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The position of Mathematics in the School Education of Girls.

Paper read by Mrs. BRYANT, before the College of Preceptors.

A rational curriculum must found its claim to consideration on satisfying the double educational demand of containing means for training all the human faculties, and supplying such kinds of knowledge, and to such an extent, as is necessary for the efficient understanding and acting out of life. If we do not teach our children how to live, by teaching them the main conditions of life, and do not so train them that they shall be better able to live, we may look on all our apparent successes with a sorrowful heart, and acknowledge them as little worth. These are the two practical aims which we all acknowledge, in whatever variations of language we may choose to express them; and, in sight of them, we must always renew the enquiry, of what to teach, and how to teach it; bearing them in mind, we must always make the attempt to construct a scale of value among subjects of instruction.

Professor Payne defined education as the harmonious development of all the human faculties. This seems to insist on one part of our educational aim, without any direct notice of the other; but Professor Payne spoke of education in its school-beginnings in childhood, rather than in youth and adult age too. Mr. Matthew Arnold, on the other hand, writing of schools *and universities*, makes the aim of education to consist in giving us knowledge of ourselves and the world. BY changing this last definition a little, we can combine both, expressed in the felicitous language of that felicitous writer:—*the aim of education is to enable us to know ourselves and the world.* This covers, as well as actual knowledge acquired, the whole idea of intellectual training; and to those of us who think that there is a good deal of truth in Socrates' opinion, that all vice is ignorance at the bottom, it seems to comprise a good deal of moral training too. To know, and have in us the capacity of knowing further, ourselves and the world, is, indeed, the grand condition, humanly speaking, of living life aright; and to live aright is the highest aim of life on earth.

The first requisite of knowing, and the earliest developed, is the faculty of observation. And, as I suppose nobody would contend that children ought to begin early to observe the internal world and its laws, we may, conclude that they should, first of all, be trained to observe the external world and its laws, and, at the same time, taught to know something of the facts surrounding them. This is, or should be, the aim of Botany and the Physics of observation, in which term I mean to include such general world-knowledge as is within the reach of the child at an early age.

Mere observation will not, however, tell us half the secrets that Nature has for her enquiring children. They must learn, not only to listen, but to ask questions; not only to observe, but to experiment; not only to recognise law by the observation of phenomena, but to seek it by the devising of appropriate circumstances in the midst of which it may be found. No concrete science is independent of experiment, and none of observation; but, as there are sciences in which observation is most conspicuous, so there are others which chiefly abound in experiment; and no curriculum can he considered complete that has not given such a training in the practical art of enquiry, and the logical methods of interpreting enquiry, as an experimental science only can give. It is scarcely necessary to mention Chemistry as perhaps the finest typical instance of this class.

But while we enquire of Nature, we must also think on what she tells us. We can hardly be good observers even, unless we are good reasoners too, not only inductively but deductively. It is not enough to take the laws which Nature gives us; we must, by the highest and fullest exercise of our reasoning faculty, find law again among these. If we do not, investigation becomes barren, and discovery almost accidental. It is all very well to know that acids turn blue litmus paper red, but it is more to have well developed in us the capacity of asking why; and this demand for the deductive explanation leads us to look more closely into the mysteries of Nature. Inductive enquiry asks, "Why is it true, and what follows from it?" and thus, at the same time, stimulates inductive enquiry and develops its results. One sometimes hears deductive reasoning depreciated in comparison with its younger sister; but it was not so that the discoverer of the laws of Inductive Logic regarded it. "The mode of investigation," he says, "which, from the proved inapplicability of direct methods of observation and experiment, remains to us as the main source of the knowledge we possess or can acquire, respecting the conditions and laws of the more complex phenomena, is called, in its more general expression, the Deductive Method, and consists of three operations: the first one, of direct induction; the second of ratiocination; the third of verification."

We must then, as a main point, become competent ratiocinists, unless we intend to be satisfied with substituting verification for proof, as beginners in geometry sometimes are, for want of the requisite logical development. Now all sciences and much language study gives some training in deductive reasoning or ratiocination, to use Mr. Mill's word. The logic of consistency, as it is sometimes called, is so necessary to all continued and precise thinking, that any continued and precise thinking, affords a development of it. Thus it happens that men and women who have had no real training in any well-marked deductive science, can yet be vigorous deductive reasoners. In fact, if one has many and various thoughts to arrange, it becomes a necessity to arrange them consistently. But, surely, no one would trust the development of this demand for inner consistency to occasional employment in the less exact sciences, and in the study of language, or in practical life, when there exists, ready to hand, a group of sciences which, starting from the simplest intuitions of Space and Time, or, if any one prefers it, from the simplest and most elementary inductions, develop themselves solely according to laws of mental consistency. I speak of occasional employment in the less exact sciences, because, though these require strict deduction for their satisfactory development, reasoning and statements of facts are of necessity so mixed up together in their subject matter, that it generally requires a mind already trained to follow closely the ratiocinative process in them. In truth, Mathematics is the one science that has put on completely a logical aspect, the one field in which embryo reasoners are compelled to perceive that they must be accurate reasoners, or—nothing. If we want to make the left hand strong and facile, we exercise it, not letting the right hand interfere. If we want to be deft, and powerful, and precise in thought, should we not use as means this science, that does not offer the distraction of external particulars, or admit doubt as to the reliability of its conclusions in other circumstances. The beginner may be very well pleased, at first, with showing (by verification) that the three angles of a triangle are equal to two right angles, but, he or she soon becomes aware of the fact that if the triangle were among the stars, for instance, this method of proof would not apply, and that there is no real proof at all except that which is universal and absolutely certain; and beginners do not take so very long to appreciate the truth, that, in comparison with the conclusions of Mathematics, all other scientific conclusions are only true conditionally—the conditions being those of the actual experience which supplied the data; whereas the conclusions of Mathematics are certain, absolutely and universally, so long as our minds are constituted as they are; and for us, of course, there is no other measure of certainly. Now, it appears to me that this inner and certain and self-contained nature of mathematical science has an educational significance, and marks it at once as a not-to-be-equalled instrument in training the mind to consistency with itself, and to direct and precise habits of thinking on all subjects whatsoever.

And the less logical a pupil is, and the less given to precise way of thinking and speaking, the more unpromising therefore as a mathematical pupil, and the more likely to attempt escape behind the plea of want of taste for the subject, the more necessary is it to persevere or else give up the hope of a complete training altogether. This, I confess, we may have to do sometimes, but only because training has been neglected too long—so long that it has become impossible even to make the best of very poor material. We never ought to do it without the inward humiliating confession of failure; and I am sure, that very often we may lose even brilliant after-results by having been too easily discouraged at first, or by continuing our work without faith in its ultimate success. For there is not in education any implement more powerful than faith: the measure of what we get from our pupils is very often the measure of what we believe that we shall get. We all know what it is to be believed in, and how, if there be sufficient time, and the belief be within rational bounds, it is certain to end in confirmation of itself.

We certeinly ought not to expect that the generality of young untrained minds, the fathers and mothers of whose owners were not properly trained before them, should take at once to pure abstract reasoning, even when introduced by a careful and not overdone elaboration of the abstract ideas involved, and made interesting by applications to experience, and fascinating by appeals to the imagination. Some persons do thus take to it, as ducks take to the water, without reference to experience, and even without need of the imaginative charms. The logical interest has indeed carried many through a first course of Geometry, with dim enough geometrical notions. But, very often, there will be difficulty at first, difficulty in concentrating attention, difficulty in connecting steps of thought, difficulty in inventing ways in which proof becomes attainable, difficulty, not least, in expression. Not difficulty so much in following another person's demonstration,—the most backward pupils will say, "I quite understand it when you do it, but I can't work it out myself."

But every time a difficulty is conquered, a chain of reasoning accurately carried out, or an easy problem rightly solved, there is a real glow of triumph which invests after difficulties with the pleasure of pursuit, and makes the troublesome art of reasoning interesting, if not easy, to acquire. A little more practice, and the necessary sequence of the reasoning becomes clearer, and the mind more on the alert to see, as well as to understand, the consequences of any one given fact with another. Then the science begins to unfold itself easily and naturally, and the beauty of this natural sequence of thought from thought begins to be really enjoyed.

So the logical charm comes into efficacy. Meanwhile,

just as, in the interrogation of Nature, it is necessary not only to observe, but to devise ways for observation, so, in the development of the Sciences of Number and Space, it is necessary not only to follow out the consequences prescribed by laws of reason, but to invent ways of bringing those laws into operation. In Geometry this is needed very early. Take Euclid's thirty-second proposition—which ought to be very early. Something has to be done, some way devised of bringing our previous knowledge of the properties of parallels to bear upon the facts of a triangle; and a characteristic exercise of invention, and the imagination which invention presupposes, is involved in success. If finding out direct consequences *per se* delight some minds, finding out how to find them out delights the rest. The pleasure to be derived from inventing geometrical methods, and discovering geometrical truths, is indeed enormous, and such as should make this science the most attractive in the curriculum.

When our pupils have reached this stage of being able to take pleasure in the logical development of Mathematics, and delight in their own powers of invention and discovery, they may tell us that they have not much ability for it, but they will hardly tell us that they have no taste; and if they leave school at this point they will leave it with some safeguard, in acquired capacity, against the jumping to conclusions, and treacherous reasoning, and uncertain credulousness, and equally uncertain incredulousness, that are only too common. In this dry clear atmosphere of absolute certain truth and unemotional thought, they have learned to think precisely and impartially, and have that power to carry with them into the much more difficult arena of actual life. Moreover, they have acquired a habit of looking closely into the *rationale* of all things—of getting to the bottom of a subject. They will not be put off with insufficient reasons; an indissoluble association between statement and proof has been wrought in their minds. We all know the story of the Senior Wrangler who asked of Paradise Lost, "What does it prove?" but it would be still more like a Senior Wrangler to ask, "How is it proved?" These two questions are indeed typical of the double training which mathematical study gives, accustoming us to look back for the reasons and forward for the consequences at once. Besides, our pupils will have acquired a certain ingenuity of invention, a power of concentrating attention, and a habit of expressing ideas clearly. These are valuable faculties in understanding oneself and the world, and the last is bound up with mathematical thought in an intimacy that cannot be too strongly insisted on. Mathematics is nothing unless it is clearly expressed; there is no escape from the necessity, and the result is an advance in the faculty of expression, more remarkable, it seems to me, than any that the study of languages can secure. The advance is indeed different in kind. Language study enriches our language; exact science gives us the command of it, requiring us to use it with the most precise sense of its meaning. For myself, I believe that one year's study of Mathematics gave me a greater power over language than many previous years of English reading and French and German study.

