NORMAL TEACHER PUBLICATIONS.

THE

NEW METHOD.

R. H. HOLBROOK.

First Edition.

Partial View of School Room, Showing Exposition Material.

THE NEW METHOD;

OR,

SCHOOL EXPOSITIONS.

FOR TEACHERS OF RURAL, VILLAGE, CITY, NORMAL, AND COLLEGIATE SCHOOLS.

SHOWING

HOW THE BEST METHODS OF TEACHING WILL RESULT IN THE BEST SCHOOL EXPOSITION, AND HOW THE BEST SCHOOL EXPOSITION WILL SUGGEST THE BEST METHODS OF TEACHING.

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"Reading maketh a full man, conference a ready man, and writing an exact man."

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PREFACE.

For more than a decade I have been urging as editor, institute instructor, and practical teacher, the failure of our school work in giving *producing* power to the pupils.

In the years 1876 and 1877, a most excellent opportunity to carry my ideas into practical operation in the public graded schools, was afforded.

The results were satisfactory and occasioned considerable interest and favorable comment; so much so that many teacher friends extracted from me a promise to set forth the details of my plans and ideas in such form as would enable them and the profession generally to have the benefit of them.

To redeem this promise is the object of this little work. I humbly trust it may do some good.

In appendix C will be found the development of the philosophical principles upon which rests the Exposition idea. It should properly appear as the preface, but feeling that the actual practice would perhaps be more acceptable than abstract theory, I have placed it where it may least obstruct the way of the practical teacher. Nevertheless, I deem its perusal essential to a fair appreciation of the work.

The other appendixes will, I hope, be found sufficiently valuable to explain and warrant their insertion.

I desire here to acknowledge the kindness and liberality of Mr. J. E. Sherrill, who has patiently borne with many expensive and trying circumstances, unavoidably incident to the issuing of this work.

R. H. H.

National Normal School, Lebanon, O., 1881.

TO

MR. H. N. GREEN, DR. J. INGRAM, AND MR. HOSEA ALLEN,

PUBLIC SCHOOL TRUSTEES,

VINELAND, N. J.

In testimony of the cheerful, generous and invaluable assistance which they uniformly granted the author when carrying out, in the schools under their charge, the plans and ideas set forth in the ensuing pages,

THIS LITTLE WORK

IS

MOST RESPECTFULLY INSCRIBED BY THEIR GRATEFUL FRIEND,

THE AUTHOR.

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SCHOOL EXPOSITIONS.

PART I.

Introduction.—Definition.—Objects.

CHAPTER I.

INTRODUCTION.

TEACHING will not be a profession, and education will not be a science until the methods and results of teaching are put upon permanent record for educational philosophers, and others who are interested, to examine, compare and form judgments upon.

The generalizations of all science are based upon observed phenomena and accumulated data, and the prelude to a true science of pedagogics will be an era of careful and intelligent accumulation of data from which will be obtained principles and laws—which principles and laws will be *fixed* and *reliable* because they will be the inductions from fixed and reliable facts.

At a late meeting of State and City Superintendents of public schools, an eminent statesman called in question the methods and results of educational practice of to-day, as compared with those of years past, citing the failures at West Point entrance examination as evidence. While the Superintendents present replied with much zeal and some heat to the reflections of the honorable gentleman, nothing was more apparent than the need of *products* of school work of the past with which to compare products of the school work of the present. Had such materials been in existence for the common examination of Congressmen and Superintendents, the question would have been easy of settlement. But, as it was, either party could make at pleasure, statements, which might or might not be of worth, without fear of contradiction or disproof by some *facts*.

The national attempts being made to display the products of the arts and sciences have also brought to light the comparative weakness of educational workers. The great variety and indefiniteness of opinion as to what educational products can be displayed, as to how they should be prepared, and how mounted, has made educational exhibits a marvel of heterogeneous, purposeless ununity, from which a thoughtful student soon discovers he can learn very little.

There is no reason to conclude, however, that because of the comparative failure of past attempts to exhibit systematically and instructively the product of school work, there is no prospect of success and that the problem is inherently impracticable. True, it is a striving to materialize, as it were, the most evanescent and subtle of influences and practices, but we must proceed here as do physicists in their investigations of the imponderable agents. The effects and products of heat are not the less abundant because heat itself is so subtle and intangible. Neither are the methods and results of teaching incapable of being caught up and solidified for patient study and examination, because of their refined character. On the contrary, upon the successful accomplishment of this undertaking depends the highest interests of our profession, and toward this end every thoughtful educator must earnestly labor. He should also willingly grant to every conscientious effort in this direction the encouragement of attention and considerate appreciation.

It is the object of this work to offer suggestions for the preparation, from the usual and regular school work, of materials, which will be tangible and permanent evidence of the processes of teachers and pupils in schools of all grades.

It is also hoped that educators will see that in the preparation of these materials according to these suggestions is to be found a most important aid to the improvement of prevailing false methods and to the introduction of new and better methods.

CHAPTER II.

Definition.

A School Exposition is the exhibition, by *systematic* arrangement, of the *regular* work of *every* pupil of every class in such manner and place as will enable every patron to examine it *at leisure*, and *easily* gain therefrom reasonably correct information as to the ability and progress of every child in every class, the capabilities of children at different ages, the degrees of advancement which they may reach, the different kinds of work and manner of working of different grades, the comparative ability of different teachers and pupils, and the destinctive methods of each teacher.

The Exposition must be systematically arranged, so that the visitor may easily find desired materials, and so that results may be easily subjected to comparison and contrast.

The materials of the Exposition should be so arranged as to enable the visitor to examine them comfortably and leisurely. This is a most important point. No just idea of school work can be obtained by a person who, while examining it, must be in a position too uncomfortable to be endured for a length of time necessary for the inspection.

The work should be so prepared as to make its examination and comprehension *easy*. It should be entirely self-explanatory. This is the most difficult feature of the Exposition. It is thought, though, that in the plans to be submitted, it is completely provided for.

The Exposition should *inform* the patrons.

The ignorance of the public as to the proper advancement of pupils at certain ages is one of the greatest obstacles experienced by the true teacher. Popularity is often gained by hurrying through subjects and books, at the expense of thoroughness. This would be impossible if parents could be informed how *well* as well as how *fast* their children advanced in their studies.

Again, it will be noticed that an Exposition is not an "exhibition." The Exposition is the display of the *regular* work of *every* pupil, of *every* class. An "exhibition" is the display of *irregular* work of a *few* pupils at the expense of all the regular work of all of the pupils. An "exhibition" is usually an oral rhetorical display, gotten up by a school in which no rhetorical instruction is given. It is an attempt upon the part of the teacher to gain credit for the school by displaying what the school does not do as a school, and by ignoring all that it does do. It is an enlargement of the practice of those teachers who, when a visitor comes in, suspend all the regular exercises, and call upon precocious pupils to parrot off pretty poems for the *entertainment* of said visitor, on the reasonable supposition, doubtless, that the *regular* school work would be anything but entertaining. This is all after the manner of the Irishman who, upon being asked for the direction to a certain dwelling, laboriously explains at great length the location of a particular house, and then declares that that is not the one. Too much of school work is after this fashion. The cause lies in the ignorance of the public as to what constitutes true school work. It will be the especial object of the Exposition to remove both the cause and its disastrous effect. People must be taught that the exhibition of the regular work can be made more entertaining than anything else, and teachers must learn that if their work is not attractive and entertaining, the fault is their own.

Let it be understood that while reference is continually made to graded schools, the Exposition is not in any way confined to them. The methods and suggestions to be offered are for *every class of school*, from the ungraded country district school to the university. Indeed, it is the especial feature and power of the Exposition that it exhibits the work of *every* pupil in *any* school in such completeness that the data necessary to compare it intelligently and fairly with the work of any pupil of any other school will always accompany it, and be presented so self-explanatorily that not only professional teachers, but all patrons, mothers and fathers, and others interested, may easily and correctly apprehend them, and so be enabled to judge adequately of any work exhibited, and so of the school producing it.

Work coming from a country district school, and prepared as here suggested, may be put beside work from any grade of a graded school and compared with it, and by the comparison it may be at once determined to what grade it *properly* belongs. This fact is mentioned here, because the first objection usually offered to the Exposition is, it can be used only in graded schools, and in schools *similarly* graded; whereas the particular object of the Exposition is to present all kinds of work from all grades or schools in such completeness and with such clear reference to common data that fair and adequate comparisons may be easily made.

The great defect in the Educational Exhibit at our late Centennial was the lack in clearness and fullness of explanation as to the *preparation* of the work exhibited. The conscientious observer was continually at loss as to the pedagogical *value* of the materials presented, owing to the general failure upon the part of the exhibitors to *explain* their work, or to prepare the work so that it would explain itself.

If the simple directions about to be given are adopted by State and City Superintendents, the future Educational Exhibits made in this country will be full of suggestion and instruction.

CHAPTER III.

Objects of the Exposition.

A Superintendent or Teacher who purposes submitting the work of his school to the examination of his patrons and fellow teachers should have clearly settled in his mind at the *beginning* of the year which points are to be exhibited.—Indefiniteness of plan or delay in its execution will bring confusion and incompleteness.

The school work is expressive of two things, the progress of the pupil and the methods of the teacher. All material exhibited should distinctly expose these phases of school life.

