

geographical equator : and if so, its effects at any one place would undergo very great changes in the earth's diurnal revolution, every part of the earth being presented, in the course of the day in different aspects toward forces so acting. Now, the fact is that the diurnal changes are very small, only about one-five-hundredth part of the whole horizontal force. It would seem certain, therefore, that external bodies or spaces do not produce any sensible part of the magnetism in the planes to which the earth's axis is normal.

That terrestrial magnetism does not reside, in any important degree, in the earth's surface, is probable, because of the non-magnetic property of the materials of which the earth's surface is composed, and upon the general absence of any perceptible change in magnetism depending on the change of soil.

Humboldt adopted the idea that the principal phenomena of terrestrial magnetism could be explained by the action of a powerful magnet, of limited dimensions, near the centre of the earth ; but it was found that the theory upon which this idea depended, though well representing the broad facts of terrestrial magnetism, failed in accuracy when applied to many special cases.

Hapsteen suggested the theory of two large magnets within the earth, but this failed to meet the facts of observation.

Gauss attempted to explain the cause of terrestrial magnetism by supposing that magnets are distributed irregularly through the earth, and the results of observations generally accord with the necessities of his theory.

Regarding the earth as a heterogeneous compound of different substances, which may possess in some degree the properties of different metals, and conceiving (as is the opinion of many physicists) that there is in the interior a great store of caloric, which may heat the points of contact, some of them steadily and some by occasional bursts of flame, it seems within the range of possibility that such a combination, of heat with dissimilar substances, may be the cause of terrestrial magnetism. But there is no evidence of this beyond mere conjecture. It is worthy of remark that the isothermal lines on the earth's surface bear a striking resemblance to the lines of equal magnetic intensity. On the whole, we must express the opinion that the general cause of the earth's magnetism still remains one of the mysteries of cosmical physics.—*Scientific American*.

Studies that bear directly upon Industry.

The educated workman is always and everywhere the best workman. This is true even if the education he has received does not bear directly upon the industry in which he is engaged. Intelligence, natural or acquired, counts even in digging ditches. If the education of the head holds no direct relation to the employment of the hands, it may tend to make the laborer discontented ; yet it will enable him, in sundry respects, to do his work easier and better.

But while some studies have only an indirect bearing upon industry others have a bearing which is direct and decided. For the workman, considered as a workman, the latter are much the more serviceable. They not only enable him to do his work much easier and better, but, by giving it an intellectual element, they cause him to take greater pride and delight in it. He who works like a machine, without thought, may work steadily from one year's end to the other ; but it will be, if not with disgust, at least with stolid indifference. He will take no genuine pride and delight in the

labor of his hands, as one so frequently does who works as well with his mind as with his hands, discovering somewhat of the Supreme Intelligence even in the rudest labor.

Just here, we come upon an important educational principle for guidance in the management of public schools. It is this : Other things being equal, those workmen who best understand the rationale of what they are doing, not only can do the most and the best work, but will take the most pride and delight in it. This can be verified by an inspection of those engaged in any pursuit. So there is no danger of educating workmen to an undue dislike of manual labor, provided the education bears *directly* upon the work to be done.

That workmen should take pride and delight in their work is deemed a matter of so great importance by the British government, that it sent, in 1870, a circular letter to its consular agents throughout the world, requesting them to make investigations bearing upon this matter among all classes of workmen. This the consular agents did, and they found that instruction in the underlying principles tended to increase the pride and delight taken by workmen in their work. A great and fertile truth.

Now, chemistry is one of the studies that has a direct and decided bearing upon many human employments. It teaches lessons of great value to farmers, gardeners, cooks, dyers, painters, potters, metal-workers, apothecaries, soap-makers, bleachers, etc., etc. It is as once the most practical and the most wonderful of all the natural sciences. There is no person who would not, at times, find a knowledge of chemistry of direct practical use. Then it introduces the learner into the very workshop of nature, acquainting him with her tools and her processes. It brings him face to face with the facts of the material world, and teaches him how to interrogate nature by experiments ; and, in so doing, trains him to observe, to weigh, and to judge, while it gradually brings him to the condition which enables him fully to realize and believe things he cannot see with the bodily eye.

Botany and Zoology—the former treating of still life, the latter of animal life—are studies that make direct and valuable contributions to several important human pursuits. Their lesson can be practically applied by all persons engaged in producing alimentary products, and the staples used for clothing. It is to botany that decorative art goes for most of its forms and principles, and so a knowledge of botany is of service to nearly all kinds of manufactures. There is indeed, no one who would not, at times, have occasion to make practical use of the lessons taught by botany and zoology. Then they are studies better adapted than almost any other to the early years of school life. They furnish the best of object lessons for training the faculties of perception and comparison, while no other studies are so well calculated to teach the young learner to classify and to tabulate.

There is also much embraced in physics, "Natural Philosophy," that has direct bearing upon many kinds of labor. Then a knowledge of color is of universal service, even if regarded only from the utilitarian point of view. What shall we say of geometry, when studied for its practical applications as well as for mental discipline ? That it is of direct, utilitarian service to every one, but is simply indispensable in all the mechanic arts. If properly treated, it may be made a suitable study for all ages, training the perceptive faculties, the imagination, and the reason. Yet not one person in twenty now receives any systematical instruction in this universally serviceable branch of mathematics. It is arithmetic, arithmetic, and arithmetic.

Finally, there is drawing, and it stands second to no study when we consider its direct influence upon indus-