Nor is this all. The product in mental training of mathematical study is more than these invaluable qualities of hard-headedness, as above described. These are the result of its methods. The result of its subject matter is to be found in the remarkable development of the imagination which its study produces. The popular type of the mathematician is the mere algebraist, who does not see, or dream of seeing, that there is, as the greater men declare, at bottom of every algebraical conception a geometrical foundation. He does not call upon his imagination, because he is content to arrive at his results by accurate numerical reasoning, and does not want to picture them in terms of space imagination as well. The true mathematician is a different kind of person from this: he seeks for a form under all his thoughts; he thinks in terms of form; he sees the details of all form around him; he makes the most elaborate space-pictures in his mind at will—his imagination is the most remarkable thing about him. As a consequence, he is the most enthusiastic admirer of natural scenery, and remembers what he has seen with marvellous accuracy. It is inevitable, indeed, that he should be a passionate lover of beauties of form, even if of poetical appreciation he did not possess one iota. Geometry is the most perfect training of the physical imagination, and, as such, subserves the ends of æsthetic development, and all other ends that imagination forwards. As another matter of fact, the two geometrical nations *par excellence*, Greece and France, have built the most beautiful cities in the Ancient and Modern worlds respectively. We are not a geometrical nation, and no one would think, indeed, from our Cambridge text-books, that Mathematics is so pre-eminently elegant as it is thought and felt to be in France, or that it is, as Gauss says, a science of the eye. Our mathematical faculty lies in our great industry, and the positive pleasure we find in doing hard things in the hardest possible way,—the hardest possible way being all very well for the strong-brained mathematicians who write text books at Cambridge, whereas the most elegant possible way has æsthetic and other educational advantages which it might be well for the youth of the country if these strong-brained personages could come to see.

Professor Sylvester has a word bearing on this subject of the educational value of Mathematics in general, and Geometry in particular:—

"Some people have been found to regard all mathematics, after the 47th proposition of Euclid, as a sort of morbid secretion, to be compared only with the pearl said to be generated in the diseased oyster, or, as I have heard it described, 'une excroissance maladive de l'esprit humain.' Others find its justification, its 'raison d'être,' in its being either the torch-bearer leading the way, or the handmaiden holding up the train of Physical Science; and a very clever writer, in a recent magazine article, expresses his doubts whether it is, in itself, a more serious pursuit, or more worthy of interesting an intellectual human being, than the study of chess problems or Chinese puzzles. What is it to us, they say, if the three angles of a triangle are equal to two right angles, or if every even number is, or may be, the sum of two primes, or if every equation of an old degree must have a real root. How dull, stale, flat, and unprofitable are such and such like announcements! Much more interesting to read an account of a marriage in high life, or the details of an international boat-race. But this is like judging of Architecture from being shown some of the brick and mortar, or even a quarried stone of a public building, or of painting from the colours mixed on the palette, or of music by listening to the thin and screechy sounds produced by a bow passed haphazard over the strings of a violin. The world of ideas which it discloses or illuminates, the contemplation of divine beauty and order which it induces, the harmonious connexion of its parts, the infinite hierarchy and absolute evidence of the truths with which it is concerned,—these, and such like, are the surest grounds of the title of Mathematics to human regard, and would

remain unimpeached and unimpaired were the plan of the universe unrolled like a map at our feet, and the mind of man qualified to take in the whole scheme of creation at a glance.

"Seek not for fulness of knowlege," said Democritus, "but for fulness of understanding." Mathematics does a good deal that is indispensable towards this latter object, and so helps to make us capable of understanding ourselves and the world. What does it do towards that knowledge directly.

Knowledge of the laws of Number and Form is an important part of world-knowledge in itself, the most wide-embracing department indeed, since these laws apply to all things whatsoever Now, we in this nineteenth century may know, besides many facts about the world without asking our way of Mathematics; but our guides would not have the way themselves had they so acted; and, if we persist in ignorance of the necessary preliminaries, we must be content to find our progress in the understanding of Nature's laws repeatedly stopped and checked. First and independent among sciences, these two stand at the door of every other, so soon as it rises from being a classification to being a science, and no one can pass without a parley more or less prolonged. No science can be understood without some knowledge of Number. Even Botany presupposes that. The Physical Sciences and Chemistry ask a good deal more; quantitative modes of thought are continually called for, and the higher developments of Electricity. Heat, &c., are distinct application of Mathematics. Mathematical habits and mathematical ideas are absolutely invaluable. A distinguished chemist told me the other day that, in his opinion, Chemistry suffered much from the absence among chemists of mathematical training. I am sure that chemical students have suffered, as a glance at the text-books will show. Then look at the great group of sciences comprised under the old-fashioned name of Natural Philosophy. The observed facts of Nature here are few indeed, compared with the enormous developments obtained by the application of Mathematics to them. All the wonderful machinery of the nineteenth century is a product of this; not to be known really without it, any more than we can know the laws of the universe governing the motion of the stars and the development of worlds. If we would know the world, we must first of all know the necessary laws of Form and Number, which apply to all external phenomena whatsoever, and mingle with all other laws, so as to make these to a large extent unintelligible without them.

There is such a thing as Popular Science, which gives the results of difficult thought, avoiding the difficulty. Much of this is good, when the better of a real knowledge is unattainable. Popular Science is, however, for grown-up people who had not the education in youth which we should desire to see given to our children now. There is an evil inherent in it when taught as Popular Science in youth. It promotes habits of satisfaction with imperfect mental grasp, and that is a moral no less than an intellectual evil.

To know ourselves, and, in ourselves, the human race, is rather the concern of a very different part of the curriculum. The life of the human race, as revealed in History, and in Language with the Literature which it contains, can do more for us here, and, as so doing, its knowledge is essential; only let it not be the history of disorganised barren facts, but of living social growths and valuable biographies; let it not be the mere language of grammar and vocabulary, but a key to literature and a reflex of national lives and thoughts. The language of a people is an index of its character, and diversities of language note diversities of national character, the study of which is an added wealth to thought. Only among a nation of precise thinkers could the French language have grown up, and German is the expression of voluminous thinking; while Gaelic is, I believe, unrivalled in its capacity for invective and pathos. Then, there is the knowledge of antiquity which the study of ancient languages opens up,—only too often lost sight of, in the rage after grammar and idiomatic composition; as if it were more valuable to write empty Latin verses than to know the writers of antiquity as friends. We want to know what people thousands of years ago thought, rather than all the petty details of how they expressed themselves. Is not this overshadowing of the greater end by the lesser largely due to the the fact that we have forced on Classics that part in training which belongs most naturally to Science? Literature has to do with culture of the human side of life rather than with development of mental grasp and training to precision; and Literature, it seems to me, should be the main end of linguistic study.

After History, Language, and Literature, in the culture of this human side, come the Social Sciences, Some elementary sociology might be founded on historical studies, and such a typical social science as Political Economy should find a place in school education, if only to initiate habits of thought on social subjects.

Now here, again, habits of thinking quantitatively become invaluable, and applications of mathematical principles are sometimes called for. The Currency question, in Political Economy, is an instance of this. There can be little doubt, too, that as this young group of sciences grows, it will call more and more for development in terms of quantity. A moment's consideration shows that the Science of Society must necessarily involve mathematical principles largely in its development.

Are we to aim at knowing the inner individual self as well as the "ourselves" of the human race? Some day, I hope the subject Sciences will have their place at the end of the school course; but as yet it is perhaps too soon; our time is too short, and our burden too heavy, and our work too young (for it is quite true that we in England have been neglecting our secondary education till of late). Still our work in school must be considered with reference to a possible after-study of these. In truth, every one who is cultured at all is, consciously or unconsciously, given to metaphysical and ethical speculations; and it is certainly the business of education to see that his habitual tracks of thought should be such as to aid him in these speculations. At best we could only make a beginning in such studies at school, for real experience of life—individual personal life—is necessary to understand them. We must have thought and felt, manifoldly, before we can analyse thought and feeling; we must have lived, before we can really understand the problems of right living; and we must have gained a firm control of all our mental faculties, before we use them largely in the most difficult and misleading investigations of all.

With this last requirement our school course should supply us. It can make us ready to learn ourselves, by training us to observe and think well in general, and also by accustoming us to turn our thoughts inward in a reflective spirit. History and Literature offer means for this latter—means which may be neglected, but can be employed with much effect. But History and Literature do not give (indeed, sometimes rather discourage, so heterogeneous are the materials) any true training in precision of thought. On the contrary, it requires a

mind already well-trained to trace the rational in history, covered over as it is by heaps of incidental circumstances. The subject matter of our minds is not unlike the subject matter of History : it needs a mind made strong and sure by climbing the steep rocks of thought in some clear calm atmosphere without distraction, to succeed in finding the way amongst the slipping stones and bewildering fogs that beset the Sciences of Humanity. To have gained this strength and sure-footedness in the region of Mathematical Science is our best preparation for making right way, so far as we venture to make way at all. Is not the old and firmly rooted idea of the educational sufficiency of Classics and Mathematics, grouped together under the title of the Humanities, a recognition of the fact that training in these is a means of making life (the inner life, for nature has only been discovered very lately) worthy and comprehensible ?

Mathematics holds indeed, by its nature, a middle place between the sciences of the external and the internal, and is thus fitted to be an introduction to both. An *à priori* science, it is wholly derived from within, and applies its laws to all that is without. It can dispense with aid from experimental enquiry at Nature's hands, and all its needs are contained within the nature of the thinker himself. Though we may, and generally should, begin with invoking much aid from the senses, this is but a crutch to be thrown away as soon as possible. If indeed we rob Mathematics of its abstract nature, we actually rob it of one great part of its value as a mental training. The mathematician is independent of all things but his own mind (though he will not do well to shut himself up in it) : his work is to think out his thoughts to the end. Is not this also the psychologist's task ? He, too, is self-contained ; only he has to add to the work of thinking out his thoughts the more difficult one of seeing into them. The connection between the abstract and subject sciences is close, therefore, on account of the innerness of both. Again, as Mathematics gives law to the physical sciences, so also does it, in a certain sense, to the subject sciences ; and as these develop, they too will come more and more under the laws of Number, and will depend more and more for intelligible language on illustration in terms of space.

I would submit then that training in the exact sciences is an invaluable preparation for that " proper study of mankind " which I hope one day to see occupying a much more prominent place in education than at present. And I would the more strongly call attention to this, because that study is so liable to be beset with weakly sentiment and false glamours, that it is the more necessary to come to it with the quality for hard-headed, cool-blooded, thinking well developed. We must turn the dry light of intellect on human affairs, and most of us must first acquire the dry-light quality elsewhere.

Mr. Mill has something touching on this subject which with your permission I will quote.

" The value of mathematical instruction as a preparation for those more difficult investigations, consists in the applicability, not of its doctrines, but of its method. Mathematics will ever remain the most perfect type of the Deductive Method in general ; and the applications of Mathematics to the deductive branches of Physics furnish the only school in which philosophers can effectually learn the most difficult and important portion of their art, the employment of the laws of simpler phenomena for explaining and predicting those of the more complex. These grounds are quite sufficient for deeming mathematical training an indispensable basis of real scientific education, and regarding [according to the *dictum* which an old but unauthentic tradition ascribes to Plato] one who is *ageometretos*, as wanting in one of the most essential qualifications for the successful cultivation of the higher branches of philosophy."

It has been my object to show that the place which mathematical science holds in a scheme of human development and of human culture is such as cannot otherwise by filled. Whatever else may be turned out of education, this cannot be without direct suffering to half the rest, and indirect suffering to almost all. The world cannot be understood without it, and its training is our safest safeguard from error in the interpretation of ourselves. It is the most effective agent in the formation of accurate habits of thinking, of the power of concentrating attention, and precise modes of expression. It is also the sure corrective to habits of mixing up sentiment and prejudice with processes of thought, and has at the same time an important æsthetic value. As a training in deductive reasoning it is unrivalled, and in processes of invention, imagination, and conception unsurpassed.