Now, to determine just the points that will serve most directly and truthfully to express the doings of both pupil and teacher, and which at the same time are capable of being set forth easily and distinctly, is not an easy task, and will not be accomplished in a first attempt. Many intelligent trials will have to be made and all ideas subjected to the test of successful application before reliable conclusions are reached. Mere theories will be found delusive and impracticable. Only that which has been faithfully tried and found possible should be finally accepted. To these vigorous conditions every suggestion here presented has been most conscientiously subjected. In every instance, the statements are not of what *may be* done, but of what *has been* done, and *can be* done.

A school Exposition, properly prepared will display, for the leisurely examination by patrons while seated, the school work so arranged as to exhibit *clearly* and *self-explanatorily:*

1. The Regular Work of every pupil in every class.
2. The Name of the pupil doing the work.
3. The Age of the pupil.
4. The Grade of the pupil.
5. The Year of the School Course in which the pupil is.
6. The Branch of Study from which the work is taken.

7. The particular Subject in the branch on which the work is prepared. For instance: *Branch*, Arithmetic; *Subject*, Decimals.
8. The Date at which the work was prepared, showing at what period of the school year the work was taken up.
9. The *Number* of the exercise in the series of exercises taken from a given class.
10. The Amount of Time used by each pupil in preparing each exercise.
11. The Average Amount of Time used by the class in preparing each exercise.
12. Whether the work was prepared as Study.
13. Whether the work was prepared as Recitation.
14. Whether the work was prepared as Review.
15. Whether the work was prepared as Periodic Examination.
16. Whether the work was prepared as Final Examination.
17. The Standing of each pupil obtained in any given exercise.
18. The Rank in any given excercise of any pupil as compared with all the other pupils in the class.
19. The Average Standing of the whole class.
20. The Number of Pupils in the class.
21. The Number and Names of Pupils absent from any given exercise.
22. The Improvement made by each Pupil in each subject during a given time.
23. The Improvement made by a Class, as a whole, in any given subject.
24. The Name of the Teacher.
25. The Course pursued by the teacher in any given subject.
26. The Methods used by a teacher in any given subject.
27. The *Comparative Value* of same kind of work prepared under direction of different teachers.
28. *For Comparison*, the Methods used by different teachers in the same subjects.
29. The Features of the Organization or System of schools from which the work is taken.
30. The Character of Work done by different grades.
31. The Name of the Superintendent or Principal.
32. The Name and Locality of the School.

It may seem ambitious to attempt to give simple and practicable arrangements whereby all these points may be attained, yet, the value and importance of such an undertaking will secure the attention of every professional teacher to any effort in this direction, however humble. And if the effort is successful in any degree, teachers who have the real interests of the profession at heart will promptly adopt the suggestions and proceed at once to put themselves and their work on permanent record for the encouragement of pupils, information of patrons, and for suggestive inspiration to their fellow workers.

PART II.

Preparation of Materials

CHAPTER I.

Introduction.

The term *Preparation*, has reference alone to the condition of the pupil while performing the work which is to be preserved and exhibited. School Exhibits usually include little more than specimens of penmanship, drawing and examinations. It is the object, of the Exposition to place in form for inspection results of the pupils efforts prepared under all the various conditions to which as a pupil he is subjected. These conditions are various, as the questions, which an intelligent inspector of the work will ask, indicate: How was this prepared? Was it done as a study? Was it put down from memory? How long did it take? After how much instruction was it done? How many hours, days, weeks, or months of study does it represent? Work prepared under these different conditions will represent so many different phases of the pupil at work, each one of which is of interest to the examiner of the work, each one of which it is of the utmost importance that the teacher should recognize and consider in assigning duties to the pupils. It will also be found to be important that these different conditions will suggest a variety in character of materials for Exposition. With regard to the condition of the preparation, the work of pupils in a school is of three kinds:

1.—*Study* at their desks with use of texts.
2.—*Recitation*, at class, from memory, what they have studied.
3.—*Examination*, brief or extended, written memoriter.

CHAPTER II.

Manner of Preparation.

Study. All work which is prepared at the study seats with the aid of the texts and reference books should be designated Study. Of course it will be written study. This writing out the points of a lesson as they are determined by the pupil will be found to be the best means of securing thorough mastery of the lesson. Work prepared in this manner should be neater and more correct than that prepared as Recitation or Examination, since the pupil is more at leisure and under less nervous strain than when depending upon his memory. The ease and facility with which lessons will be thus prepared and the high degree of neatness and business style which can be attained and made *habitual*, will surprise both, pupils and teachers, and prove a most valuable result of the practice.

These written studies will usually be examined at the Recitation, sometimes by exchanging and having papers read and criticised, sometimes without exchanging. Every paper should be marked at the close of the recitation by the critic, by the pupil, or by the teacher, and the Standing recorded on the teacher's register. This affords a fair and equal estimate of the work of the pupils, and should be preserved faithfully.

Frequently the teacher will prefer to reserve the papers for his own examination and marking. In such cases, they should, when marked, be returned to the pupils, and they be required to report orally the correction of errors made, at next recitation. When the papers have served their purpose for recitation, they should be collected *by the teacher* and preserved, in order, for the Exposition.

Recitation. Oral recitations, though useful and indispensable, are a poor test of the knowledge or power of the pupils. Either each pupil recites but little or few pupils recite, making any attempt at determining the standing of the pupils either insufficient or unfair. This may be remedied by occasionally substituting for the oral recitation a written recitation. Let the pupils be informed before hand that a written Recitation will be had of the next lesson. This will enable them to come with paper suitably headed and prepared for the exercises. Instead of the scattering questions of the oral recitation, *all* the pupils are now required to answer in writing the same questions. These papers will be examined by the teacher, and each pupil's standing determined by one standard. So, not only are the pupils subjected to a fair and searching test, but the valuable habit of readily expressing their ideas in writing is formed. The ease, facility and cogency of expression which young pupils attain under this management are its best and sufficient recommendation.

No more time than the usual recitation period should ever be used for this exercise. This should be insisted upon. If it is, the pupils learn to be quick and correct. If it is not, irregularities, waste of time and lack of power will be the result.

These written recitations should be held, not too frequently, but just as the needs of the class seem to dictate. Great care should be taken that they do not become a means of overtasking pupils and teacher, also that they do not become merely formal. Every exercise should be *marked*, either by the teacher, or by the pupils by "exchanging", or by the pupil without exchanging. The standings thus obtained should, of course, be carefully preserved to make up the record of the pupil.

Review. This term should be restricted to that examination which covers the ground of several lessons, but for the preparation of which the usual study-period is given, and for the writing of which only *the usual recitation-period is given.* The exercise should be treated as the preceding, excepting that the teacher will almost always examine the papers. Sometimes, though, it will be well at the close of the recitation to have the pupils exchange their written reviews and criticise them as their next lesson, the next recitation being then used to hear the reports of these criticisms. These papers are of course carefully marked and the standings put upon the register.

Periodic Examination. This is a written examination which is resorted to at the close of a certain subject of a certain branch—for instance of Addition of Fractions, in Arithmetic—to secure thorough reviews and test the knowledge of the pupils. It is from memory, of course, and occupies *whatever time may be necessary.*

Final Examination. This constitutes the material which usually and most abundantly appears at school exhibits. It is, of course, written from memory, and embraces the work of the class for the year. Upon the standing obtained by these papers the advancement of the pupils is usually made to depend. It will be found more fair to average the standings of all preceding exercises, and then average that (called *Class Standing*), with the *Examination Standing*, and so obtain the *Final Standing*. Such a practice will obviate the unhealthy moral and physical effects of the usual Final Examination. All these examination papers should be returned, as soon as they are examined and marked, and the pupils permitted to see their mistakes and required to correct them. Then they should be collected by the teacher and preserved for Exposition.

CHAPTER III.

Time Used in Preparation.

This should be invariably noted upon every set of exercises by the teacher and upon every individual exercise by the pupil. It is not only important to the inspector of the work, but to the teacher, for he will then keep himself informed as to the amount of time given by different pupils to the preparation of their lessons and so avoid the two greatest sources of disorder, undertasking and overtasking the pupils.

In a happily managed school, the judgment of the pupils will often serve to correct and guide that of the teacher in reference to the length of a lesson. If a spirit of laziness prevails the teacher will be compelled to push or pull his pupils along. On the other hand, if a spirit of happy industry exists, and the practices here suggested will do more than anything else to arouse such a spirit, the teacher will need to watch lest he and his pupils overtask themselves.

PART III.

Sources of the Materials.

CHAPTER I.

INTRODUCTION.

Two difficulties will at once present themselves to the teacher who is for the first time considering what materials to prepare for an Exposition: First, to obtain something from every *subject* taught. Second, from every *grade* of pupils from the *youngest* to the *oldest.* The succeeding chapters of this Part, it is thought, will not only remove these difficulties, but will, by their suggestiveness, give the teacher a power of inventing innumerable original expedients which will again become the parents of other and prolific progeny. The immense variety of products which will thus be obtained from the pupils will be the means of a practical and excited industry in the school that will dispense with almost every disciplinary necessity.

There will be some four kinds of materials necessary to make up a complete Exposition.

First, *Written* material. This will be obtained from every class and drill.

Second, *Industrial* material; such as apparatus made by the pupils, specimens of minerals gathered, plants pressed, or animals prepared, sewing or handwork of any kind.

Third, *Oral* material; as experiments performed, songs sung, and rhetorical exercises, all of which should be results of the regular school work—not special exercises prepared for this occasion.

