

to all who know its mysterious influence on the mind and heart. There is no better way of combining moral culture with intellectual attainment than by incorporating music as a branch of common school education.—*Iowa School Journal*.

2. WASTING TIME IN SCHOOL.

Probably but few teachers are fully conscious of the great amount of time frequently wasted, or at least unprofitably employed, in conducting the various operations of the school-room. School life is short. If a most rigid economy of time should be practiced in any place and in any circumstances, that place and these circumstances must certainly be found in the teacher's workshop, the school house.

It is a very general complaint among teachers, especially teachers of graded schools, that insufficient time is allowed for the completion of the work assigned to the classes of the various grades. That this complaint is, in many cases, reasonable and just, there would seem to be no cause to doubt. That it originates often in a misconception of the nature and extent of the work to be accomplished, and especially in a misuse of the time allotted for its performance, is, doubtless, equally certain.

Let us glance at some of the forms of wastage frequently to be observed in the conduct of the varied operations of the school-room. To whatever cause this waste may be ascribed, whether it be due to the neglect, inefficiency, incompetency, or the misconceptions of the teacher, no one will deny the necessity of an immediate, thorough, and radical reform.

There is no way, perhaps, in which many teachers lose so much time as in that which may be denominated superfluous talk. The practice of talking excessively in the process of government or of recitation, is a very great evil, injurious alike to pupil and teacher. The magnitude of the evil resulting from this form of waste can be fully realized and appreciated only by the strictly conscientious teacher, who is neither unwilling nor afraid to scrutinize rigidly and impartially his entire professional conduct, so far as it pertains directly to the discharge of his daily duties.

He who thus habitually or frequently reviews his daily work, will scarcely fail to discover the use of a great amount of verbiage in the form of commands, exhortations, admonitions and threats, wholly unnecessary to and inconsistent with good government; if it be true, as it is frequently alleged, that the best government in the school, as in the state, is that which is inaudible, invisible and unfelt.

Not only in the government of a school does great waste arise from a superabundance of words. The same pernicious result occurs not less frequently, perhaps, in the conduct of recitations, in which the teacher imposes upon himself, rather than the pupil, the burden of the exercise. Notwithstanding the great temptation to commit this error, springing from the love of imparting knowledge, or the greater incentive to do the same thing existing in poorly or indifferently prepared lessons, he who yields to the temptation and performs the work which, in all circumstances, should be done by the pupil, must be regarded as ignorant; or for the time being, forgetful of the true objects and ends of all recitation. It should never be forgotten that no amount of entertaining, interesting, or purely instructive information merely poured into the pupil's mind can, in any degree, secure that intellectual vigor which it is one of the principal objects of the teacher to promote. Pupils may, indeed, learn much from the teacher's utterances, but more from their own, when judiciously directed by the teacher. Let answers be reconstructed and repeated by the scholar, not the teacher, till accuracy in matter and excellence in manner shall be secured.

Much time is uselessly consumed by some teachers in repeating the answers, correct or incorrect, given by each pupil during recitation. This extremely unfortunate practice, so readily perceived by the most careless observer, and of which the teacher himself seems wholly unconscious, needs no illustration. Every one may find examples enough of its disagreeable and positively wasteful influence within the sphere of his own observation. It is an unnecessary and inexcusable habit which cannot be too strongly condemned nor too speedily abandoned. The pupil is benefited chiefly by his own recitation, and not by that of his teachers'. If the latter consume one-half or one-fourth of the time of the exercise in the mere repetition of answers, the progress of the former must be retarded in the same ratio.

Another fruitful source of waste is the practice of laboring too long, during recitation time, with individual pupils, whose lessons have not been carefully and satisfactorily prepared. This practice is fraught with great injustice to the scholars whose delinquency has occasioned it, as well as to those whose ceaseless industry and tireless application entitle them to rapid and constant progress.