Now, in all this, I do not mean that mathematical training is so supremely excellent as to dispense at all with the necessity for the other typical subjects, a Science of Observation, a Science of Experiment, Language, Literature, and History. A mere mathematical training is a poor thing indeed ; witness the Senior Wrangler before mentioned, who had reasoned out of his soul every particle of poetry he had once possessed. There is a mental region where Law, on the face of it, does not obtain, and it is the height of folly to refuse its supplies. No one is truly cultured who is deficient in literary susceptibilities, who cannot cast Law to the winds on occasion, and enter into the free life of poetry and art. Nevertheless, I do hold that Mathematics is more important than any one of the other typical subjects taken separately ; that, if we had to retrench in some direction, it should not be in that direction ; that Mathematics and one Language, or Mathematics and one concrete Science, are better than that Science and that Language without it, Literature not being neglected in any of the three cases.

What is to be said, then, for those who would contend, who even now still contend, that Mathematics is a superfluity in the education of girls, or at any rate of very minor importance to one half of humanity ? And why forsooth ? Well, first, because girls have no need in life for the knowledge and the training ; and, secondly because the feminine mind has a marked incapacity for the subject.

No need in life for the knowledge or the training ! Have women, then, no need to understand themselves and the world ? Perhaps not ; only it must follow that men, being human beings, under the same general relation to their own minds and the world, can have no need either. What is the difference ? From the very most ultimate conservative point of view, I suppose, the difference would be that women are destined to do the lighter work of life, and have the larger share of bringing up the next generation. Well, then, if the men who do the heavy work, who get to understand the world by rubbing against it, who find no place for illusion or false sentiment or general weakliness of spirit in the ups and downs of life, if they need this knowledge and training to give true dignity to their lives ; how much more must those others need it, in their ideal sheltered homes, with restricted liberty and limited experience, and yet with the most important duties of all to fulfil—duties which do demand day by

day, and ostensibly, a knowledge of life and the world, a wide horizon, and a thoroughly trained mind. Why, the more special one makes the destination of women, the more urgent becomes their claim for an equal and similar education with men, the more necessary to extend to their case at once any argument concerning subjects of instruction for human beings in general.

To come to the second point;—all questions of capacity are ultimately questions of experience. It is always an interesting little exercise of ingenious argument, to deduce from some assumed theory of the feminine mind the kind of studies suited to it; but, unfortunately, it is equally easy to prove, in this way, all sorts of contradictory assertions. Women are emotional; women are practical; women are imaginative; they cannot learn Latin, or they can; they cannot learn Mathematics, or they can. It is quite immaterial which side we take; they are both so extraordinarily susceptible of proof—not mathematical proof, however. It would not be at all an unpleasant task, in my estimation, to frame a little theory about the feminine mind, founded upon facts, and prove from it, that girls might be expected to take special pleasure and have much success in mathematical studies, on account of the specialities of mental constitution which their special position is fitted to develope. To do this would be possible, and not unpleasant, and, moreover, it might be true—just as true as any other working theory, before sufficient facts for its proof are collected. But it is much too soon to do this yet. Girls are only beginning to get an equal and similar chance of mental development with boys; we cannot tell for several generations yet what the result will show the feminine mind to be, whether sex is appreciable in inteilect at all, or, if there be differences, of what kind and to what extent. At present, we can only speak of facts, and avoid generalisations as much as possible, only noting in what direction the facts point.

Experiments in girls' education have been going on long enough to indicate at least that generic intellectual similarities in race are enormously greater than specific differences in sex. But this is a generalisation, which was to have been avoided. Well, the experiments have shown that success has attended the efforts to introduce all the new subjects one by one. The results of examinations show that average girls have learned Latin, Arithmetic, Natural Science, Mathematics, &c., with success.

The examinations of this College show, as regards Arithmetic, a distinct tendency to steady improvement on the part of the girls. How many girls' schools in England really taught Arithmetic twenty, nay ten years ago? And now Mr. Hodgson tells me that, while bad Arithmetic still comes from a greater number of girls' than of boys' schools, no difference is discernible between the best schools for either sex. Remembering that Arithmetic was not taught to girls ten years ago, it is of course impossible that there should be a sufficient number of good teachers now to supply all the schools; but the old state of things is passing away with marvellous rapidity. It is a significant fact, that the Examination history of the Arithmetic of girls' schools in general should be—first a break-down, then a rapid improvement inexplicable save on the supposition of a revolution in the method of teaching. Two years ago a comparison was made of the results in the Cambridge Examination list respecting the most important boys' and girls' schools. Of failures in Arithmetic a girls' school had the smallest percentage. This year the percentage in the same school is zero. These facts do not seem to follow very readily from the hypothesis that girls are naturally inferior as regards the study of Arithmetic. The fact that lends colour to that hypothesis is, that on the whole more girls fail than boys; but look closer, and it turns out that this undue proportion of failures comes from the schools which have only lately allowed themselves to come under the mind-awakening lash of examinations; and who does not know how deep was the slumber in which the education of girls was wrapped before the days of examinations and criticism?

Mathematics has not been made obligatory either by this College, or by Cambridge and Oxford in their Local Examinations; and it being manifestly more convenient at first to take up the subjects long established in girls' schools, few girls enter for it. At the London General Examination, however, Geometry, Algebra, and Natural Philosophy are required, and the result is not very fatal. The girls, or their teachers, have not yet found it necessary to complain of that originality in the Geometry papers developed of late years, which has given rise to so much suffering and some little vituperation. One of the present Mathematical examiners, Professor Townsend, has personally expressed to me his satisfaction at the intelligent and thoughtful way in which the girls give their answers. "The average girl," he says, "contrasts, in my opinion, very favourably with the average boy at examinations. As a rule, I have found her answer more as an intelligent being and less as a mere machine than I have found him, and I have found her attempt less where she did not know than I have found him. This may possibly arise from the circumstance that the girls I have examined have been few in comparison with the boys, and for the most part trained in the best schools of the country. But it does not the less unmistakeably prove their capacity for mathematical study."

At Girton College the girls have the same choice of subjects for their Degree certificates that the young men have for their Degrees. At first, the far-famed Mathematical Tripos was not much sought after. There have been no failures, and up to the present 5 have taken the Classical Tripos, 3 (at least) the Moral Science, 3 Mathematics, and 2 Natural Science. Now, out of the 38 students, 1 reads History, 3 Moral Science, 5 Natural Science, 9 for the ordinary Degree, 9 Classics, 11 Mathematics. So it seems that the feminine mind is rising to this subject at Cambridge, as it has been rising to Arithmetic in the schools. When a large number of facts of this kind have accumulated, we shall have a true *reductio ad absurdum* of the feminine incapacity argument.

I find in my own experience, that there are mathematical geniuses (so to speak) among girls—young people who get on with Algebra and Geometry from the first, better than with anything else; who sometimes do dreadful things in Arithmetic, but are quite at home with number in the abstract, and apt to become enthusiastic over a geometrical solution; who take quite naturally to logical methods of thought, and have no difficulty with mathematical conceptions; who seem to have been born with a capacity for imagining combinations of lines in all sorts of inconvenient positions.

Then, there are the girls who do everything well; who have a genius for every thing, and take pleasure in everything, and make steady way from first to last with mathematical work. The cleverest generally clever girls I have known have made this subject a special favourite—both Pure Mathematics and Applied.

Then, there are the average girls, some having more ability in one direction, and some in another. These form the bulk of a class. The other day I asked a

number of these young people (certainly not a selected number) whether they liked Geometry. The unanimous reply being "Yes," I went on to enquire, "Why, what is the attraction?" After a minute's thought one girl said, "It is so nice to see the proofs coming out," and the rest accepted the explanation. I then went on to ask whether the pleasure lay simply in seeing this gradual evolution of truth from truth, or in partly finding out the processes for themselves; and I think I understood that the chief pleasure was the very English pleasure of pursuit. These were beginners, who knew less than the contents of Euclid's first book, but they were quite capable of appreciating logical processes and enjoying the hard work of discovering methods of proof. They also told me that they liked Geometry better than French (the typical girls' subject), two only dissenting. I then enquired about Algebra, and found it most strongly approved of.

Girls do quite as well with Mathematics as with any other subjects. The start is difficult in the majority of cases, as I understand it is generally, and as, from the nature of the subject, one would expect it to be; but pleasure in the work is soon aroused, and then all goes well. I find that the secret of success lies in the solution of original questions. The first real success in an effort of this kind is always the turning point. I never let beginners in Geometry have a book, and try not to do more for them than is sufficient to serve as a model of what they should do for themselves, or to suggest to them means of help. Gain of geometrical knowledge ought, in the beginning, to be coincident with gain of geometrical power. Appeals to memory, when substituted for efforts of reasoning, make the dull learners still duller, and clog the wings of those who can fly. Memory has its function later. Gain of knowledge being thus coincident with gain of power, the second year is always in a marked degree a great improvement on the first, and the third year on the second, and the average girl leaves school with very respectable mathematical acquirements.

I do not deny the existence of girls who are very slow indeed in taking hold of mathematical ideas and methods; but, so far as my experience has gone, these are nearly always weak persons all round. I cannot see myself how elementary Mathematics can present enormous difficulties to any person with fair abilities of whatever kind, unless there has been some mistake in training or it has been delayed too long.

I believe, then, that girls are quite as capable of learning Mathematics as boys. I take this belief as a credible hypothesis on which to work, and hope that one day its truth will be proved by a *reductio ad absurdum*, by the demonstrated contradiction of the contrary hypothesis to the facts which will then have sufficiently accumulated.

But, even if I did not believe this, I should still hold that to this subject belongs, for girls as for boys, the position of central force in education, from which radiates most fittingly exact knowledge and efficient training in all things. We may choose to make any other subject the central force instead; but in so doing, as regards human nature generally, we substitute the artificial for the natural; because the mathematical habit of thought is, in its nature, the backbone of intellectual power, and mathematical science is at once the foundation, the scaffolding, and part of the superstructure of the temple of knowledge. That this is so, I have very imperfectly attempted to show.

Mr. Mason concurred in the whole substance and purport of the paper, and congratulated the lecturer's pupils on having so able teacher. From the results of a large experience of examination work, he could certify that not only could girls learn Arithmetic and Geometry as well as boys, but that, on the average, the girls did better than the boys in those subjects; they showed more accuracy, and intelligent comprehension of the processes. In regard to Geometry in particular, evidences of rotelearning were conspicuous in the work of the boys, and the diagrams seemed often to be used merely as a kind of *memoria technica*. He could not help remarking on the delusive character of what was termed "Science" in school teaching, and insisting on the great superiority of mathematical studies for training the mind of the young. The method commonly pursued in the so-called Science teaching tended to engender a habit of taking on trust, without verification, which was destructive of the mental precision which it was so desirable to cultivate. In reference of the function of the imagination in mathematical investigations, it might be remarked that the Greeks were of old the most distinguished mathematicians, and they were also without dispute the most imaginative people.