Fourth, *Ornamental* materials, such as pictures, evergreen adornments, flags, bird-cages, pot-plants, flowers &c., &c. The pupils will supply and arrange these under the direction of the teacher and delight in doing it.

Let us now consider, in order, the several branches taught in the schools, and determine in what manner the instruction in each case will be corrected and enhanced by securing from them materials for the Exposition.

CHAPTER II.

Reading.

With the teacher of abcdarians, the practice of having children prepare their little lessons by printing them (or writing, if script is taught at the first) on *their slates*, and bringing them to the class for the inspection of the teacher, is now almost universal. Besides helping to fix the whole form of the letters clearly on the mind, this method keeps the children occupied and their muscles busy. A little care on the part of the teacher will soon enable these little folks to accustom themselves at the first and always to prepare these lessons neatly and with business-like rulings, crosswise and lengthwise of the slate. This important habit of order and neatness may be, should be, established at this time and in this grade.

Now, let one of these lessons be put upon paper instead of the slate. Let the teacher supply the lead pencils and the paper; both can be easily obtained at slight expense. If writing paper can not be supplied, there are many kinds of wrapping paper, cheap and abundant, which will answer the purpose. Teachers of primary schools who have had much experience know that it is better and cheaper to have on hand slate pencils and lead pencils for the children, and to distribute and collect them at every exercise.

The crudeness of these exercises is nothing against them. Frequently the child will do little but perpetrate some mysterious scrawls, which will be but *slightly more* legible than the writing of many distinguished men. But when these first "cunning" efforts are carefully taken at the first of the term and preserved and compared with the efforts from the same pupils at the close of the term, the improvement thus shown and made apparent to all the parties interested fully repays all trouble and dissipates all doubts which the first performances may have caused.

At first, of course, these exercises will be "*Studies*" that are prepared at the seat during the regular study period. But in a few months the pupils will have so advanced that they may be required to write from *memory* during the *recitation* period, say one stanza of a little poem they have read and learned from the reader. This will be a first effort in composition. In a small way, the capitals and spelling and punctuation will be noticed. An exercise so prepared will be a "*Recitation.*" Before the close of the first year written "*Reviews*" will be taken, and "Examinations," both periodic and final.

The little children become very fond of these exercises, and will beg the teacher for them, so that many will be taken on scrap paper (but always neatly), which will not be preserved. The aids which such exercises will afford toward keeping order and maintaining interest will a thousand times pay for the trouble of examining and properly mounting the papers thus preserved.

For more advanced grades, the variety, profit and interest in the exercises are infinite. Teachers will go far beyond the suggestions which the limits of this chapter will permit.

It is well known that there is no better method of securing thorough study of a reading lesson than by having a part or a whole of it carefully copied by the pupil. It is a practical drill in all rhetorical particulars, spelling, punctuation, capitals, paragraphing, etc., points which, strange to say, are too generally utterly ignored in the reading class, the *only* class in language, in rhetoric, in literature, in most schools. The reading book is supposed to be an adaptation of good literature to the taste and abilities of the pupils. But to too many teachers the idea that the first, second, third—all the reading classes form the *literary* department of this school will be new. And yet, should it not be so? Ought not every reading class, from the lowest to the highest, be a practical literary club, a rhetoric class, a *language* class? The best writers and speakers have not become so by the study of the *principles* of rhetoric, but by familiar acquaintance with good models and constant practice. The first thought with the teacher of every reading class should be to make the exercise a literary one. The correct pronunciation of words and inflections are comparatively unimportant; but, indeed, the very way of securing good inflections and intonations is *by way* of the literary interest that may be aroused. So with all classes in reading above the first year, innumerable exercises may be profitably required.

What better first examination of a choice selection, such as "We Are Seven," or "Hamlet's Soliloquy," can be made than to copy it neatly and correctly? (*Study.*) Let it be examined carefully by the teacher, or by the pupils themselves, by exchanging. It is wonderful how many errors can be made by children (of older growth, too,) in merely copying.

Then for a closer study, after the poem has been read, let the pupils be required to commit to memory a part or the whole of the selection, and during the recitation period write it off from memory. (*Recitation.*) Again, after it has been recited orally by all the pupils, and after its beauties and peculiarities have been explained and commented upon, by teacher and pupils, let the class then, as a "*Study*," write their own comments upon the poem. This will be an easy, but very profitable, form of composition.

Or let them come to class before the selection has been committed to memory, and reproduce during the recitation the *story* of the selection. So innumerable exercises can be engaged in, which, if preserved, will show most encouraging literary development and improvement in the class. It is all *active*, *creative* effort on the part of the pupils and so in the highest degree profitable and fascinating.

To put on record the pupils' elocutionary power, let them write some selections, and by suitable marks indicate the inflections, intonations, and emphasis. This would of course indicate only the theoretical reading. Perhaps when the phonograph has become a school instrument, the actual record of the vocal powers of the pupils will be made, and then subjected to public inspection. Really, though, the *mastery* of the piece will be adequately shown by these marks. This mastery should be required of all, the mere vocal expression can be accomplished well by few, and is comparatively unimportant.

Could a pupil go through such training in a reading class and present the spectacle of bad spelling and literary incompetency, which the pupils of many schools and colleges afford when called upon to express their own or any one else's thoughts in writing?

CHAPTER III.

Spelling.

The methods in this subject have lately so much improved that written spelling lessons are now the rule, rather than the exception, it being generally admitted that a pupil should *acquire* his knowledge in the same manner in which he *uses* his knowledge—a principle of wide application and infinite value in pedagogics. Spelling is used in writing, it should be learned by writing. Yet, the oral spelling should not be entirely given over. The ear is a gate to the soul as well as the eye and hand. There is much good, too, in the "head and foot," oral spelling. But the most of the spelling should be by writing and usually on the slates, always neatly. Sometimes a "Recitation" or "Review" will be put on paper for preservation. Of course, the Final Examination will be also preserved.

If trustees are so benighted as to require the use of a Spelling Book, then words with definitions will form an important exercise. But spelling should really be confined to words in the Reader, when, since they are taken in their connections, definitions of the words will not be so important.

The spelling lesson from the reader should be made to include capitals and punctuation. Frequently fifty or a hundred words in a given paragraph in the order in which they come will be dictated and written by the pupils in columns, so that they may be easily criticised.

Again, the pupils will be required to write upon their slates all words of their reading lessons containing four or more letters. This will be frequently done on paper and exhibited to show the teacher's method.

In dictating selected words for spelling, it will be well to have the class count off by Threes, then give the "*Ones*" a certain word, the "*Twos*" another, the "*Threes*" another, and so on with the whole lesson.—This will extend the area of the recitation and prevent copying, since there will always be at least two pupils between those spelling the same words. Criticise by exchanging, letting the critic have words different from those he spelled. After criticising, pass back, have the words spelled correctly, and let the critics be marked for errors in criticism as well as in spelling.

The variety of methods in teaching spelling is very great and a specimen or specimens of all his different methods should be preserved by the teacher for the Exposition.

CHAPTER IV.

ARITHMETIC.

In the lowest grades, the first efforts to make the figures and to add and substract should be most *seriously* preserved. Neatness and order in the work can be secured at first more easily than later. Soon the "tables" will be prepared and preserved, some exercises being "Study," some "Recitation," and at last "Examination." Written examinations should be held of all first-year pupils in reading, writing, and arithmetic, and spelling, and the work carefully preserved and subjected to public inspection. It delights the pupils as it does also the parents, and it makes the instruction pointed and thorough.

For the more advanced pupils in arithmetic, nothing will be more helpful than the habitual preparation of their lessons, solutions of examples, statement and illustration of rules, demonstration of principles, etc., etc,, in a neat, orderly, and business like manner. The degree of accurate neatness which can easily be attained by pupils will be as pleasing and astonishing, as are the slovenly inaccuracies, which the slates of most arithmetic classes disclose, unpleasing and astounding. The thoroughness and clearness of instruction are greatly enhanced by requiring pupils to put all work neatly and fully upon their slates, and occasionally having it put upon paper and preserved.

Of course, every character of work will be taken up, according to the needs of the class. Sometimes as "Recitation" one difficult example may be given, and its solution put neatly on paper during the recitation period, and thus the actual condition of *every* pupil of the class be exposed to the teacher.

At another time, either as a *Study* or *Recitation*, a rule may be written, its steps numbered, and an example or examples solved, having, in the written solution, figures placed indicating the number of the step of the rule.

Again, the tables of compound numbers will make a good exercise.

Again, bills, notes, and drafts necessary for the full understanding of an example.

Again, the written demonstration of same rule. (*Recitation*).

So Reviews of principles and definitions and innumerable exercises will grow out of the management of a teacher who desires to use every aid to make his instruction thorough and systematic. If the progress of the class is retarded somewhat by these mechanical exercises, good will be accomplished ln many schools where some weighting down is necessary to prevent skimming, shallow work.

CHAPTER V.

Geography.

In no subject will the Exposition better serve to bring about greatly needed improvements in methods of teaching, which will relieve the pupil of the effects and the teacher of the necessity of cramming, than in Geography.

In every grade, map-drawing is an indispensable *aid* to correct study. I underscore "aid" because there is a growing impression throughout the schools that map-drawing is an *end* rather than a *means* of teaching Geography. In many of our graded schools, the teachers have gone still a step further and are making some *system* of map-drawing an end rather than a means, so that all the instruction in Geography is warped to the one purpose of teaching *thoroughly* the construction of some arbitrary system designed to complete some series of Geographical text-books.

