

confine ourselves to Preformism, I suppose we have to accept Mr. Galton's law of Regression and Weismann's principle of Panmixia in some shape. Now when social life begins we find the beginning of the artificial selection of the unfit; and so these negative principles begin to work directly in the teeth of progress, as many writers on social themes have recently made clear. This being the case, some other resource is necessary besides natural inheritance. On my hypothesis it is found in the common or social standards of attainment which the individual is fitted to grow up to and to which he is compelled to submit. This secures progress in two ways: First, by making the individual learn what the race has learned, thus preventing social retrogression, in any case; and second, by putting a direct premium on variations which are socially available.

Under this general conception we may bring the biological phenomena of infancy, with all their evolutionary significance: the great plasticity of the mammal infant as opposed to the highly developed instinctive equipment of other young; the maternal care, instruction and example during the period of helplessness, and the very gradual attainment of the activities of self-maintenance in conditions in which social activities are absolutely essential. All this stock of the development theory is available to confirm this view.

And to finish where we began, all this is through that wonderful engine of development, consciousness. For consciousness is the avenue of all social influences.

J. MARK BALDWIN.

PRINCETON.

THE SCIENCE OF EXAMINING.

MUCH severe criticism is being directed against examinations, and much of it is timely and fully deserved. And yet when the criticisms are carefully considered they

appear to be directed not so much against examinations as a method in education as against certain forms of examination which are very prevalent and which certainly do not show anything more than evanescent memorization, adroitness or trickiness on the part of a student. No one will deny, however, that much of actual life is a kind of examination, and that we are being continually pressed to solve problems of all kinds, apply knowledge, and in general to act, and that on the success of our efforts will depend the positions we will attain, or, at least, maintain. There seems to be no reason why examinations should not be made an extremely important part of education, instead of being, as I fear they often are, an unmitigated nuisance to both student and teacher, a bone for the pedagogical critics continually to snarl over, and, when all is done, to be of no real use to either teacher or student, and to show nothing as to the real nature of the teaching done and the mental development of the student.

For the teacher who teaches from love of teaching, and who knows that successful teaching calls for the application of psychological principles far more than is generally supposed, there is a peculiar fascination in an examination paper. An examination may be made a test of the contents, capacity, quality and action of a mind under defined conditions; but the paper must be a good one; I do not refer to the work of an inexperienced hand. The idea seems to be prevalent that anyone can write an examination paper. This is a great mistake. The elaboration of a paper that will really test not only the contents of the mind, but also its different functions as developed by a particular study under the guidance of a particular teacher, requires experience and ability. It is true that a man may be a good teacher and a poor examiner, but this usually arises from a lack of attention to the science and art of examining. My ex-

perience in this branch of pedagogical science leads me to believe that there are not very many really good examiners, and that the average examinations do not test the minds of the student as they ought to be tested. The average examination calls mainly for an exercise of memory, and for some proof that the student understands the matter he has studied. No man values the faculty of memory more highly than I do, or requires a better understanding of a given subject. But memory and mere understanding are only the foundations of education. More than this is called for. Some examinations require skill in observation, others accurate definition; while others bristle with problems. Some call for knowledge in which the teacher is weak. Almost every pedagogic earmark may be found in examination papers, but rarely is the paper constructed on such a plan that it tests not only the quality and quantity of knowledge in the mind, but also the various workings of the mind, and ascertains what the mind can do when set in action by the particular subject.

In my own specialty of chemistry there is an excellent opportunity for examination papers, which may test the mind qualitatively and quantitatively, and probe both absorptive and productive powers. I have always taken a great interest in working out examination papers and in studying the minds as they appear in the answers. I am accustomed to work out questions under various heads. The following examples will serve to indicate my meaning, and may also encourage others to experiment in examinational science; and I think that the method will be found so interesting that the investigation will not be hastily dropped. I should add that in the examination paper as given to the students the questions are mixed up, so that the classifications given as follows do not appear.

QUESTIONS FOR TESTING:—

Memory.—(1) Give a brief history of oxygen. (2) Outline the theory of phlogiston. (3) What are 'copperas,' 'bluestone,' 'tincal.'

Accuracy of Definition.—(4) State concisely the laws of Dalton, Charles, Mariotte and Avogadro. (5) Define a mechanical mixture. (6) Define an element.

*Observation of Experimentally Demonstrated Facts.**—(7) Describe and sketch an apparatus for producing acetylene from calcium carbide and explain the working of it. (8) Describe and sketch the combustion of nitric acid in iodohydric acid.

Accuracy of Detail.—(9) Explain with the aid of sketches the reduction of hot cupric oxide by hydrogen, heating the oxide in a combustion-furnace and preparing the hydrogen in a Kipp generator.† (10) Make a sketch of a section of Peppas gasometer, and explain how the apparatus works.

Acquaintance with the Properties of Matter.—(11) Describe the properties and chemical behavior of nitrogen, sulfur, zinc, silica and iodine.

Retention of Oral Instruction.—(12) Explain the contamination of water by sewage. (13) Describe the process for making open hearth steel.