Mr. Drew remarked on the absurdity of the popular notion that mathematical studies were unfit for girls. This prejudice was very generally found among parents; but teachers ought on no account to give way to pressure, or allow their convictions to be overcome by the prejudices of ignorance. He referred to the advantages of educating boys and girls together in "mixed schools," and was of opinion that women might well be employed to teach boys. The female mind was quite as capable as the male of dealing with the abstract sciences, and it would generally be found that girls took a greater interest in such studies than boys. The results of the Government Science and Art Examinations showed that this was the case. He differed, however, from the former speaker as to the value of Science teaching in school education, and thought that the publication of of the large number of Science Primers written by men of the highest authority in their respective fields of study, was of good augury for the proper development of this hitherto too much neglected branch of instruction.

Mr. Mast thought it was material to enquire whether the age and natural mental growth of the pupil should not be considered in reference to the nature of the studies to be taken up at the different stages of the school course. He was of opinion that language studies were better adapted than mathematical to very young children.

Mr. Ellis said that the lecture they had all listened to with so much pleasure reminded him of the saying that "there was nothing like leather;" but it was of course possible to go too far in this direction. The notion of the principles of Mathematics being based on intuition, and not on induction, he held to be fallacious. It was a popular saying that mathematicians were the worst of reasoners, and the explanation was not far to seek; for the field of view of the mathematician was, from the nature of his subject, very limited as compared with the problems of practical life. It was not correct to say that Mathematics offered a good training in Logic; but in that the former deals with such simple things, it was peculiarly fitted to become a good introduction to the latter. Mathematics did not give the laws to the other sciences; but furnished rather the *tools* to dig out truth. Professor Sylvester, whose opinion had been quoted, was indeed himself an imaginative man, but it was nevertheless hard to believe that the study of Mathematics did appeal to the imagination in any appreciable degree. There was undoubtedly an emotional feeling of triumph to be extracted from the solution

of the dullest of mathematical problems ; and it would be the aim of intelligent and enthusiastic teachers, whether of boys or girls, to awaken this feeling of pursuit and carry their pupils on to patient and continuous exertion, which was one of the most desirable results of school training.

Mr. Magnus said that the lecturer had ably shown the important part played by Mathematics as the handmaid of Science. He quoted the opinion of Professor Tait that the physicist must be a mathematician ; and recent examples showed to what an extent mathematical processes could be employed even in such a science as Sociology. In regard to the part the imagination might play in the study of Mathematics, he thought that it could not at any rate be brought to bear on the elementary parts of the subject. And with regard to the proper place of Mathematics in education, it seemed to him that the lecturer was not quite on the right track. The proper object of the study of Mathematics was not the cultivation of the logical faculty, but for learning the properties of space ; and he would even go so far as to say that Logic could be better taught without Mathematics than with it. It was surprising to what an extent an apparent knowledge of geometrical reasoning was sometimes found co-existing with ignorance of the properties of space, as shown in the figures drawn to illustrate the proofs. He thought that strict accuracy of form should always be required. Problems also should be used to a greater extent, and the constructions be worked out carefully step by step. He could add his unqualified testimony as to the great improvement that had taken place of late years in the arithmetical teaching in girls' schools ; some of the very best papers he had had the pleasure of looking over had been worked by girls, and he was entirely of opinion that the female mind was well adapted to such investigations. He had great pleasure in moving a vote of thanks to the lecturer for her very thoughtful and practical paper.

M. Spratling could not agree with what appeared to be the general opinion of those who had taken part in the discussion as to the equal capacity of the male and female mind to deal with the difficulties of mathematical studies ; and he sought in vain for examples of women who had distinguished themselves in this field. If boys were found to be dunces in this as in other branches of study, it was, he thought, owing in great part to the laziness and indifference of their teachers ; whereas the women had set themselves with praiseworthy energy to show that the girls were as good as the boys, and the results were in proportion to the efforts put forth.

Mrs. Bryant having replied to the various speakers, the vote of thanks was passed by acclamation, and the proceedings terminated.

Samuel Johnson.

Most men of letters, like most men of science, have gained their reputation by their power of entering into an understanding that which was outside of them and different from them. Dr. Johnson gained his reputation by this unrivalled power of concentrating his own forces, of defending himself against the aggression of outer influences—and striking a light in the process. Of course Johnson was a man of very strong general understanding. Had he not been so, he could not have commanded the respect he did, for those who do not in a considerable degree understand others, will never be themselves understood. Still admitting freely that it both takes a man of character as well as insight to understand distinctly what is within himself, it is clear that Johnson's genius lay in the latter, not in the former directions, in maintaining himself against the encroachments of the world, and in interpreting himself to that world, not in enlarging materially the world's sympathies and horizons, except so far as he taught them to include himself. The best things he did of any kind were all expressions of himself. His poems—'London' and 'The Vanity of Human Wishes.'—'Life of Savage' —almost all his moral essays of any value, and above everything, his brilliant conversation, were all shadows or reflections of that large and dictatorial, but in the main, benign character which he has stamped for us on all he did. Of his companions and contemporaries, all but himself won their fame by entering into something different from themselves—Burke by his political sagacity, Garrick by imitating men and manners, Goldsmith by reflecting them, Reynolds by painting them, Boswell by devoting his whole soul to the faithful portraiture of Johnson. But Johnson became great by concentrating his power in himself, though in no selfish fashion, for he concentrated it even more vigorously in his unselfish tastes,—for example, in the home which he so generously and eccentrically made for so many unattractive dependants—than in the mere self-assertion of his impressions and his convictions. What made Johnson loom so large in the world was this moral concentrativeness, that incapacity for ceasing to be himself, and becoming something different in deference to either authority or influence. His character was one the surface of which was safe against rust or any other moral encroachment by things without. And it has capacity for not only making this visible, but for making it visible by a sort of electric shock of surprise, which announces his genius for repelling any threatening influence, that constitutes the essence of his humor. Some of his finest sayings are concessions in form to his opponent, while in reality the yreassert with far greater strenght his original position. They are, in fact, fortifications of his personal paradox instead of modifications of it—the fortifications being all the more telling because it took the form of an apparent concession. Thus when he said of the poet Gray, 'He was dull in company, dull in his closet, dull everywhere—he was dull in a new way, and that made people think him great,' his concession of novelty to Gray was, in fact, aggravation of his attack upon him. And still more effective was his attack on Gray's friend Mason. When Boswell said that there where good passages in Mason's 'Elfrida,' Johnson replied that "there were now and then some good imitations of Milton's bad manner.' Or take his saying of Sheridan, Why, sir, Sherry is dull, naturally dull ; but 'it must have taken him a great deal of pains to become what we now see him. Such an excess of stupidity, Sir, is not in nature.' Johnson's humor, indeed, generally consists in using the forms of speech appropriate to giving way, just as he puts the crown on his self-assertion, as in the celebrated attack on Scotch scenery, in answer to the Scotchman's praise of the 'noble wild prospects,' to be found in Scotland—'I believe, Sir, you have a great many. Norway, too, has noble wild prospects, and Lapland is remarkable for prodigious noble wild prospects. But, Sir, let me tell you, the noblest prospect which a Scotchman ever sees is the high road that leads him to England.'

The McGill University Calendar for the Session of 1878-9.

This is a thick 8vo pamphlet of 148 pages, and with the examination papers a bound volume of considerable sixe, and the matter which it contains is condensed in such a manner as to give the greatest possible amount of information in the least possible space. The advantages which the City of Montreal and the McGill University in particular, offer to intending students are well worthy of their consideration, and we would commend this calendar to their study. The Faculty of Arts, which its four years' course of Literature and Science, stands much as in previous years, with some minor improvements in text-books and in arrangement of subjects. Nine exhibitions and scholarships of the value of $100 to $125, are offered for competition in the matriculation examinations of September, 1878. The new Faculty of Applied Science, until this year a department in Faculty of Arts, presents a four years' course of study, leading to the professions of civil engineering, mechanical engineering, mining engineering and practical chemistry. These courses are freely set forth in detail and seem very complete. The Medical Faculty, now very fully and ably officered, gives more completely than heretofore the details of its course of study, along with the specialities provided for in its summer course. Great attention is now given in this Faculty to Histology and to clinical demonstrations, and courses in Hygiene and Ophthalmology and Otolgy have been added. In the Faculty of Law the course stands as in former years ; but now arrangements are being made to ensure more full courses of lectures and a higher standard of examination. The McGill Normal School will commence the 26th session of its useful work next autumn ; and as usual offers a thorough training free of expense to all intending teachers. The calendar may be obtained on application to the secretary of the University.

OFFICIAL NOTICES.

Department of Public Instruction.

Notice of applications to fix limits of school municipalities in virtue of the 5th section, 41st Vict , ch. 6.

To detach from the school municipality of East Farnham, in the county of Brome, lots Nos. 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26 and 27, in the sixth range, and to annex them to the parish of Saint Alphonse, in the county of Shefford, for school purposes, the description being as follows : bounded on the north by the road separating the 6th range of East Farham, from the first range of the township of Granby, on the east by the line separating lots Nos. 15 and 16, on the west by the seigniorial line, and on the south by the line separating the 5th from the 6th range of the township of East Farnham.

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To detach from the school municipality of the parish of Saint Zotique, all that portion of the lots and lands of the said municipality situate below the Sainte Catherine range, and annex the same to the school municipality of the parish of Saint Polycarpe, of which it already forms part for all other purposes, religious and civil, to take effect from and after the 1st of July, 1879.

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His Excellency the Lieutenant Governor has been pleased, by order in Council, dated the 6th of July last 1878, and in virtue of the powers conferred on him to order :

Saint Roch North, Quebec :—That there be detached from the school municipality of Saint Roch of Quebec North, all that part thereof which lies to the west of the easterly boundary of the property of present owned and occupied by one James Gillespie, and to annex the same to the school mu .icipality of Saint Sauveur de Québec.

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Notice of erection, &c., of a school municipality, in virtue of the 5th section, 41st Vict., ch. 6.

Application to erect into a school municipality under the name of "Saint François Xavier de Shefford," the parish of that name, comprising part of the township of Shefford ; part of the township of Granby, in the county of Shefford ; part of the township of Brome ; part of the township of Farnham East, in the county of Brome ; with the limits assigned to it by the canonical erection of the said parish of Saint François Xavier de Shefford.

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Notice of erection, &c , of school municipalities, in virtue of the 5th section, 41st Vict., ch. 6.

Application to erect into a school municipality under the name of Notre-Dame des Bois de Chesham, detached from the school municipality of the United-Townships of Ditton, Chesham aad Emberton—with the limits assigned to it by the canonical erection of the parish of N.-D. des Bois de Chesham.

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Application to erect into a school municipality under the name of the Village of Roxton Falls, in the county of Shefford, detached from the school municipality of Roxton—with the limits assigned to it for municipal purposes.

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COMMISSIONERS.

By order in Council, dated the 25th of July last 1878 :

Montreal.—Catholics.—The Revd. M. Ed. Moreau, continued in office.

Montreal.—Protestants.—The Revd. John Jenkins, D. D., continued in office.

Quebec.—Catholics.—F. L. Gauvreau, esquire, continued in office.

Quebec.—Protestants—The Revd. Charles Hamilton, continued in office.

An act to further amend the laws respecting Public Instruction in this Province.

[*Assented to 9th March*, 1878.]