How this tendency of weak minded teachers to become the slavish victims of some good practice is to be remedied is a question of no small moment. The Exposition practices will serve to recover them somewhat; but, like all other methods in the hands of weak creatures, it will be easily pushed from its normal healthy use into deadening abuse.

The map-drawing has its place, an important place, in the teaching of Geography. It should be practiced, from the lowest to the highest grades, and the records of pupils efforts in this direction should be preserved as much for the instruction of teachers as for the encouragement of pupils and patrons.

Among the first maps will be:

1. Points of Compass.
2. School Room.
3. School Yard.
4. School Yard with neighboring fields and roads or blocks and streets and so on.

Proper preliminary drill on these subjects will enable children in the first year of school to gain a good knowledge of their surroundings, the power of representing their knowledge neatly by drawing; and, besides, the knowledge of many Geographical technicalities. These efforts should first be made on the slates until the ideas of place and form are clear, to the teacher as well as to the pupil. For the teacher will need to experiment and test many plans before the best and neatest and most practical results are obtained.

From maps of surrounding neighborhoods, the pupils will be lead to a map of township, county, state, neighboring states and so on. This course will now be more easily accomplished by the teacher, since publishers are furnishing special *local* editions of their Geographies which go so far as to provide teachers and pupils with maps of the counties at least.

The singular fact may be noted here, that this *local* material is added to the *advanced* text-book instead of the *primary;* that is, that portion of the study which should come first is placed last. Thus it is arranged that ideas which pupils ought most to have, because most useful, are placed so that a majority will not reach them, since they will not be in school long enough; while ideas, which are useless and inconceivable are conscientiously crammed, —and so deep and disagreeable an impression of the study is left that the pupil is entirely robbed of that native curiosity in that direction which would have impelled him, had he not touched the subject in the school, to inform himself.

A primary course should be almost entirely a map-drawing exercise. By this I do not mean the pupils should not have books. A book containing most of the maps to be drawn should be in the hands of every pupil. At first, not being able to read, they will *study* only the pictures and the maps, but these they *should* study in their weak way at regular periods. The prevailing idea that, for the first few years of school, children should not be required to study, and that oral instruction only is possible, is a dry rot at the foundation of our school system which will surely endanger it beyond salvation if it is not totally abandoned. Children can study just as much as they can do anything, no more.

At the first, these maps will be "Study." It will be well to let the preparation of one map extend over many lessons. The first effort at the map of the county, for instance, will be merely its outline; then its rivers, then its mountains, then its towns and cities, and so on. While all this work is done on one sheet, the subjects of each lesson will be carefully noted on the sheet with time of preparation, standing and date. In this manner a history of the class proceedings will be fully kept, a record which any one would examine with great interest.

After the pupil is able to read, the map-drawing should be mainly "*Recitations*" or "*Examinations*" and in addition there will be innumerable exercises, such as tabular statements of cities, rivers, mountains, lakes, taken variously as "*Studies*," "*Recitations*" or "*Examinations*."

Until the results are seen, one can hardly believe the prompt, practical accuracy which pupils may be led to attain by these methods.

Warning. Let nothing be done for Exposition, *merely*.

CHAPTER VI.

GRAMMAR.

Grammar is a study and practice of language. Language is for the expression of thought. This expression can be either oral or written—it should be both. Oral expression is the highest gift. Written expression is the more useful and practical one, and is the surest means to the end of oral expression.

Efficient instruction in Grammar will therefore be a continued drill in written expression. If the object be language-teaching, then of course, a majority of the exercises will be written. If the object be a study of technical Grammar, the best method, it is generally admitted, is by having the lessons written. Parsing lessons are best prepared by writing. The analysis of sentences must not only be written for thorough study, but it makes very attractive material in its appearance.

Outlining can be made a very useful help in teaching Grammar. Subjects may be investigated by outlining (*Study*) or Recitations and Reviews may be made in outline.

There is no more effectual means of conducting a thorough review of a certain part of speech than by taking its divisions and subdivisions in order, and making them a subject of oral discussion, preparatory to a written "*Study*," or "*Recitation*," or "*Examination*."

In conducting his recitations with a view to an outline, the teacher will find himself benefited quite as much as his pupils. Trains of thought, practical distinctions, and points of association will be brought out, which will all tend to a deeper appreciation, wider mastery and firmer retention of the subject.

As an illustration of such an exercise, an outline of the *Infinitive Constructions* is given on the following page.

Any teacher will readily perceive how such a study is helpful to thoroughness of investigation and to the memorizing of the important points of the discussion.

It will be found that much of the regular material of the work of the grammar class need not be preserved, lest there be too great an accumulation. Yet pupils should be encouraged to retain and preserve all exercises that are not reserved for Exposition.

The teacher should be careful to select those exercises best illustrative of methods and progress, rather than those which present the best appearance.

CONSTRUCTION OF INFINITIVES.

1 1 Infinitive Constructions	
1 2 Con. of Noun.	
1 3 With Verb.	
1 4 Subj. of Verb.	1 *Is* it lawful for us to *give* tribute.
2 4 Obj. of Trans. Verb.	2 I *wish* him *to go*.
3 4 In Pred.	
1 5 With Intrans Verb.	3 To obey *is to enjoy*.
2 5 With Passive Verb.	
2 3 In Apposition.	
1 4 With Noun.	4 Delightful *task to rear* the tender thought, &c
2 4 With Pronoun.	
3 4 With Phrase.	5 *To escape from this existence, to die* is what I [wish
3 3 With Preposition.	6 What went ye out *for to see*. (Obsolete.)
2 2 Con. of Adjective.	
1 3 Limiting Noun.	7 *Time to come* is called future
2 3 Limiting Pronoun.	8 *They* seem *to study*.
3 3 In Predicate.	
1 4 With Intrans. Verb.	9 Our duty *is to be done*.
1 4 With Passive Verb.	
3 2 Con. of Adverb.	
1 3 Limiting Verb	
1 4 Active.	
1 5 Transitive.	11 *To confess* the truth I *say* I was wrong.
2 5 Intransitive.	12 He *labored to excel*.
2 4 Passive.	13 He was *judged to be* competent.
2 3 Limiting Adjective.	14 They are *about to go*.
3 3 Limiting Adverb.	15 The object was *so* high as *to be* inaccessible.

CHAPTER VII.

Writing.

Upon entering school *every* pupil should be required to write, on a sheet of paper, large enough to receive the same specimen three times, something as follows:

> *I am —— years old, and this is the way I write and make the figures: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, upon entering school at the beginning of the year 1878.*
>
> *John Smith.*

This should be followed by a stanza or paragraph, written as well as possible.

At the middle of the year, the same sentence and paragraph should be again written on the same sheet, changing only the clause "upon entering school at the beginning of the year" for "at the middle of the school year," or "——months after entering school."

This specimen should be now followed by some new *Trial* paragraph which the pupil has never before seen.

At the close of the year, exactly the same should be written on the same sheet, with the few necessary changes, and the substitution of a new paragraph, not for the one first chosen, which should be written every time, but for the Trial paragraph.

At the Exposition, this record of the pupils progress will appear on one page and furnish one of the most interesting features. Care should be taken to put every pupil on record at the time he enters school, whether it be at the beginning, middle or close of the school year.

The incomprehensible hyeroglyphics which some of the abedarians will perpetrate in their first efforts, will be only less surprising than the improvement, which will be manifest in their last efforts.

It should be understood from the first that all copy books are to go on exhibition.

How the preparation and exposition of such material will inspire the whole school in this direction will be readily discerned.

CHAPTER VIII.

Music.

Instruction in music is becoming more and more universal and definite. It would hardly seem posible to put upon record the vocal products of this instruction. The phonograph will be adapted to this purpose as well as the elocutionary examinations. Since by it all the properties of the voice, except quality, are recorded, this record will soon be so magnified that the eye will be enabled to recognize all the peculiarities which are supposed to be confined to the ear.

Still, there are many exercises of the class in music which ought to be taken on paper. Every tune learned, should be written from memory, "*Recitation*," or "*Review*." No exercise would better correct the failure of most of the teaching of the day in giving pupils the power of reaching music.

So all the elements of written music, the staff, notes, marks of expression &c., will be most thoroughly taught by requiring the pupils to put their knowledge upon paper.

It is now the practice in most of our puplic schools, where music is taught, to hold written examinations upon it.

CHAPTER IX.

Drawing.

This subject is best managed and most systematically developed, when the exposition is kept in view.

In all cases the drawing books can be exhibited. But in connection with the drawing books, independent efforts to draw from real objects, placed before the pupils, should be taken frequently. This will add unthought of interest and zest to the study, as well as correct the greatest deficiency in existing methods in drawing. The everlasting "principles" are made so everlasting that pupils too frequently never get beyond them to their commonest applications, so that drawing, the most practical of the studies in the schools, suffers the fate of too many subjects—suffocation by the text and strangulation by the teachers. With any text, with any system, with any teacher, with any class, the pupil should occasionally (always?) be required to draw real objects. These efforts should be preserved and the success in efforts compared.

One of the most useful and practicable of all systems is Prof. Willson's, published by Harpers. The paper is all cross-lined, and the interstices of the lines make so many established points which the pupil appropriates in copying the lesson, or in inventive efforts. If the books can not be obtained for the school, any teacher, after seeing them, can obtain foolscap paper, cross-ruled, and give valuable original instruction. From the first year pupils to those of twelfth year, beautiful original designs for wall-papers, calicoes, oil cloths, carpets. window curtains &c., &c., can be obtained. If here (and the principle is true in all departments of education) the teacher will only busy himself in *giving the pupil a chance*, in merely removing obstructions in the way of natural and spontaneous effort, results can be obtained which orthodox drawing teachers will sneer at as too good to be genuine.