If a pupil is incompetent, through lack of natural ability, to maintain an average standing in his class, without such excessive personal efforts of the teacher as tend to retard the progress of the class as a whole, his mental welfare requires that he should be assigned to a position whose duties reasonable exertions of his own will enable him to perform satisfactorily, without the hurtful assistance alluded to.

If, on the other hand, the incompetence of the scholar results from indolence or neglect, and he is retained in the class by the patient and persevering aid of the teacher, such an expenditure of time and energy would seem to be worse than useless, a direct and positive premium, in fact, on idleness and inefficiency, prejudicial to the present and future interests of all concerned, the active and the lazy, the competent and the incompetent, the faithful and the unfaithful.

Another source of wastage may be found in the lack of system which characterizes the management of many teachers, who, in some respects, are justly regarded as models of excellence. It not infrequently happens that lessons are assigned with so little distinctness and intelligence, that the most careful and attentive scholars are unable to determine precisely their nature and extent. In consequence of this remissness of the teacher, the preparation of the lesson, by the pupils, is liable to be very imperfect, the recitation a partial, if not a complete failure, and its precious minutes which should have brought progress and profit, are frittered away in needless and useless complaint and censure, occasioning an irreparable waste which must be directly charged to the unsystematic habits of the teacher.

Again, and lastly, many teachers subject their pupils to a considerable loss in not conducting and directing the various exercises of recitation and study, in exact accordance with a carefully devised and well arranged programme, neatly and conspicuously placed on the blackboard. Few things are more conducive than such a programme, if rigidly adhered to, to an economical and profitable use of time, and to the prevention of wastage in the conduct of the affairs of a School.—*E. C. D., in Chicago Schoolmaster*.

II. Intercommunications with the "Journal."

1. ON EQUATIONS INVOLVING THE RADICAL SIGN.

BY J. C. GLASHAN.

[NOTE BY THE EDITOR.—We call the attention of teachers and others interested in mathematical pursuits, to the present and former papers in this journal on these subjects. Their discussion in our columns will doubtless afford much interest and pleasure to those whose tastes lead them in this direction. We propose to devote a portion of our columns monthly to these subjects.]

In the equation $x + \sqrt{x^2 - a^2} = b$, if $a^2 > b^2$, on solving and substituting there appears a difficulty. It seems as if not the equation proposed had been solved, but $x - \sqrt{x^2 - a^2} = b$. The majority of writers on elementary algebra declare this to be actually the case. Todhunter accepts it, (*Algebra*, 3rd ed., pge. 170, sects. 329 and 330,) and Colenso, I believe, goes so far as to say that no method of solving the proposed equation has, up to the present, been discovered. I shall examine this view, briefly pointing out wherein I believe it to have originated, and then proving it must be rejected that algebra may be consistent throughout.

The error arises from a mistaken view of the function of $+$. In $x + y = c$, what is the algebraic meaning of $+$? It is merely the symbol of addition, and has nothing whatever to do with the 'affection' positive. If the equation arose from a problem requiring y to be positive, it should be written $x + (+y) = c$, x plus positive y equals c . This seems all very plain when applied to rational quantities, but there appears to have been a difficulty in recognizing the application of the principle to radicals, else why should a writer of such acuteness and accuracy as Todhunter have fallen into the error of confusing $x + \sqrt{}$ and $x + (+\sqrt{})$, x plus one of the square roots, and x plus the positive square root. But if it be denied to $+$ to symbolize at once both an operation and an affection where only rational quantities are involved, it must also be denied it in expressions containing radicals, or, to state the principle distinctly,—*In unapplied equational algebra, not only are the 'affections' of the unknown quantities undetermined, but so also are the 'affections' of all functions of these quantities.* The laws developed in the general theory of equations will affect this rule, but not in its application to radical functions of the unknown quantities, for these must be rationalized ere the laws are applied, and their 'indeterminateness' of sign eliminated. It is easy to see why $x + (+\sqrt{x^2 - a^2}) = b$, $a^2 > b^2$, cannot be solved; there are really two equations given to find x , and under the condition $a^2 > b^2$, they are inconsistent.