Her Majesty, by and with the advice and consent of the Legislature of Quebec, enacts as follows :

1. Section 24 of the act of this province, 39 Vict., Cap. 15, is repealed, and the following substituted therefor :

"24. An appeal lies by summary petition, signed by the parties interested, or by their attorney, from the decisions of the superintendent, to the council of Public instruction, or to one of the committee thereof, whenever the said parties interested have no recourse before the courts, and the law does not declare the decision of the superintendent to be final.

In cases where the decision of the superintendent refers to a difficulty between catholics and protestants, the appeal lies to the council of public instruction ; in the case of a difficulty between persons of the same religious belief, the appeal is within the competence of the committee of the said council which represents that belief."

2. The council of public instruction, and the committees of the said council, shall make and adopt the rules and regulations respecting such appeal which are subject to their respective jurisdictions, and may establish such fees as they may deem expedient, to cover the costs or disbursements of such appeals.

Such regulations and tariff shall be published in the *Journal de l'Instruction Publique* and in the *Journal of Education* and shall be obligatory.

3. The council of Public Instruction and each of the committee thereof are authorized, to appoint sub-committees, which shall consist of n ot less than three mem-

bers, for the consideration of all affairs submitted to them, and such sub-committees shall make a report of their proceedings to the council or to the committee, as the case may be, which appointed them, and which shall adopt or throw out such report.

4. Each of the commitees of the said council of Public Instruction, may alter the holding of meetings of boards of Examiners and fix the date at which each of said boards shall hold its meetings, in such manner as it may deem proper, subject to the approval of the Lieutenant Governor in Council; and the Superintendent shall cause such alterations to be published in the *Journal de l'Instruction Publique*, in the *Journal of Education* and in the *Quebec Official Gazette*.

5. Section 30 of chapter 15 of the Consolidated Statutes for Lower Canada is repealed, and the following is substituted therefor:

"30. The Lieutenant Governor in Council may, from time to time after the limits of existing municipalities for school purposes, subdivide such municipalities or erect new ones, but these alterations, subdivisions or erections shall only take place after public notice, inserted twice in the *Quebec Official Gazette* and once in the *Journal de l'Instruction Publique* and the *Journal of Education* shall have been given at the expense of the parties applying for such alterations, subdivisions or erections of municipalities, and with all due diligence by the superintendent; and if these alterations, subdivisions or erections of municipalities take place, notice thereof shall be given by the superintendent in the *Quebec Official Gazette*.

6. Section 31 of the said chapter 15 is amended, by adding at the end thereof the following words:

"The school commissioners or trustees of any incorporated town or village, which has been or may hereafter be erected into a separate school municipality, need not, if they do not judge it advisible, divide the school municipality under their contract into school districts; and if such a division has already taken place, they may, by resolution, annul and cancel it, in which case the whole of such school municipality shall be considered as forming, and it shall form, only one school district."

7. The school inspectors shall be *ex-officio* visitors of academies and model schools under the control, management or direction of the school commissioners or trustees, in their district of inspection; but it shall be lawful for any inspector to visit the schools within any district of inspection, other than that confined to him, on receipt of an order from the superintendent, and to report on such visits, as well as on those made to schools in his own district.

8. The superintendent, and, by his special appointment, the secretaries of the department of public instruction, the editor or editors of the *Journal de l'Instruction Publique* and the schools inspectors have power to hold inquiries, to summon before them and administer oaths to all persons, witnesses or parties, in all inquiries or difficulties whatsoever which may arise in reference to the schools or school houses, in the same manner and to the same effect as is such powers had been specially conferred upon them by the Lieutenant-Governor; the whole in accordance with the statute passed in the the 32nd year of Her Majesty's reign, chapter eight, intituled: "An act respecting inquiries concerning public matters," which shall apply to such inquiries and to all those which the superintendent and each of the committees of the Council of Public Instruction may order.

9. Saturday is declared to be the the day on which every school under the control of commissioners or trustees shall have its holiday, unless a by-law to the contrary be passed by the said commissioners or trustees and be approved by the superintendent; but such by-law may, at any time, be repealed by the superintendent or by the commissioners or trustees after notice duly given by these latter to the superintendent.

10. The form annexed to the present act is substituted to the form No. 19 of the act 40 Vict., cap. 22, but the engagements of teachers entered into in virtue of the latter shall be valid for the whole period for which they were made.

11. Sections 45, 46, 47, 48 and 49 of the act 40 Vict., cap. 22, are repealed and replaced by the following, which shall form part of the said act:

"45. There shall be made, each year, or as often as required, a report to the superintendent by the principal of the Polytechnic School, or by any other person whom the superintendent may and is authorized to appoint to make an examination shewing:

1. The curriculum followed at the school;

2. The degree of progress of the pupils of the said school, as ascertained by the examination passed by them on the different branches of the sciences which have been taught them during the year;

3. The state of the collections, instruments, laboratory, library, etc., and also upon all which concerns the studies in the said school;

4. The amount of receipts and expenditure of the institution, and of everything which concerns its statistics and working."

"46. This report shall shew the result of the examination and the classing of the pupils, according to their ability. It shall also state the improvements, alterations or modifications indicated with respect to the teaching, and the length of the courses of study; the said report shall be addressed to the superintendent and to the roman catholic school commissioners of the city of Montreal."

"47. In accordance with this report, the superintendent shall deliver to each pupil who shall have regularly followed the complete course of studies of the said school, and who shall have passed at the end of each school year a satisfactory examination before the principal and the professors of the said school or any other person appointed by the superintendent, an engineer's diploma, according to the branch of scientific knowledge to which the pupil shall have applied himself, either a diploma of civil engineer, mining engineer, mechanical engineer, or, lastly, as industrial engineer; and the names shall be published in the *Quebec Official Gazette*, indicating the grade of the diploma obtained by each of the successful candidates. Mention shall also be made in the diploma in accordance with the opinion expressed in the report, that the pupil had passed his examination in a satisfactory manner, or with distinction, or lastly, with the greatest distinction."

12. Section 59 of said chapter 15 of the Consolidated Statutes for Lower Canada is amended by adding thereto the following:

"2. The chairman of the school-commissioners may call a meeting of the latter, by a notice signed by the secretary-treasurer, in the name of the chairman. Two commissioners may require the chairman, in writing, to call a meeting, and he shall thereupon be obliged to call such meeting under penalty of a fine of two dollars."

"3. The meetings of the commissioners are not public; but the commissioners or trustees, as the case may be, may admit such persons as may desire to be present on business.

13. Sub section 5 of section 64 of cap. 15 of the Consolidated Statutes for Lower Canada is repealed and replaced by the following:

"5. If it be necessary to purchase or build a school-

house in any district whatever, the school commissioners or trustees may, at all times, for this purpose, tax, either the particular district, or the whole municipality, according as one or the other plan shall have been already adopted in the municipality.

If a house for a model school be in question, the district in which the said school be situated is first taxed for an amount equal to that which it would have cost the district to erect a primary school. The balance necessary to render the house fit for a model school, shall be levied on the whole municipality, the district also paying its share.

The ordinary notices required for all taxes shall also be given for such tax."

"5*a*. The superintendent may authorize school commissioners or trustees of any school municipality, not being a town or incorporated village, to build and maintain two or more school houses in any school district."

5*b*. The school commissioners or trustees of any municipality which has not yet been divided into school districts under the provisions of this act, may upon the recommendation of the superintendent and with the approval of the catholic or protestant committee of the Council of Public Instruction, as the case may be, enlarge the school buildings already existing, erect one or more additional school houses as may be required for the accomodation of the pupils in such municipaliy, and embellish and ornament the grounds surrounding such school houses and buildings; and for the above purposes, the school commissioners or trustees may raise, by a special tax, the funds necessary to defray the expenses thereof, provided the total amount of such expenses do not exceed, in any one year, the sum of $3000.

14. Sub-section 7 of said section 64, as amended by the act of this Province 40 Vict., chap. 22, section 10, is further amended, by adding thereto the following sub-section:

"7*a*. And the said school commissioners or trustees may upon the recommendation of the superintendent, and with the approval of the catholic or protestant committee of the Council of Public Instruction, as the case may be, and in accordance with the formalities and rules which shall be adopted, laid down and passed by such committee, which shall have the force of law, in addition to the powers already conferred upon them by the preceeding sub-section, devote to the aid and maintenance of such superior schools, academies or model schools, which are under their control, a sum which shall not exceed in any one year, $1000, to be divided by them among such educational institutions according to their several wants; and the amount thus appropriated by the said school commissioners or trustees shall be included in the general tax raised by them.

15. Sub-section 2 section 64 of chapter 15 of the Consolidated Statutes for Lower Canada, is amended, by adding thereto the following sub-section:

"2. The school commissioners or trustees of any school municipality which is not divided into school districts, may establish a graded system of schools, whenever they deem it advisable so to do for the better advancement of education and administration, of the schools under their control with the approval and sanction of the catholic or protestant committee, as the case may be, upon the report of the superintendent."

16. Section 26 and 63 of cap. 15 of the Consolidated Statutes for Lower Canada are repealed and replaced by the following section:

"In case of difficulties between the commissioners or school trustees and the secretary-treasurer in office or who has abandoned the office in the municipality, or in case of a written application to the superintendent from at least five contributors to the local school fund, having for the object the revisions of the accounts of the said secretary-treasurer for the year ending of the first of July previous, or for any other year, the superintendent may cause the said accounts to be laid before him with vouchers therefor, or copies of the said accounts and on the whole render judgement in detail, which shall be entered in a register by him kept for that purpose, which shall have force of a judgement of arbitration between all the parties and shall be authentic, as well as any copy thereof certified by him or by the secretary of the department of Public Instruction, or the superintendent shall himself proceed to the place in question, or shall appoint a delegate in his stead.

The examination shall take place in presence of the commissioners in regular meeting assembled and of the said secretary-treasurer duly summoned to appear at the said examination, under penalty of being condemned by default.

The superintendent, whether he has examined the accounts himself, or has had them examined by his delegate, shall deliver judgment after mature deliberation, which, as in preceding case, shall be entered in the book kept for that purpose and shall have the force of a judgment of arbitration between all parties and shall be authentic and final in all cases.'

17. The school commissioners and trustees have the right to appoint an auditor to examine and audit the accounts kept by their secretary-treasurer, in office or out of office.

2. The chairman shall give written notice thereof to the secretary treasurer either personally or at his domicile by a bailiff, who is authorized to act under his oath for all the purposes of this act, notifing him that he may assist at the said auditing and give his explanations to the auditor. If he refuses or neglects to attend, the auditor shall proceed to the examination and auditing of the said accounts and shall make his report to the commissioners or trustees.

3. The auditor so appointed shall forward his report signed by him to the school commissioners or trustees to whom it may appertain, including the amount of his costs and expenses, and the latter, at a regular meeting, shall adopt the said report in whole or in part, as the case may be, and shall certify the amount to which the auditor is entitled for expenses and shall communicate the result to the secretary-treasurer, by causing a copy of the resolution or resolutions adopted by them respecting the report, to be served upon him by a bailiff, and the secretary-treasurer shall pay within fifteen days, the amount which shall have been found deficient in his accounts. But if the said secretary-treasurer contests the said report and gives notice thereof within the said delay to the school commissioners or trustees, by a noticed served on the chairman by a bailiff, the latter shall forward the report to the superintendent, together with a copy of their proceedings and of the notice to them given by the said secretary-treasurer, and all documents connected therewith; whereupon the superintendent shall appoint a school inspector or any other person to examine and to audit the said accounts, in presence of the parties or after their having been duly summoned; and such inspector or person so appointed shall have all the rights and powers conferred by the act 32 Vict., chap. 8. intituled: "An act respecting inquiries concerning public matters."