There is in this subject a great unknown country which it is the privilege of the humblest school-masters of the land to explore, and from which may be gathered unheard of riches and in which discoveries are to be made, which shall free our schools from the stifling influence of bad "systems" and ignorant and bigoted professors.

CHAPTER X.

United States History.

In no study will the Exposition methods furnish greater relief from the evils of bad teaching than in history. Instead of the tedious cramming of dates, they will substitute practices of interested investigation, and secure an intelligent mastery of the subject.

While the suggestions offered are applicable to all departments of History, their illustrations will be here confined to United States History, their wider applications being left to the skill of the enthusiastic teacher.

Introduction.

Generally speaking, we learn things, first, as wholes, finally, as composed of parts. With increased knowledge comes an increased familiarity with the number and variety of the parts of what we first knew as a whole composed of few parts.

A child's knowledge of a dog is different from the scientist's knowledge of *Canis familiaris*, in that the latter has familiarized himself more thoroughly with the parts of the whole, which to the former seems composed of very few parts. Yet the child's knowledge is good so far as it goes. It is *practical;* it enables the child to recognize the dog when he sees it. So in all directions of learning, our first conceptions are distinguished with few marks—are wholes composed of few parts. To learn all of the parts of a tree before recognizing trees would be tedious and unnatural. We all can recognize trees before we study botany. The *Natural* method of learning begins with wholes, and passes, first, to a few parts, then to more parts, and so on until the sufficient number of parts are mastered. On the other hand, the *Logical* method, which one would pursue if he followed the order of statement of facts as laid down in any logically arranged text-book, passes from parts to wholes. Geometry, for instance, is usually taught after the logical method. Out of postulates, axioms, and definitions, as parts, are formed certain wholes, which again become parts to form new wholes, and so on, until the science of Geometry is evolved. So with most of the sciences presented in text-books. The *Logical* method is well enough at certain times. I am not objecting to it absolutely; but I do claim that we *naturally* take hold of new subjects as wholes, and learn them by discovering their parts; and, generally speaking, it is distasteful to begin with uninteresting parts, and unite them to make interesting wholes. The less discipline the mind has, the truer is this statement.

Now, all this bears upon the proper study of history; but, before I show how, let me use another illustration. Suppose, as strangers, we are about to visit a large city—Cincinnati, for instance—with the purpose of learning as much about it as we can in the time at our command. What would we best do first? Perhaps we would do nothing but jump on the cars and go into the city. Yet, will it not pay us to *glance* at a map first? If we know nothing about that city, its locations, etc., we shall like to know where we shall alight; where the more important streets are; how we are to go from the depot to reach them, etc., etc. But, while these general facts are very interesting and useful, would we be so foolish as to commit to memory, as a preparation for our first visit, the names of *all* the important streets, *all* the important public buildings, all the important business centers? Not at all. We would prefer to learn them by visiting, and so *impress* their names upon our mind—that is, commit them to memory.

But now we have arrived in the city. We desire to learn it *thoroughly*. Should we therefore stop at the first building we come to, examine it critically, study its architecture, the number of rooms in it, the materials of which it is built, the exact dimensions of all its parts, etc., etc.; then pass to the next building, and so on with each building on each street, and so through successive streets until we have mastered thoroughly every house on every street in the city?

Of course we would do no such thing. We haven't the time. 'Twould occupy months, years. It would be as foolish as the too common method of studying history.

But supposing we *had* time, all the time we need, would we pursue this course? Would it pay us, if we did? Would it give us the information we *need*, or would we remember any length of time very much of this quantity of knowledge which we had so *thoroughly* (?) acquired?

We would go at it in no such way. First we would be glad to go to the top of some tower, in a central part of the city, and see how the more important streets run, and where the prominent buildings stand. Having thus gained a clear idea of the points of the compass and the general "lay" of the city, we would visit a few points first, and fix the most important streets. If at our first visit we learn Third, Fourth, and Fifth streets, Walnut, Vine, and Race; visit the Fountain, the public libraries, and the public institutions, we shall be satisfied. At succeeding visits we shall extend our examinations, but endeavor all the time to learn just that about which everybody knows something. Then, having become generally acquainted with the city as a whole, we can settle, if we choose, upon certain localities, and make them our "specialties." But, if it is not our object to be specialists, we shall have reason to feel that we are what any one would consider "well informed" with regard to Cincinnati. We can talk intelligently about it to others who have also visited it.

Now, in studying History, let us adopt the same reasonable course. Let us avoid that false notion of thoroughness, which, in studying the city, would have kept us, during our first visit, in one important building, *and left us ignorant of Fourth Street and Fountain Square.* Let us, from a bird's-eye view, map out our subject, studying it first as a whole composed of a few prominent parts. Then take these parts as wholes, and study them in the same manner. But we must beware of the minutiæ, lest they swamp us. We must be cautious, lest in the desire to master a multitude of details we fail to remember any thing. We must also see to it that what we do learn shall be immediately available—shall make us "well informed."

First Recitation.

General Outline of the U. S. History. The teacher will place upon the board the following *Outline, omitting the Dates:*

1[1]	Origination (1st Explorations to 2d Continental Congress),	1000—1775
1[2]	Explorations (1st Explorations to Jamestown Settlement),	1000—1607
2[2]	Colonization (Jamestown Settlement to King William's War),	1607—1689
3[2]	Consolidation (King William's War to 2d Cont. Congress),	1689—1775
2[1]	Formation (2d Continental Congress to Jackson),	1775—1829
1[2]	Separation (2d Continental Congress to 2d Treaty of Paris),	1775—1783
2[2]	Organization (2d Treaty of Paris to Washington),	1783—1789
3[2]	Federalization (Washington to Jackson),	1789—1829
3[1]	Reformation (Jackson to Garfield),	1829—1881
1[2]	Agitation (Jackson to Lincoln),	1829—1861
2[2]	Emancipation (Lincoln to Johnson),	1861—1865
3[2]	Reorganization (Johnson to Garfield),	1869—1881

The pupils will copy this while the teacher is putting it on the board, and as soon as finished the teacher will explain in the following or equivalent: .

Remarks upon the Outline. I have given you here a "birds-eye view" of the History you propose to study. You will soon discover that our history is as clearly a *growth* as the tree standing near the window, and that it should be studied first as that tree would be studied. At first glance you see the tree is a whole, composed of a few distinct parts, namely, roots, stem, and leaves, and by noticing these with a little care, you will easily learn enough about the tree to be able to recognize it or a similar one.

In the same manner you may become quickly and easily familiar with the most important parts of our nation's history, taken as a whole. These few, yet important, divisions are presented in this outline. By fixing them clearly in your mind, you will be better informed than many who have recited from memory whole text-books on this subject.

But, understand, pupils, I do not propose to make the mistake of asking you to commit these bare facts to memory without preliminary research on your own part, but, on the other hand, after a few explanations, I shall request you investigate with the aid of your text-book the time over which these divisions extend, and to determine the proper date for the beginning and close of each period.

The simplest, first analysis divides the history of the United States into three important eras; namely, ORIGINATION, FORMATION, REFORMATION.

Our nation was a long time coming into being. The country was first discovered and *explored;* then settlements, or *colonies*, were established; finally, these colonies were *consolidated* into a nation. These three steps constitute the whole history of the origination of our nation, and corresponding to them we have three periods—*Explorations*, *Colonization*, *Consolidation*.

The United States were spoken into existence when the first blood was shed. The nation was really born at the battle of Lexington; but the Second Continental Congress, which assembled in 1775, completed its individualization by the Declaration of Independence. But a nation declared and a nation established are two things. Having *affirmed* and achieved independence and separation, the next process was to *organize* into an indissoluble whole the distant, jealous, and sovereign parts, first on paper, then in the hearts of the people. These several steps—namely, *Separation*, *Organizatior*, and *Federalization*—make up the three periods into which the FORMATION separates itself.

Separation was accomplished by the war of Revolution; and not until the Treaty of Paris, 1783, was it a fact. Following this, was a period of great anxiety to our forefathers. While the war was in progress, the union of the colonies was necessary and inevitable; but, at the moment when that pressure was removed, it was discovered that there was really no National government. The Confederation organized by the Second Continental Congress was powerless for union. To remedy this, the Federal Constitution was formed, and at last adopted. Now the *Organization* is completed; but there remains the more important step of creating and establishing this in the hearts of the people; of creating and developing that *national* sentiment of union, which, when expressed in those memorable words, "The Union, now and forever; one and inseparable!" found an echo in *every* patriotic bosom. It took time to bring about that feeling which now prompts every American to surrender any thing but the Union. We must remember that the colonies, proud of their individual independence, and more or less jealous of one another, made with some reluctance the surrender of State sovereignity necessary to a strong Union. And though they at last adopted the Federal Constitution, that instrument had to be administered with the utmost delicacy and caution, lest some irritated State should of itself break the yet feeble bonds which held it in the Union. In other words, the process of *Federalization* took time, required great skill and patience. But it was thoroughly accomplished by the time of President Jackson, for his threatened coercion of South Carolina received the practical support of the whole people. To fix the exact time at which we became a nation, *in fact* as well as on paper, is, of course, impossible; but I let it include the time from the beginning of Washington's administration to the administration of Jackson, 1829.