The Faculty of Comparison.—(14) State similarities and differences between the properties of oxygen and hydrogen. (15) What substances resemble lead sulfide in color and solubility in nitric acid.

Lucidity of Statement.—(16) Describe minutely and without sketches the apparatus and method of preparing phosphine. (17) Prove by analysis of stibine by volume that the molecule of antimony is tetraatomic.

Recognition of Substances.—(18) A yellowish green gas with a suffocating odor. What may it be? (19) A colorless gas, very soluble in water, gives white fumes with hydrochloric acid. What may it be? (20) A white powder, insoluble in water; heated with concentrated nitric acid it evolves red fumes and yields a solution, which, when excess of acid is evaporated off, and it is diluted with water, yields a precipitate which is insoluble in concentrated nitric acid. What may this white substance be? (21) A chemist wishes to fill a jar with red liquid. What substance may he use?

The Ability to Observe.—(22) Give four examples of chemical change which you observe in this room. (23) Describe an ordinary red building brick, stating dimensions and properties of surface, weight, fracture, etc. (24) Water expands on freezing. Give five examples of results caused by this expansion which you have personally observed.

* Given in lectures and not in text-book.

† Given in text-book and demonstrated in lecture.

The Application of Facts to Proofs. (25) Prove that water is formed by the combustion of a kerosene lamp. (26) Prove that hydrogen sulfid contains sulfur.

The Interpretation of Phenomena.—(27) A piece of white paper on being held for an instant in the flame of a candle and at right angles to it, a black ring is formed on the paper. Explain what the ring indicates, and how the particles of carbon are formed and why they are deposited on the paper. (28) A Roman candle on being ignited and then thrust under water continues to burn. How can this be accounted for? (29) Why cannot fish live in lakes on the tops of very high mountains.*

The Application of Knowledge.—(30) The iodine falls into the sand box. How can the iodine and sand be separated? (31) A mixture consists of barium carbonate, sodium sulfate and sulfur. How can they be separated? (32) A manufacturer has a waste product consisting of a liquid containing 40 % of sulfuric acid, 10 % sodium sulfate and 5 % ferric sulfate. How can he treat it so as to convert it into other products that have commercial value?

Deceptive or Misleading Questions.—(33) Dilute sulfuric acid is poured upon zinc. A gas with a slight bluish* color is evolved which burns with a red† flame. What is it? (34) Chlorine gas is collected in a jar over mercury‡ in the usual manner. It is then brought into a eudiometer, mixed with twice§ its volume of hydrogen, and exploded. How many volumes of hydrochloric acid gas will be produced?

The Imagination.—(35) Filthy water of the gutter, warmed by the sun's rays, escapes from a foul environment, and, condensing, sparkles like diamonds on the petal of the violet. Use this as basis for an allegory in life.

These questions do not by any means represent all the possible divisions of mental action, and I have purposely avoided those of a very technical nature, most of which, however, would fall under the heads given; but they will serve to indicate what opportunities there are to construct examination papers that shall test a student's knowledge and the working of his mind. It may be urged against the questions I have given

that several of them might fall as well under one head as another, or that a few more elaborate questions could be made out and each question marked under the several heads. My experience, however, has not been that the real ends are best attained in this way. The question that is distinguished by its definite nature and object gets a clearer answer and gives a more satisfactory insight into the student's mental equipment and action than a long or complicated one. If, after teaching a student a subject for a certain time, an examination shows that he can bring forth nothing more than that which has been put into him, it may be inferred either that the teacher is incompetent, or that the student is intellectually deficient; assuming, of course, that the system in the particular institution permits the teacher to do his best, does not assign him more pupils than one man can teach, and requires the student to do the work assigned to him. In such case I think that the fault usually lies with the teacher. Still I admit that there are institutions in which educational work of a high pedagogical order is impossible, and mind development, as distinguished from mind cramming, is out of the question. In such a case students are produced who are saturated with knowledge, but who are incapable of utilizing it. Like water-logged vessels they roll about aimlessly, and are unable even to keep out of the way of craft which are taking the fullest advantage of wind and tide. In such an institution the earnest teacher, when he fails, deserves sympathy more than blame.

The results of examinations, conducted on some plan like the one I have attempted to describe, are very interesting. Such examination papers are far more difficult to write than the calls for mere memorization that are so frequently made on the student, and which a hasty cram will enable a fairly bright candidate to pass. The answers are

* Compare London University Matriculation Examinations, Stoker and Hooper, p. 31. Q. 6.

† Colorless.

‡ Chlorine cannot be collected over mercury.

§ Once.

more difficult to rate; and often an attempt to mark them according to the usual rules is unsatisfactory. It is quite easy to assign a mark to the amount that a student knows, or even to discriminate as to the quality of his knowledge. To assign a figure to his ability to apply this knowledge, to originate, to create, to act under its instigation, is more difficult; yet it can be done with a fair degree of success.

It must always be borne in mind that a man's value in this life does not depend merely on what he knows, but upon what he can do. *Ceteris paribus*, the more he knows, the more he should be able to do; for so much the greater should be the incentive, if the knowledge imparted to him acts on him as it should. Until technical education was introduced, this fact was not well understood, and it is still far from appreciated in many schools.