The inspector, or person appointed by the superintendent, shall report the proceedings followed or adopted by him, and the superintendent shall give his decision,

which shall be final, and whoever shall be adjudged debtor shall pay without delay to the proper person, the amount for which he shall have been declared debtor, and, in default of payment, legal proceedings shall be instituted to render the said decision executory; provided always, that nothing contained in this act shall prevent the superintendent, or school commissioners or trustees from proceeding under the act 40 Vict., cap. 22, section 36, if they consider it preferable.

The said judgment of the superintendent shall establish the amount of the costs and expenses of the said inspector.

18. Every secretary-treasurer in office or who has vacated that office, who shall have accounted to the school commissioners or trustess who have appointed him, but whose accounts shall not have been admitted, or who shall have been prevented from so accounting by any cause whatsoever beyond his control, may, by written notice served upon their chairman by a bailiff, call upon the commissioners or trustees to appoint, within eight days, an auditor, to examine and audit the said accounts, and if he be so appointed the said auditor shall proceed in the manner provided in and by this act, and in default of the school commissioners or trustees making such appointment, or in default of the person so appointed taking proceedings, the said secretary-treasurer shall apply by petition to the superintendent, who shall then proceed in the manner provided by this act and by the preceding sections.

19. Section 36 of the act 40 Vict., chap. 22, is amended, by adding the following, as forming part thereof:

"2. The superintendent may also sue in his own name any secretary-treasurer in office or out of office, for the recovery from him of any sum of money which he may still owe to any school corporation, arising from the collection of school taxes, monthly fees or other school dues during the term of his office, if the commissioners neglect to do it themselves after having been put in default so to do, in the manner laid down in this section and with the same effect."

20. In all cases in which an inspector of schools is appointed by the superintendent, to make any inspection, inquiry or investigation, the travelling expenses and other disbursements of said inspector shall be paid by the party whom the superintendent shall name in his judgment upon the report of the said inspector, unless such inspection, inquiry or investigation takes place at the time of the ordinary visit of such inspector to the schools of the municipality where he has to make such inspection, inquiry or investigation.

21. Sub-section 3 of section 72 of cap. 15 of the Consolidated Statutes for Lower Canada, and section 38 of the act 40 Vict., cap. 22, are hereby repealed, and replaced by the following:

"3. To keep registers of their proceedings signed, for each sitting, by the chairman and the secretary-treasurer:"

"4. To keep account books of the form and according to the forms which shall have been established by the superintendent and not otherwise;"

"5. To afford communication of such accounts to those who contribute towards the maintenance of the school, at suitable hours, and in accordance with the conditions which shall have been established by the school commissioners or trustees, or in their default, by the superintendent."

22. If, by the erection of new municipalities, the municipality from which they are formed cease to exist, the superintendent, shall appoint the school inspector or other person to proceed to the examination of the accounts of the old municipality, after a written notice of at least eight days shall have been given to the school commissioners or trustees of the new municipalities to take steps to be represented at such examination.

A report on the result of such examination shall be made to the superintendent, who shall give his decision on such examination, and his decision shall have the effect of a judgment of arbitration between all parties and shall be final.

By such decision he may authorize one of the new school corporations above mentioned to collect the arrears and to pay the debs of the original corporation.

If, after payment of all debts, a balance remain, this balance shall be divided between the new municipalities, according to their respective valuations as shown on the last valuation roll of the old municipality. If on the contrary there is a deficit, each municipality shall be likewise held to liquidate its share according to the same rule and to take, without delay, the steps necessary to effect the same.

23. Sections 29 and 30 of 40 Vict., cap. 22, are repealed and the following are substituted thereto:

"29. A depository of books, maps, publications, models, specimens, apparatus and other school necessaries having been established in the department of public instruction, the same may be sold by the superintendent to any school municipality, school, educational establishment, teacher, clergyman or bookseller applying therefor, and the school commissioners or trustees shall pay the price of such purchases out of the school taxes which they shall increase in consequence thereof, if it be necessary, or by any other means the superintendent may prescribe, by rules to that effect approved by the Lieutenant Governor in Council; they shall then distribute gratuitously the said necessaries, in conformity with the said rules, to the children attending the schools maintained under their control."

"30. The school commissioners or trustees may, in the course of the months of July and August of each year, or at any other time, address a requisition to the superintendent for such books and other school necessaries or they may require for their schools, and those articles shall be forwarded to them without delay."

24. If a school municipality is abolished and its territory, annexed to an adjoining municipality, all the documents and property of the municipality so abolished shall become the property of the municipality to which such territory shall have been annexed, saving all rights of indemnity or other rights which shall be established by the commissioners or trustees of the latter municipality and in their default, by the superintendent, according to law.

25. If in any municipality the minority has declared itself to be dissentient and subsequently the number of dissentients increases and becomes the majority, the dissentients shall in consequence thereof, have a right to themselves, that is to say to elect in usual manner five commissioners in the month of July. On the other hand, the former majority having the minority, may declare itself to be dissentient, and may elect three trustees for the management of its schools affairs.

26. Section 77 of chapter 15 the of the Consolidated Statutes for Lower Canada, is amended by adding after sub-section 2 the following provision;

"3. Every educational institution receiving no grant from the corporation or municipality in which they are situated, and the land on which they are erected, and its dependencies, shall be exempt from municipal and school taxes, whatever may be the act or charter under which such taxes are imposed, notwithstanding all provisions in the contrary."

27. The monthly contribution, the amount of which

shall have been fixed by the commissioners, shall form part of the assessments and shall be recovered in the same manner.

If, by order of the commissioners or with their consent, the assessment or monthly contributions, is payable in grain and in wood, the commissioners shall value the said articles in money and shall recover the amount so fixed by them in the manner aforesaid ; Provided always that the provisions of the present section shall not be interpreted as applying to the cities of Quebec and Montreal or to any other place where the collection of the annual contribution is regulated by special statute.

28. Subsections 4 and 5 of section 34 of the said chapter 15 of the Consolidated Statutes for Lower Canada, are repealed and the following substituted therefor :

" 4. The said election, commenced on the first or any other Monday in July, at ten o'clock in the forenoon, shal be finished at five o'clock in the afternoon of the same day. "

29. Section 37 of the said chapter 15 shall conclude as follows :

" And in accordance with the manner provided in reference to the election of municipal councillors by articles 308, 309, 310, 311, 312, 313, 314, 315, 317, 318, 319, 320, 321 and 325 of the municipal code which are hereby declared to form part of the said act and shall be so interpreted as to cause the election to be made on the one and same day. "

30. In case the superintendent is absent from the Province, or in case of continued illness,he may delegate to one of the secretaries of the department of Public Instruction the powers conferred upon him by law.

31. The present act shall come into force on the day of its sanction.

SCHEDULE.

Canada, Province of Quebec. } Municipality of

Engagement of Teacher

On the day of the month of in the year 187 , it is mutually agreed and stipulated between the school commissioners of the municipality of in the county of , represented by their chairman, under a resolution of the said commissioners passed on the day of 187 , and teacher, residing at , as follows :

The said teacher holds a diploma for a school and engages himself [or herself] to the said school commissioners, for the term or space of years from the day of unless the diploma of the said teacher be withdrawn, or any other legal impediment arise] to hold the school in district No. , according to law, to the rules and regulations established by the competent authorities, and amongst others to exercice an efficient supervision over the pupils, attending the school ; to teach such subjects as are authorized and to make use only of duly approved school books ; to fill up all blank forms which may be sent him [or her] by the department of Public Instruction, the inspectors or commissioners ; to keep all school registers required ; to preserve amongst the archives of the school such copy books and other works of the pupils which he [or she] may be ordered to put aside ; to keep the school-rooms in good order and not to allow them to be used for any other purpose without permission to that effect ; to follow such rules as may be established for discipline and punishment ; to preserve carefully the " *Journal of Education* " ; in a word to fulfill all the duties of a good teacher ; to hold school every day, except on Sundays, and festivals and on the holidays authorized by the commissioners or granted by proper authority.

The commissioners undertake to pay to the said the sum of for the said school year as follows : in current money and not otherwise and the secretary-treasurer, or any other person shall have no right to alter the method of payment, which shall always be made in money to the teacher.

The said commissioners declare that they do comply with the provisions of the law respecting the payment of the said salary of the said teacher ; and respecting suits for the recovery thereof, if necessary, by the superintendent, if he deems it advisible.

A copy of the present deed is forwarded to the superintendent.

In default of any other engagement the present shall continue to remain in force between the parties until it be legally set aside.

And the parties have signed, after hearing the same read.

Done in TRIPLICATE at the day of eighteen hundred and seventy

Chairman of the School, Commissioners.

Teacher.

MISCELLANY.

What an Educational Journal can do.—In a few simple words of plain English, we propose to state to the great body of our teachers why an educational journal should be sustained by them, why it should be well sustained, why they should extend its circulation to their school patrons, and why they should contribute frequently to its pages. First,—the great masses of our people are not well informed ,on school affairs. They love our public-school system, but they know very little of its practical working. The cause of this, plainly and concisely stated, is the astonishing ignorance of the greater portion of the daily press,—those instructors of the people—on everything pertaining to our schools and their teachers. In our modern society, the public policy of a State is guided mainly by the current of opinion in its large cities. How this current is created, guided, directed, or diverted, we all know ! The number of ruined reputations, blighted lives, political, social, and financial wrecks, too well attests the unnatural, fearfull power of the press ! Yet this wonderfull engine, like many another monster which modern ingenuity or modern genius has created, may be controled by the simplest means.

It is not generally known, but it is nevertheless true, that in San Francisco the educational policy and utterance of prominent newspapers is dictated by interested parties, who have had sufficient shrewdness to make the acquaintance of editors and reporters. Or worse still, any one who has the *entree* into the editorial rooms of one or two leading dailies can sit down, and by writing practically shape its educational policy. We believe this explanation will account for many of the educational crudities and absurdities by which a portion of the daily press does so much to injure the cause of popular education. This, then, is one reason why an educational journal, outspoken, consistent, able, and powerful, is needed in this community. Such a journal can point out, accurately and disinterestedly, the defects of our schools and suggest the remedies. It can represent educational interests, and teachers, as such. It can defend intelligently, and therefore more effectually, our free school system from the attack of its foes. It can advocate such changes in our course of instruction as are demanded by our age and clime. It can aid materially in gaining recognition for teachers as professional men, and in

placing the profession of teaching in that high rank to which it is entitled.