Now, the *Union* being no longer a question, the nation being sufficiently consolidated to stand, whatever else might fall; and the States being sufficiently cemented together to withstand any wrenching, however severe, we begin the exciting era of REFORMATION, which embraces the prolonged struggle over slavery. Our forefathers, who were practical men, compromised with slavery again and again when attempting to unite the colonies. This was necessary. No Union could have been formed without it, and a Union was the first thing. Yet it is wonderful how, in these concessions to slavery, *practices* were permitted which involved the sacrifice of no *written* principles of liberty in the Constitution; and still more wonderful, how these written principles at last asserted themselves, and have survived the practices which were so inconsistent with them.

The more it is considered, the more will it appear that the great slavery struggle was wisely postponed until the nation attained the matured strength necessary to undergo the surgical operation of the REFORMATION.

This era readily falls into the periods, *Agitation*, *Emancipation*, *Reorganization*. During FORMATION the system of the body politic was being "toned up," preparatory to undergoing the *sickness* of the *Agitation* and the *surgical performance* of the *Emancipation*. The invalid is now enjoying a hopeful *convalescence* of *Reorganization*, which we all hope will terminate in a healthful vigor which shall make ours the grandest of nations. All intelligent persons, North and South, are agreed that slavery was a fearful inconsistency in our national organization. Our forefathers, North and South, deprecated it sincerely and repeatedly. Washington and Jefferson, both southerners, freed their slaves. At last it threatened the life of the nation. It is gone. The nation survives. Whatever we may have suffered, all must rejoice at the result, the South more than the North; for now, relieved of this incubus upon her commerce, her industries, her internal improvements, with the great advantages of seaboard, climate, and fertility of soil, she must soon rival the North in peaceful prosperity—a rivalry which slavery alone made unequal.

You thus see, scholars, that I have taken you over our whole history as a nation. The full significance of all that I have said, you will not realize until by your own study and investigation you have corroborated my every statement. To this work I will now direct you.

For your next lesson you may copy this outline neatly upon paper and place opposite each division and subdivision the date, which you must determine by studying your texts. While determining and affixing these dates strive to impress them upon your minds. This exercise will require you to go over the whole book and you will find, that in your first lesson you have mastered the *whole* of United States History, and that, should you never look into the study again, you will be familiar with its most striking features and.

be more *intelligent* concerning your nations history than many are who have memorized it from beginning to end.

Second Recitation.

This will be chiefly given to hearing reports from different·pupils as to dates determined. The outline will then be again put upon the board with the proper dates, the pupils when necessary correcting their own papers. Every paper should be graded by the teacher, in this case about *ten* being taken from one hundred for every wrong date, there having been about ten dates to be determined.

Before dismissing the class, the teacher should drill the pupils in the divisions and their dates, encouraging them in this way to fix them in their minds and to give them from memory. It will be found that, at the close of this recitation, these periods are quite well memorized, so that at the next lesson they may prepare for a written "*Recitation*" of the outline, that is, they will copy the outline and so prepare themselves to put upon paper, from memory, during the next recitation period, the whole outline with all the dates.

Succeeding Recitations.

In just the same manner treat each subdivision. Consider at first only its salient parts, so that in one or two weeks the class will have *again* passed over the *whole* history. Let the pupils frequently from their own investigation discover the *divisions* as well as their dates. This will train them to weigh and balance events, and so cultivate practical historical judgment—a power sadly defficient in many students (?) of history.

These papers will all be preserved, and when placed upon "*Exposition*" will show the method of the teacher and the growth of the class in the subject.—*

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* For complete outlines the reader is referred to a work by the writer, "Outlines of United States History." Danville. J. L. Sherrill, Publisher.

CHAPTER XI.

Physiology.

The best means of studying Physiology, and indeed, all the Natural Sciences is by outlines, (*Vide* Appendix), prepared by the pupils. These will in some cases be "*Study*" work, frequently "*Reviews*," and will always enter partly into "*Examinations*." Pupils will soon become so disciplined in the subject by outlining that oftentimes a recitation will pass without the teacher asking a question. The effort to grasp the subject for the purpose of arranging its heads in logical order, such as the outline requires, soon gives them such a mastery of the subject of a lesson that any one, when called upon, will take up the proper topic and discuss it fully without question or suggestion from the teacher, but usually with correction and criticism from his fellow pupils. Physiology affords one of the best opportunities for developing outlining power.

Besides the outlines, neat drawings of the parts of the human system will be frequently requested and preserved. Some of these will be "*Recitations*" and "*Examinations*," but usually "*Study*."

Teachers will be surprised to learn, how many pupils can draw well if opportunity is afforded them, and it will be found that good or bad drawing is a most efficient aid to thoroughness and definiteness of knowledge.

Besides drawing upon paper, the pupils should be required to put on the board drawings of organs to be recited upon.

For the assistance of the teacher as a basis of further proceding, I submit the following outline. It will be found well, after the pupils have attempted to make a general outline of the whole subject as their first lesson or two, for the teacher to aid them by giving them the benefit of his wider and maturer knowledge of the subject in some such outline as follows. It is quite essential that the *cast* of the subject should be well made in order that no topics may be omitted and in order that the most important leading relations may be clearly set forth:

Outline of Human Body.

1^1 Tissues.
- 1^2 Definition.
- 2^2 Parts.
  - 1^3 Cells. 2^3 Fibres. 3^3 Intercellular Substance.
- 3^2 Kinds.
  - 1^3 Cells suspended in Liquids.
    - 1^4 Blood. 2^4 Lymph. 3^4 Chyle. 4^4 Glandular Secretions.
  - 2^3 Cells placed on Free Surfaces.
    - 1^4 Epithelium.
      - 1^5 Definition:—The outer surface of the skin and mucous membranes, being always exposed to the air.
      - 2^5 Kinds.
        - 1^6 Tessellated. 2^6 Columnar. 3^6 Ciliated. 4^6 Spheroidal. 5^6 Transitional.
    - 2^4 Endothelium.
      - 1^5 Definition:—Parietal surface of membranes with free surfaces, not exposed to the air.
      - 2^5 Situation.
        - 1^6 Serous membranes. 2^6 Inner surface of blood and lymph vessels, &c.
  - 3^3 Cells imbedded in solids.
    - 1^4 Connective Tissues.
      - 1^5 Definition:—The supporting frame work and binding material of the textures of the body.
      - 2^5 Kinds.
        - 1^6 Neuroglia.
        - 2^6 Retiform.
        - 3^6 Gelatinous.
        - 4^6 Fibrous.
          - 1^7 Areolar. 2^7 Dermous. 3^7 Mucous. 4^7 Serous. 5^7 Fasciæ. 6^7 Tendinous. 7^7 Ligamentous.
    - 2^4 Adipose.
    - 3^4 Pigmentary.
    - 4^4 Cartilaginous.
    - 5^4 Osseous.
    - 6^4 Muscular.
    - 7^4 Nervous.

2^1 Organs.

1^2 Hard.

1^3 Bones. 2^3 Teeth.

2^2 Soft.

1^3 Connecting = Gristle.

1^4 Cartilage. 2^4 Tendon. 3^4 Aponeurosis

2^3 Binding and Lining = Membranes.

1^4 Fascia. 2^4 Serous. 3^4 Mucous.

3^3 Moving = Muscles.

4^3 Secreting = Glands.

5^3 Transmitting.

1^4 Nervous Force.

1^5 Nerves. 2^5 Peripheral End Organs. 3^5 Central End Organs.

2^4 Air.

1^5 Nose. 2^5 Pharynx. 2^5 Larynx. 3^2 Trachea. 4^5 Bronchial Tubes &c.

3^4 Liquids = Vesicular.

1^5 Heart. 2^5 Arteries. 3^5 Capillaries. 4^5 Veins. 5^5 Lymphatics. 6^5 Ducts.

4^4 Food = Alimentary Canal.

1^5 Mouth. 2^5 Pharynx. 3^5 Œsophagus. 4^5 Stomach. 5^5 Intestines.

3^2 Liquid.

1^3 Blood. 2^3 Lymph. 3^3 Chyle. 4^3 Glandular Secretions.

3^1 Systems.

1^2 Motive.

1^3 Supporting = Skeleton.

1^4 Bones. 2^4 Cartilages. 3^4 Ligaments.

2^3 Propelling = Muscles.

1^4 Muscles. 2^4 Tendons. 3^4 Fascia.

2^2 Nutritive.

1^3 Preparing.

1^4 Digestion.

2^4 Absorption = Lactials and Thoracic Duct.

3^4 Purification.

1^5 Liver. 2^5 Lungs.

2^3 Transporting.

1^4 Circulation = Blood Vessels.

2^4 Reabsorption = Lymphatics.

3^3 Appropriating.

1^4 Assimilation = Capillaries.

2^4 Secretion = Mucous Membranes and Glands.

3^4 Excretion.

1^5 Kidneys. 2^5 Skin. 3^5 Lungs.

3^2 Sensitive = Nervous System.

Remarks on the Outline.

The classification of the Tissues is mainly that of Prof. Turner, given in Encyclopedia Britannica. It is possible that the teacher will find it necessary to omit portions or all of this, for the reason that neither he nor his pupils may have sufficiently full texts or reference books to pursue the headings.

