from the results of prior collective experience. I only say that the benefit of such an art cannot be had until a sufficient number of individuals have experimented without its beneficial aid in order to provide its materials. And what they need above all else is the creatively courageous disposition. Fear, routine, sloth, identification of success with ease, and approbation of others are the enemies that now stand in the way of educational advance. Too much of what is called educational science and art only perpetuate a régime of wont and use by pretending to give scientific guidance and guarantees in advance. There is in existence knowledge which gives a compass to those who enter on the uncharted seas, but only a stupid insincerity will claim that a compass is a chart. The call is to the creative adventurous mind. Religious faith in education working through this medium of individual courage with the aid of non-educational science will end in achieving education as a science and an art. However, as usual we confuse faith with worship, and term science what is only justification of habit.

References

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