These are but a few results to be sustained by a standard, representative educational journal.—*The Pacific School and Home School.*

—Children do not reach perfection at a single bound; the patience and care which a teacher has to exercise in the right discipline of a large school, is scarcely realized by the average citizen.—*A. P. Marble, Supt. Schools, Worcester, Mass.*

Pronunciation of Greek.—English is English, and Greek is Greek; and as the proper method of spelling Greek words, when adopted into English, has been settled by the usage of the past English classics now for three hundred years, it is not only a silly affectation to change it, but it is a violation of the historical continuity of our language, which adopted these words, not directly from the Greek, but indirectly from the Latin. It is for this reason that we say Plato, Zeno, Strabo, and such like; not *Platon, Zenon, Strabon.* The law of historical continuity in the same way leads us to say Socrates, not *Sokrates;* Isocrates, not *Isokrates;* and so forth. As little are we entitled to write *Keltic* for Celtic, *Mykenæ* for Mycenæ, *Kikero* for Cicero, on account that the Greek *K* and the Latin *C* were both pronounced hard, even before a slender vowel, as they are always in the Gælic at the present hour. For, as before said, Latin is Latin, and English is English; and we are no more entitled to say *Keltic* and *Kikero* than we are to call Munich *Munchen,* or Florence *Firenze.*—*Professor Blackie, of Edinburgh.*

"*Get the Best.*"—"Only the best teachers employed" is a sentence in a school circular before us. Would it were over every school door in the land! And more, would that our school officers were instructed in the art of selecting good teachers.—*New York School Journal.*

Children.—The world is new to young children. It is beautiful, and excites in them the most intense interest; and the teacher should lead them to contemplate its mountains and valleys, its hills and dales, its winding rivers and meandering brooks, its pleasant sunshine, and gentle, pattering rain, its trees when draped in the gorgeous hues of Autumn, its coverings of snow in Winter, and its beautiful carpet of green in the Springtime They love to behold the sun in his noonday glory, the moon as she walks the heavens in her silvery fairness at night. They admire the gorgeous sunset, and bound with delight to catch the beautiful rainbow of promise as it spans the heavens. They view with glowing ecstasy the azure vault bespangled with richest diamonds, and instinctively adore the Creator and Giver of all these gifts. They like to hear the murmuring of the brook, the dashing of the cataract, the lowing of the herd, the pattering of the rain, the crowing of the fowl, the bleating of the lambs, the warbling of the birds, and the melodies of the human voice, as they fall in musical cadences on their enraptured ears. They are pleased to look at their teacher's loving eye, and listen to her gentle, winning voice, as she instructs them and leads them into the paths of knowledge, virtue, and peace. They appreciate an act of kindness, and have a keen sense of justice. Their hearts are tender, their consciences pure, and they implicitly throw themselves in her arms for instruction, guidance, and counsel. The amount and diversity of knowledge which can be imparted to young children by proper teaching is almost limitless, and the day may not be far distant when radical changes shall be made in the primary instruction of this country.—*Wm. Connell, Jr., Supt. of Schools, Fall River, Mass.*

—The Irish National School System is perhaps one of the most perfect in the world. After serving a probationary term, the candidate receives his certificate to teach; but even after that his career is watched with attention, the success of his work is noted, and his ability for the position fully ascertained; and thus, in that country teachers have several grades,—such as first class, first division of the first class, and so on.—*The Scholastic News, Montreal, Canada.*

The Cheerful Teacher.—What a blessing to a school is a merry, cheerful teacher, one whose spirits are not affected by wet days, or little disappointments, or whose milk of human kindness does not sour in the sunshine of prosperity. Such a person brightens the school-room like a little piece of sunshiny weather. The children go to school with a sense of something great to be achieved, and so day by day their strength and energy are renewed.—*Inter. State Normal Monthly, Iowa.*

A Talk With the Boys.—I would speak an earnest word with those boys who are thinking of leaving home. You are anxious to push out for yourselves. In many instances there are younger brothers in the family, and you think the farm hardly large enough for all. Those who live East are anxious to go West, and those who live in what is termed the West desire to go still further towards the setting sun. At any rate, as you look at it, it seems desirable in order to succeed that you get as far as possible away from home. No doubt many young men have done as well, if not better, by casting themselves among strangers; they have worked harder, and denied themselves more than they would have done at home. But it is a very important step, and one which will pay you to look all over before you take it. If you intend to go among frieuds of your family, or with a company of your townspeople, it will make it much better, but to start out all alone, and threw yourselves among strangers, in a distant part of the country is 'a hard row to hoe.' It is true you may be successful, but the chances are all against you, and it is quite likely you will hear the cry of 'hard timés,' no matter which road you trauel. Taking it all in all as things stand now, there is little difference in favor of one part of the country over another.

The man who works an Eastern farm will have many days of hard labour in the course of the year, on land that don't yield much; but on the other hand he has a good market, and can sell at a fair price all from the farm he wishes to sell; he will live as well and his home will be as pleasant and well furnished as that of the Western farmer; the chances of his children getting a good education are as fair, if no better, than in many parts of the West. The only advantage there seems to be is, that if you have a little money left when at your journey's end, and know how to take care of it, you can do more with it than in the East. But if you have no money, and must go to work for for any one who will hire your time, you will find that to get in to the condition you wish to be will require much hard work self-denial. And when in future years you visit your old home you may be likely to find that those of your early companions who have remained there have done about as well, and some how you will be apt to think, have fared a little better. Doubtless much of this 'changing about' in our country is owing in a great mesure to our restless disposition, Mr. Greeley remarked while making his overland journey to California, as he passed many emigrants to that Eldorado, and about as many coming back, that he didn't think there was another such a restless people on the face of the globe.

To the boy who has become dissatisfied with his home and its wholesome restraints; who thinks he is hindered from being all he could be; who thinks the family are no help to him; who speaks of father and mother as 'old man' and 'old woman;' who is determined to leave home whether they are willing or not, allow me to say in all kindness, you are getting yourself into bad shape. Such thoughts are poison; if you continued to cherish them no one will suffer more than yourself. Nothing, absolutely nothing, can be done to better your condition, while you are in such a frame of mind. As has been said before, in order to be successful you will have to move with much caution; all the good counsel your family give you will be so much clear gain. So let me entreat you to get rid of the thought that they are not willing to help you to be all that you can be. When you go umong strangers you will find, for a long time, that the community have only taken you on trust. There may be nothing wrong about you; we will allow that you are all right, but someone has said, that 'confidence is a plant of slow growth,' so you see if you go among strangers you most for a while stand before the people 'on trial.' If the time ever comes when good men are obliged to 'let go of you' it will be a sad day for you.—*Tribune.*

More Microphone Experiments.—Some interesting experiments with the microphone were recently described by Mr. James Blyth in a paper read before the Royal Society of Edinburgh, of which *Nature* publishes an abstract. Instead of the pointed piece of carbon supported between two pieces of the same material as used by Professor Hughes, it occurred to Mr. Blyth that ordinary gas cinders would be likely to answer the purpose tolerably well. To test this he included in the circuit of an ordinary Bell telephone a single Leclanche cell, and a small jelly can half filled with cinders broken into pretty coarse fragments. The connections were made by slipping down at opposite sides, between the cinders and the sides of the jar, two strips of tin, to which the circuit wires were attached. When this simple instrument was used as a transmitter, arti-

culate sounds were heard very loud and distinct in the distant telephone, though occasionally marred by what appeared to be the ratting of the cinders in the jar. Sounds were also quite audible, even when the speaker stood several yards away from it. But the most remarkable feature which the experiments tended so show was that the transmitter could also be used as a receiver. For this purpose similar jelly-cans containing cinders were used, both for transmitter and receiver, and a battery of two Grove's cells was included in the circuit. Articulate sounds uttered in the one cinder jar were distinctly heard in the other, and even voices could be distinguished, although the results were not perfectly satisfactory.

Purifying Water. A writer in the *English Mechanic* gives the followiug mode of purifying water: Different waters, like different diseases, require different treatment to purify them, aud all waters, no matter how impure they may be, can be made quite pure for drinking or other domestic purposes without distillation, providing the proper materials be used, and sufficient time allowed the re-agents to act; but in many samples of water I have fouud distillation to be the quickest and cheapest mode of purifying them. All filters in use that I am aware of only purify the water from solid impurities mechanically suspended in the water. The following is a description of a filter that I have often used, which purifies foul water from organic impurities held in solution as well as from suspended solids: Take any suitable vessel with a perforated false bottom, and cover it with a layer of animal charcoal; on the top of that spread a layer of iron filings, borings; or turnings, the finer the better, mixed with charcoal dust; on the top or the filings place a layer of fine clean siliceous sand, and you will have a perfect filter. Allow the foul water to filter slowly through the above filter. and you will produce a remarkably pure drinking water. Before placing the iron filings in the filter they must be well washed in a hot solution of soda or potash, to remove oil and other impurities, then rinse them with clean water; the filings should be mixed with an equal measure of fine charcoal. If the water is very foul it must be allowed to filter very slowly. The deeper the bed of iron filings is the quicker they will act. If you have to purity water containing Bacteria, you must first add hydrochloric acid to the water till it is slightly acid to test paper; that will destroy the whole of the animaculæ; then add sufficient lime water to neutralize the acid, then precipitate the lime with oxalate of ammonia, and filter through the iron filter described above. The foulest ditch water, treated as above, is rendered quite pure and fit for drinking, I may mention that I have made it a practice during the last twenty-seven years to boil all my drinking water. It is the safest plan for a man moving from place to place. You cannot always carry a filter and chemicals about with you, but you can always manage to get boiled water; people talk about it being vapid and tasteless but I am used to it, and liked it.

Cause of Infant Deformities.– A Manchester (Eng.) physician, Dr. Crompton, who has made a study of the care of Infants, gives some information of great importance to mothers, in regard to the cause of the common deformities known as bow-legs and knock-knees. He attributes the first mentioned distortion to a habit some youngsters delight in, of rubbing the sole of one foot against that of the other—some, as is well-known, will go to sleep with the soles pressed together; they appear to enjoy the contact only when the feet are naked, not attempting to make it when they are socked or slippered. The remedy, therefore, is simply to keep the child's soles covered. Knock-knees the doctor ascribes to a different childish habit—namely, that of sleeping on the side, with one knee tucked into the hollow behind the other, a custom familiar to the observation of most parents. Here the preventive prescribed is to pad the inside of the knees, so as to keep them apart, and let the limbs grow freely their own way.

Poison in Wall Paper.—Formerly suspicion fell on green wall papers only, and there was a certain reason for this, because there is really not the slightest excuse for using arsenic in even the brilliant colours of any other shade than green. Paper stainers, however, have found that it is such an unusually profitable practice that now they are not content to use arsenic in green papers only, but are introducing it into even the palest white drawing room papers, and especially into those which have an enamelled ground. Some recent analyses have resulted in the startling disclosure that many of the pale coloured wall papers coutain from fifteen to twenty five grains of arsenic per square foot, or a quantity in excess of that which is contained in most of the brilliant green papers. By attempting to make the colour of the pattern as dead as possible, the evil is increased, for the arsenical colouring matter is put on in such a loose and powdery form that the mere friction of a coat or dress against the paper is sufficient to bring off quantities of arsenic which can be detected by a chemical test.