The idea of this outline is that the class shall take three excursions over the whole subject. The first by the way of *Tissues*, the names, and examples of which should only be determined. It will be well to have the pupils to investigate the etymology of each term, if possible. The recitation upon the tissues should not be made too close, the object only being to secure a slight acquaintance with terms and a mere passing acquaintance with the objects.

The second excursion will be by way of the *Organs*. Here again only names and locations should be familiarized. It is not expected that each organ should be studied exhaustively. The first two trips are merely preparatory trips, reconnoissances before the complete and exhaustive excursion by way of the *Systems*.

The order of the trips may be reversed, if thought best, but with a strong class the order given is the best.

CHAPTER XII.

Natural Philosophy.

Investigation of Subjects by Outlines.

In order to give as particular and full an account of how this or any other one of the Natural Sciences may be handled with outlines, I will extract from National Normal, Vol. IV, No. 7, the following account of the proceedings of one of my classes in Natural Philosophy:

First Recitation. I determined in the management of this class, to impress thoroughly upon the minds of my pupils the unity of plan and practice exhibited by Nature in her physical world; to co-ordinate in their minds the subject or subjects to be investigated with those they had before investigated; to train in them a power of masterly investigation, logical discrimination, and so secure thorough knowledge. It was my first effort, by questioning and suggestions, to evolve the following outline, which I take from the one presented by *J. W. Campbell:*

- Existence.
  - 1^1 Matter.
    - 1^2 Considered abstractly—Mathematics.
    - 2^2 Considered concretely—Natural Sciences.
      - 1^3 Organized.
        - 1^4 Vegetable—Botany.
        - 2^4 Animal.
          - 1^5 Generally—Zoology.
          - 2^5 Particularly—Physiology.
      - 2^3 Unorganized—Physics.
        - 1^4 Considered extrinsically—Physical Sciences.
          - 1^5 Geology.
          - 2^5 NATURAL PHILOSOPHY.
        - 2^4 Considered intrinsically.
          - 1^5 Chemistry.
  - 2^1 Force.

It was concluded that the grand theme of investigation in all sciences was *Existence.* This resolved itself into *Matter* and *Force*, two terms which, it was afterward thought, are very nearly, if not entirely, synonymous. Under these two terms must, then, be included all the subjects of investigation involved in a complete course of study. By considering the relations of these studies to each other and to the subject, *Matter*, the above outline was evolved.

The Next Lesson was anticipated by a preliminary discussion of *Force*. This led us to the conclusion that every subject of human investigation might be brought under this one topic, even as it might have been under *Matter.* But our purpose was to find the position of Natural Philosophy, or of the subjects studied in Natural Philosophy under the general theme, *Force*. The next lesson, then, was: *Such an outline of Force as would embrace the topics of Natural Philosophy.* For this investigation, I, of course, referred my class to the introductory chapters of their own different text-books on Natural Philosophy and Chemistry, and to the numerous and fuller treatises upon the same subjects, to be found in the Reference Library.

As a result of their investigations, corrected and improved by the discussions at the next and succeeding recitations, I take the following from *Mr. T. A. Gibbon's* final outline:

2^1 Force.
 1^2 Kinds.
  1^3 Spiritual.
  2^3 Vital.
  3^3 Physical.
   1^4 Kinds.
    1^5 Molar.
    2^5 Molecular.
   2^4 Effects.
    1^5 Equilibrium.
    2^5 Motion.

How all the topics in Natural Philosophy would be reached by a logical carrying out of the above sub-heads was brought out in the class discussions, but left for more thorough investigation when those subjects came up for special study and outlining.

Having thus taken a bird's eye view of the ground over which we were to travel, I thought it best to come down to more concrete, but just as logical and natural, considerations. We accordingly assailed the topic, *Mechanical Elements.* I desired them to look upon the subject as susceptible of logical arrangement, and, accordingly, to prepare such an outline of the Levers as would embrace everything, practical and theoretical, relating to them. They would find that their authors, in many cases had arranged their discussions in this light. Some of them had not. The class were to improve upon them.

Manner of the Oral Recitations. The prepared outlines were the only guides during the recitations. The teacher merely presiding as chairman of the meeting. A pupil was first asked to introduce the theme for discussion. I avoided asking questions. If points were not reached, I stated as much, and called upon others to *tell what they were*, and to expand them, and still others to elaborate them.

I frequently encouraged each one to feel that, if he had investigated the lesson in a masterly manner, he ought to feel confident that he could recite upon it as a whole just as well as upon some of its points. I could not think that the subject had been fully grasped if, by particular questions, I must supply each one with a particular theme. I, therefore, in calling upon "the next" (which was of course, *any* pupil), simply said: "Mr. Vance, please continue the discussion." If he failed to take up the point in logical order, the criticism of the class very quickly apprised him of his mistake. He tried again, or gave place to some one who looked a little deeper.

A thoughtful teacher will easily see that pupils of any class who can, day after day, *handle* their subjects in this manner, must, of course, discipline themselves to a rigor of thought and thoroughness, and breadth of investigation which the six-page-a-day-lesson teaching and reciting simply ignores, or rather never dreams of.

During the recitation I put upon the board, step by step, the outline of the subject recited upon, as it was evolved by the recitation. Each pupil, at the same time, reconstructed his own outline upon this model. These partial outlines, made at different recitations, were preserved for the purpose of forming them into a complete whole, which was to represent the work of the term, and to be handed to the teacher at the close of the term, for examination and grading. Space will not permit me to give in full any one of the thirty-five "handed in" at the close of the term, since most of them, arranged in the manner of these presented, covered more than six yards of paper. The mechanical skill, neatness, logical ingenuity and exhaustiveness displayed in many of them was very remarkable. I graded each one on the last three points. Many appropriated a special blank book to the purpose, and are now carefully preserving the result of their labors as *most valuable treatises* upon Natural Philosophy, which are to be used as *works of reference* in their future career as teachers.

In order do give a general view of the work of the term, I will now, from these final outlines, make suitable selections. It will be remembered that one *route* to National Philosophy was through *Matter*. But we found that the topic, FORCE, grasped more correctly the topics of that study, as presented in the text-books. It was, therefore, *the* theme of the term. I have given our general outline of it above. To show how certain topics were reached, I will give extracts from the *final* outlines, omitting the definitions.

The following, of Molar Force, I take from Miss *Mate Phillips'* paper:

- 1^5 Molar.
  - 1^6 Natural.
    - 1^7 Gravitation.
      - 1^8 Universal.
        - 1^9 Terms.
          - 1^{10} Mass.
          - 2^{10} Density.
        - 2^9 Laws.
      - 2^8 Terrestrial—Gravity.
        - 1^9 Kinds.
          - 1^{10} Absolute—Weight.
          - 2^{10} Relative—Specific Gravity.
        - 2^9 Center of.
        - 3^9 Laws of.
    - 2^7 Inertia.
  - 2^6 Artificial—(Force utilized by the *art* of man).
    - 1^7 Through Solids.
      - 1^8 Mechanics.
    - 2^7 Through Liquids.
      - 1^8 At rest—Hydrostatics.
      - 2^8 In motion—Hydraulics.
    - 3^7 Through Gasses.
      - 1^8 Pneumatics.

The following partial outline, of Molecular Force, was by Mr. *Warren Darst:*

- 2^5 Molecular.
  - 1^6 Cohesion.
    - 1^7 Strength of the material.
    - 2^7 Elasticity.
  - 2^6 Adhesion.
    - 1^7 Capillary Attraction.
    - 2^7 Friction.
  - 3^6 Chemism—Chemical Affinity.
  - 4^6 Polarity—Crystallization.

The following, of *Motion*, is from Mr. *J. M. Staley's* outline:

2^1 1^2 3^3 2^4 2^5 Motion.

1^6 Molar.

1^7 Kinds.

1^8 As to relations.

1^9 Absolute.

2^9 Relative.

2^8 As to time.

1^9 Uniform.

2^9 Varied.

1^{10} Accelerated.

1^{10} Retarded.

2^7 Measure of.

1^8 Momentum—$M \times V$.

2^8 *Vis Viva*—$M \times V \times V$.

3^7 Laws of.

2^6 Molecular.

1^7 Sound.

2^7 Heat.

3^7 Light.

4^7 Electricity.

Space will not permit the presentation here of the more extended treatment of all of these heads. These will suffice to show how the different subjects were reached. That the preparation of such material as this will give power to the pupil, I need not urge, neither need I say that the examination of these outlines by those interested at the *Exposition* will be profitable.

Investigation by Experimentation.

One of the most interesting features at the Exposition will be the display and use of apparatus, most of which will have been made by the pupils.

The following suggestions as to the management of experiments will be found useful.

Let one recitation a week be given entirely to experiments. It will be found convenient to take the last period of the day, so that the class can, by remaining after school, be less hurried. At least a week before time, the teacher should prepare a "List of Experiments;" giving the name of the pupil who is to perform it; the name of the experiment, and references to the book or books containing an account of it.

By consulting the text, each pupil will learn his theme and where he can study it. The extra moments will then be given to studying the principles and devising materials. Friday afternoon the teacher will remain with the pupils, show them what apparatus is on hand, and explain its use. He will then give directions how the pupil can himself prepare similar apparatus. The following Saturday will then be devoted by each pupil to his task. The study period of Monday will then be given to the preparation of notes for the lecture. At Monday's recitation, the experiments will be performed before the class and visitors (for they should be invited) each pupil giving in connection with the experiment, a brief lecture, explaining the principle or law involved and its application in the apparatus. After each lecture, the pupils should be questioned by the teacher, so that the facts and principles may be fixed in their minds. This review of the class on a lecture, given before them by a comrade, is very helpful and should never be omitted.