For instance: A shows in his paper an encyclopedic knowledge. In his answer to Q. 11 he recites with great precision the properties of silica and iodine. But he fails to answer Q. 30, which calls for a conclusion dependent upon this knowledge. He is like a recruit who has been given a gun, but has not been taught how to fire it off. Such a student demands the teacher's attention at once. His mental inaction is usually the result of poor teaching.

It may not be amiss for me to say parenthetically here that teaching is the most difficult of all professions. It is not usually regarded so, but I believe that it is. Much of what is called teaching is nothing more than a kind of pumping. Knowledge is forced in through the most convenient intellectual orifice, a great deal being lost *in transitu*, and not a little leaking out afterwards. The engorged recipient is like a boiler whose feed pump is too big for it and will not cease pumping, but fills the boiler entirely full of water and leaves no space for steam; whereon the engine slows down

and stops, or throbs soggly with its cylinder filled with lukewarm water instead of hot expansive steam.

Again, a student may fail in his attempts to state anything correctly or exactly; but he fills pages with attempts to apply his knowledge, suggesting all sorts of ideas and applications. Most of them may be impossible, some even ridiculous. But no matter, let the teacher take hold of this boy at once, for the mind of an Edison, a Siemens or an Ericsson may be seeking nourishment and development. Happy is the teacher who can discern what mean the instinctive strugglings of the embryonic master mind, and who can liberate it from the thralldom of routine—who can guide its first weak attempts to walk and climb, until it becomes hardy and venturesome, and fearlessly scales cliffs heretofore inaccessible; and so clambering by hitherto unknown ways to the peak discovers new fields for human activity, and cuts a wide path by which thousands may enter and take possession.

What man gets closer to the Creator than the teacher, who can discern and understand His idea as shown in the youth and who clears away the obstacles in the way of its development, nourishes it until it is strong and independent, and itself becomes creative? Verily such a teacher has his reward.

Examination papers constructed on the basis I have suggested, viz.: to test not only the knowledge possessed by the student, but also the working of his mind upon the particular subject, will show more clearly the nature and condition of a mind than the daily recitation, because the case is more capable of systematic study and can be made to cover larger fields of mental activity. While I do not intend to suggest that such examinations should replace the regular recitation, I believe that they should be held frequently, and should serve a far wider purpose than that of merely

noting the quantity of knowledge absorbed by the mind. Such an examination is not a mere matter of testing and registering—it is a creative exercise of the mind.

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THE 'NEW RACE' IN EGYPTIAN HISTORY.

DURING the session of the International Geographical Congress, Professor Flinders Petrie invited a number of the members to visit the extraordinary collection of Egyptian antiquities exhibited at the University College, the results of his excavations between Ballas and Nagada in the early months of 1895. They may well be called 'extraordinary,' as they introduce an entirely new element into the history of ancient Egypt, proving the presence on the Nile 'of a fresh and hitherto unsuspected race, who had nothing of the Egyptian civilization,' to quote Professor Petrie's words. Not that they were uncivilized. Far from it. Their culture was in some respects superior to that of the Egyptians of their age; but it was wholly independent of it, developed in another center, under an entirely different inspiration and technique, proving it the product of another ethnic group.

These intruders overthrew the great civilization of Egypt at the close of the VIth dynasty, and were in turn overthrown by the rise of the XIth dynasty at Thebes. In the current chronology this would place them from 3300 to 2800 B. C. They completely expelled or destroyed the former inhabitants for more than a hundred miles along the Nile Valley, in the district situate between Gebelen and Abydos. How thoroughly they extirpated their predecessors in this region may be judged by the fact that, in opening over two thousand of their graves and examining several of their town sites, not a single Egyptian object was found. Nor did they care to learn any Egyptian

art; for though they worked extensively and skilfully in clay, all their vessels are made by hand, and they refused to adopt the potter's wheel, which was then and long before familiar to the Egyptians. They brought with them a culture belonging to the highest neolithic type. I have never seen in any other collection, flint implements of equal finish or so graceful in outline. Beautifully polished beads and small ornaments of cornelian, amethyst, turquoise, garnet and other hard stones were found in abundance. Stone vases were shown in great variety and of graceful outlines.

The decorative designs are often elaborate, some in conventional lines, spirals and network, some representing boats, birds, trees and human beings. Animal designs in relief are portrayed with artistic consciousness.

Of metals, copper was the only one in frequent use. Adzes, needles, harpoons and daggers were manufactured from it.

Their mode of interment was altogether unknown to the Egyptians. The bodies were buried in the gravel, not in rock tombs. The graves were square pits, and the corpse was laid in a contracted position with the head to the south and the face to the west. The custom of incineration did not prevail; but there are signs of funereal human sacrifices, and apparently of cannibalism.

It is not likely that they shared the Egyptian's skill in architecture. Two of their towns which were examined showed remains of structures of mud brick of small size.

What were the ethnic relations of these mysterious invaders, this 'new race,' as Professor Petrie called them?

In the interesting address which he made to us on the occasion of our visit, he expressed himself cautiously but with a positive conviction. From numerous analogies