Gaining the Attention.—The teacher who fails to get the attention of his pupils fails wholly. There is, and there can be, no teaching where this is not secured. Gaining the attention, however, is not the only indispensable condition. We have seen a class wrought by tricks and devices to the highest pitch of aroused mental activity,—fairly panting with eagerness, yet learning nothing. The teacher had the knack of stirring them up, and lashing them into a half-frenzy of expectation, without having any substantial knowledge wherewith to reward their eagerness. With his one sided skill, he was but a mountebank. For real, successful teaching, there must be these two things,—the ability to give sound and seasonable instruction. Lacking the latter ability, the pupil goes away with his vessel unfilled; lacking the former, the teacher only pours water upon the ground.

How shall the teacher secure attention?

In the first place, let him make up his mind that he will have it. This is half the battle. Let him settle it with himself, that, until he does this, he is doing nothing; that, without the attention of his pupils, he is no more a teacher than the chair which he occupies. With this truth fully realized, he will come before his class resolved to have a hearing; and this very resolution will have its effect upon the scholars. Children are quick to discern the mental attitude of a teacher. They know, as by instinct, whether he is in earnest or not; and, in all ordinary cases, they yield without dispute to a claim resolutely put.

This, then, is the first duty of the teacher. He must go to his class with the resolute determination of making every scholar feel his presence all the time. The moment a pupil shows that the consciousness of his teacher's presence is not in his mind, as a restraining or attracting power, something is wrong. The first step toward producing that consciousness, as an abiding influence, is for the teacher to determine in his own mind to bring it about. Without being arrogant, without being dictatorial, without being or doing anything disagreeable or unbecoming, he must put forth a distinct power of self assertion. He must determine to make them feel that he is there, that he is there all the time, that he is there to every one of them.

In the next place, the teacher must not disappoint the attention which his manner has challenged. He must have something of value to communicate. He must be thoroughly prepared in the lesson, so that the pupils shall feel that they are learning from him. His lips must keep knowledge. The human heart thirsts for knowledge. This is one of its natural instincts; and nothing is more common than to see children hanging with fondness around one who has something to tell them. Let the teacher, then, be sure to have something to say, as well as be determined to say it.

In the third place, the teacher must have his knowledge perfectly at command. It must be on the tip of his tongue. If he hesitates, and stops to think, or to look in his book for the purpose of hunting up what he has to tell them, he will be very apt to lose his chance. Teaching children, particularly young children, is like shooting birds on the wing. The moment your bird is in sight, you must fire. The moment you have the child's eye be ready to speak. This readiness of utterance is a matter to be cultivated. The ripest scholars are often sadly deficient in it; the very habit of profond study being apt to induce slowness. A teacher who is conscious of this defect must resolutely set himself to resist it and overcome it. He can do so if he will; but it requires resolution and effort.

In the fourth place, the teacher should place himself so that every pupil in the class is in sight. It is not uncommon to see a teacher pressing close up to the centre of the class, so that, if he turns his face to those on one side, he must at the same time turn his back to those on the other. Always sit or stand where you can see the face of every pupil. I have seen the whole character of the instruction and discipline of a class changed by the observance of this simple rule.

Another rule is to use your eyes quite as much as your tongue. If you want your class to look at you, you must look

at them. The eye has a magic power. It wins, it guides, it rewards, it punishes, it controls. You must learn how to see every child all the time. Some teachers seem to be able to see only one pupil at a time. This will never do. While you are giving the absorbed attention to one, oll the rest are running wild. Neither will it do for the teacher to be looking about much, to see what is going on amoug the other classes in the room. Your scholars' eyes will be apt to follow yours. You are the engineer, they are the passengers. If you run off the track, they will do likewise. Nor must your eye be occupied with the book, hunting up question and answer, nor dropped to the floor in excessive modesty. All the power of seeing that you have is needed for looking earnestly, lovingly, without interruption, into the faces and eyes of your pupils.

But for the observance of this rule, another is indispensable. You must learn to teach without a book. Perhaps you cannot do this absolutely; but the nearer you can approach to it the better. Thorough preparation, of course, is the secret of this power. Some teachers think they have prepared a lesson when they have gone over it once, and studied out all the answers. There could not be a greater mistake. This is only the first step in the preparation. You might as well think that you have learned the multiplication table, and are prepared to teach it, when you have gone over it once, and seen by actual count that the figures are all right, and you know where to put your finger on them when required. You are prepared to teach a lesson when you have all that is in it at your tongue's end. Any preparation short of this will not do. Once prepare a lesson in this way, and it will give you such freedom in the art of teaching, and you will experience such pleasure in it, that you will never want to relapse into the old indolent habit.—*N. Y. Teacher.*

ABSTRACT FOR THE MONTH OF JULY, 1878.

OF TRI-HOURLY METEOROLOGICAL OBSERVATIONS TAKEN AT MCGILL COLLEGE OBSERVATORY, HEIGHT ABOVE SEA LEVEL, 187 FEET.

Day.		THERMOMETER.				BAROMETER.				+ Mean pressure of vapor	‡ Mean relative humidity.	WIND.		SKY CLOUDED IN TENTHS.			Rain and snow melted.	Day.	
		Mean.	Max.	Min.	Range	Mean.	‡ Max.	‡ Min.	Range			General direction.	Me'n velocity in m. p. hour.	Mean	Max	Min.			
	1	83.66	90.5	78.6	11.9	29.9775	30.033	29.921	.112	.6167	54.5	W.	6.6	0 9	3	0		1	
	2	84.34	90.7	76.0	14.7	29.9415	29.966	29.915	.051	.5860	50.0	W.	6.9	1.9	8	0		2	
	3	78.31	82.9	73.0	9.9	30.0510	30.108	29.973	.135	.6670	69.1	W.	6.2	6.2	10	0		3	
	4	76.75	83.2	66.0	17.2	30.0874	30.153	29.988	.165	.5395	60.6	W.	7.6	5.1	9	0		4	
	5	75.49	80.3	67.0	13.3	29.9632	29.996	29.920	.076	.3627	41.1	W.	9.4	5.5	10	0		5	
	6	70.65	78.1	61.9	16.2	29.9779	30.041	29.928	.113	.2585	34.9	W.	6.4	2.9	10	0		6	
Sunday	7	.....	86.9	58.6	28.3	.....	.....	.....	.....	.....	.....	W.	11.9	.....	.....	.....		7	Sunday
	8	78.40	85.2	70.9	14.3	29.8161	29.874	29.760	.114	.6020	62.0	W.	13.4	6.7	10	4	Inapp.	8	
	9	79.66	88.2	73.0	15.2	29.8050	29.875	29.751	.124	.6315	63.7	W.	9.9	4.6	10	0		9	
	10	71.61	81.0	66.8	14.2	29.8687	29.999	29.806	.193	.5800	74.9	W.	9.9	6.2	10	0	0 07	10	
	11	67.55	73.1	59.7	13.4	30.1672	30.210	30.054	.156	.3594	54.7	W.	7.3	1.6	4	0		11	
	12	68.27	77.3	56.4	20.9	30.1161	30.229	30.012	.217	.3561	54.0	S. W.	2.6	4.9	10	0		12	
	13	74.27	83.0	59.7	23 3	29.9630	30.027	29.886	.141	.3 05	45.6	W.	6.8	2.6	5	0		13	
Sunday	14	.....	86.0	64.6	21.4	.....	.....	.....	.....	.....	.....	W.	15.0	.....	.....	.....	Inapp.	14	Sunday
	15	65.85	74.2	55.8	18.4	29.9962	30.042	29.913	.129	.3237	53.7	W.	6.0	5.2	9	0		15	
	16	67.26	76.8	60.4	16.4	29.9539	30.029	29.870	.159	.4502	67.6	W.	6,7	10.0	10	10	0.04	16	
	17	76.99	88.4	66.2	22.2	29.7041	29.864	29.596	.268	.7219	78.1	W.	12.5	7.5	10	1	0 60	17	
	18	78.11	84.3	71.9	12.4	29.7424	29.782	29.687	.095	.6271	66.0	N. W.	10.0	5.2	10	0		18	
	19	76 41	82.1	68.8	13.3	29.8272	29.934	29.731	.203	.5407	00.6	W	8.0	2.4	7	0	Inapp.	19	
	20	74.52	82.0	64.7	17.3	29.8589	29.954	29.651	.303	.4741	56.6	W.	3.8	7.0	10	1	Inapp.	20	
Sunday	21	....	76 8	64.8	12.0	.....	.....	.....	.....	.....	.....	W.	10.3	.....	.....	.....	1.86	21	Sunday
	22	61.37	65.5	57.8	7.7	29.5384	29.737	29.345	.392	.4650	85.5	N. W.	13.8	9.6	10	4	0.36	22	
	23	68.45	76.9	60.0	16.9	29.9052	29.955	29.868	.092	.4 02	62.6	N. W.	9.3	3.6	10	0	0.07	23	
	24	72.07	78.1	61.2	16.9	29.9347	30.024	29.826	.198	.3551	45.1	W.	9.7	4.0	10	0		24	
	25	73.16	81.9	66.4	15.5	29.7109	29.8 2	29.622	.200	.4510	56.0	W.	15.0	8.8	10	0		25	
	26	66.06	68.6	64.0	4.6	29.6270	29.720	29.395	.325	5006	92.1	S. E.	4.5	10.0	10	10	2.04	26	
	27	66.8	76.2	63 0	13.2	29.6531	29.886	29.399	.487	.4984	7 .5	N. W.	9.5	6.7	10	2	0.46	27	
Sunday	28	.....	72.0	54.2	17.8	.....	.....	.....	.....	.....	.....	W.	8.5	.....	.....	.....		28	Sunday
	29	68.49	75.1	62.0	13.1	30.6605	30.096	30.028	.068	.4205	61.4	W.	6.1	8.4	10	3		29	
	30	67.85	74.2	63.3	10.9	29.9911	30.052	29.948	.104	.5220	77.3	S.	7.2	7.9	10	0	0.03	30	
	31	66.72	68.2	69.2	6.0	29.9299	29.978	29.893	.085	.5030	79.7	S.	6.3	8.8	10	0	Inapp.	31	
Means.....		72.596	79.60	64.48	15.12	29,8511			.1748	.49201	62.18		8 62	5.72				Means.	

* Barometer readings reduced to sea level, and to temperature of 32o Fahrenheit, † Pressure of vapor in inches of mercury. Humidity relative, saturation 100. ‡ Observed.

Mean temperature of month. 72.596. Mean of max. and min. temperatures, 72.04. Greatest heat was 90.7 on the 2nd; greatest cold was 54.2 on the 28th,—giving a range of temperature for the month of 36.5 degrees. Greatest range of the thermometer in one day was 28.3 on the 7th; least range was 4.6 degrees on the 26th. Mean range for the month was 15.12 degrees. Mean height of the barometer was 29,89511. Highest reading was 30.229 on the 12th; lowest reading was 29 345 on the 22nd; giving a range of 0.884 in. Mean elastic force of vapor in the atmosphere was equal to .49201 in. of mercury. Mean relative humidity was 62.18. Maximum relative humidity was 97 on the 26th and 0st. Minimum relative humidity was 28 on the 5th. Mean velocity of the wind was 8.62 miles per hour; greatest mileage in one hour was 23 on the 8th. Mean direction of the wind, west. Mean of sky clouded 57.2 per cent.

Rain fell on 14 days. Total rainfall, 5.47 inches.

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