Besides preparing the apparatus, performing the experiment and lecturing upon it, each pupil should prepare notes of his experiment, stating clearly what materials were used, how those materials were manipulated, and how and what the experiment illustrated. Accompanying this written statement, there will be neat drawings of the apparatus, properly lettered and explained. This written account will prove the most valuable exercise to the pupil and will of course be preserved for Exposition.

The teacher need seldom experiment or lecture himself. The most valuable apparatus may be safely entrusted, after proper instructions, to the pupils. This statement is just as applicable to boys and girls as to adults. I have tried it.

If a pupil fail to master his theme, it should be assigned again.

All the apparatus thus prepared should be carefully preserved by the teacher and exhibited and used at the Exposition,

Teachers will find it well to use the following or equivalent: —

Directions to the Pupil Lecturer.

1. Try your apparatus several times before bringing it before the audience, especially when it works well the first trial. Many failures with final success before your public effort, will be a great deal more helpful than repeated success. If there is any possibility of failure in the apparatus, you are sure to find it out when before the audience, unless by repeated trials, beforehand, you have learned how to guard against it.

2. Have an assistant who knows what is to be done and who can anticipate your requests for any part of the apparatus or other assistance.

3. Let the table, on which you are to operate, be entirely cleaned of unnecessary materials.

4. Have on your table only such materials as it will be inconvenient to move while you are lecturing.

5. Have your other materials on a side table near at hand.

6. State or define the principle or property you are to illustrate.

7. Give some account of its discovery or other interesting historical incidents, if possible.

8. Mention familiar every day applications of the principle.

9. Explain your experiment and apparatus from drawings on the board, being careful to use the letters placed on the drawing to designate. This is a very important part of your lecture, as in many instances the particulars of your experiment will be observable at only a short distance from the table. Your explanation from the drawing will help both the eye and the intelligence of your audience to comprehend what is going on when your experiment is in operation.

10. In arranging the materials on your table, be very careful to dispose them so as not to obstruct the view of your audience.

11. Don't keep the audience waiting while arranging and adjusting your apparatus. *Explain all the Time.* Your hearers are just as much interested in the adjustment of your materials and the particulars of their manipulation as they are in the result of the experiment.

12. Predict the results of the experiments just as you are about to produce them, giving your audience to understand that a little time, or possibly several trials, may be necessary.

13. If it takes a little time for the operation, prevent suspense of waiting by introducing explanatory or other suitable remarks.

14. While the results are being produced, be very careful to place or hold the materials where they can best be seen by the whole audience.

15. If the experiment fail, do not be disconcerted and make remarks which, though intended to conceal, but the more clearly expose your embarrassment. Your audience will kindly refrain from betraying unnecessary consciousness of the mishap. Readjust the materials at once, at the same time explaining the mechanical reasons for the failure. Oftentimes a failure thus well explained will illustrate the principle better than the experiment itself.

16. The result having been produced again, give their scientific explanation and import. Your lecture does not reach its culmination in the "flash or pop" of the experiment, but in the lesson to be drawn therefrom.

17. Maintain throughout an earnest and dignified demeanor. Some of the experiments would be almost trivial, did they not illustrate principles which scientists have labored years to discover.

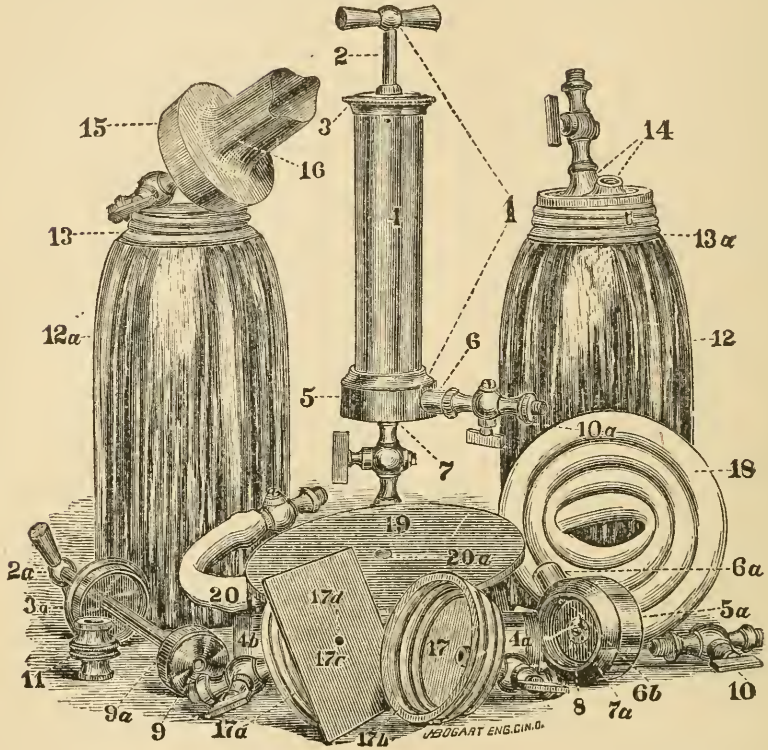
18. Do not indulge in supposed facetious remarks or parenthetical triflings during the progress of your lecture. They usually expose or lead to embarrassment. Unless you are an expert as a wit, this is a very dangerous time to try to be funny.

19. Courteously indicate by suitable words or bow your thanks to your audience for their patient attention.

20. Carefully remove all your materials from, and clean or dry, the tables when you are through, so that the lecturer who follows you will find it as clean as you did.

As a result of my efforts to simplify apparatus, the following set for pneumatic experimentation has been devised. It is now in use in many schools, where equivalent, costly materials, having been found less convenient and effective, are set aside.

HOLBROOK PNEUMATIC APPARATUS.



1--Holbrook Air-Pump.

Exhausts and Condenses without change of parts—2, 2a, Piston Rod (P. Rod)—3, 3a. Piston Cap (P. Cap)—4, 4a, 4b, Cylinder (Cyl.)—5, 5a, Valve Cap (V. Cap)—6, 6a, 6b, Condense Orifice.(C. Or.)—7, 7a, Exhaust Orifice (E. Or,)—8, Exhaust Valve (E. Val.)—9, Plunger (Plun.)—9a, Leather Washer on Plunger—10, Stop Cock (S. Ck.)—10a, Washer on Stop Cock—11, Connector (Con.)

12--Holbrook Movable Receiver and Condensing Chamber.

With Cap on (Rec.)—12a, same with Cap off—13, 13a, Rubber Washer—14, Double (orificed) Cap (D. Cap)—15, Single (orificed) Cap (S. Cap)—16, Rubber Connector (R. Con.) stretched over Single Cap—17, 17a, 17b, 17c, 17d, Magdeburg Hemispheres—18, Rubber Tubing (R. Tub)—19, Brass Plate—20, Rubber Tube connecting Plate with Stop Cock. The set is complete without the Brass Plate, 19.

The following list of experiments, with a few accompanying references and suggestions, will be found useful. It is the result of years of practical research in this direction and essays to present the experiments which, with the least material and expense, will best illustrate the important principles of Natural Philosophy.

A full description of the materials necessary and of their preparation, adjustment and manipulation to perform the experiments, together with simple explanations of the principles illustrated, will be found in the author's "Hand Book of Experiments in Natural Philosophy."

LIST OF SIMPLE EXPERIMENTS TO BE PERFORMED BY THE PUPILS.

Impenetrability.

1. *Tube and Cork.* Norton p. 16, art. 20. Holbrook p. 23, ex. 67. Place lamp chimney, closed by hand at top, over cork floating on water in glass jar, and push down to bottom of water.

2. *Alcohol and Water.* Norton, p. 16, art. 21. Alcohol poured gently on water in glass tube occupies more space than when shaken.

3. *Nails and Tumbler.* Norton, p. 16, art. 20. Carefully drop small nails or pins, into tumbler, brimful of water.

Porosity.

4. *The Filter.* Norton, p. 31, art. 34; Steele, p. 17, fig. 2. Brown paper and dirty water.

5. *Water and Sugar.* Norton, p. 22, art. 35. Glass brimful of hot water takes sugar.

6. *Cotton and Alcohol.* Norton, p. 22. Introduce cotton into test-tube full of alcohol.

Divisibility.

7. *By Solution.* Norton, p. 20, art. 29. Put drop of nitric acid on copper cent, which wash in tumbler of water.

8. *By Geometry.* Norton, p. 19, fig. 3.

Elasticity.

9. *Snaps.* Norton, p. 31, art. 55. Hold steel, whale-bone, wood &c., strips so as to snap objects across platform.

10. *Bounders.* Norton, p. 31, art. 56; Steele, p. 20, fig. 4; Cooley's "Easy Experiments" p. 20, ex. 9. Drop glass, iron, wood, rubber, clay, putty, &c., marbles on flat stone.

11. *Pop Gun.* Norton, p. 30, art. 54. Quill or elder.

Expansibility.

12. *Heat and Air.* Norton, p. 25, fig. 6. Apply heat to a test-tube, almost filled with water, inverted in a tumbler of water so as to incline over lamp.

13. *Bubbles in Vacuo.* Holbrook, p. 16, ex. 21.

14. *Air in Vacuo.* Tie thin rubber over small test-tube, put into a bottle. Suck at mouth of bottle.

Ductility.

15. *Glass Drawn.* Heat glass tube in alcohol lamp and pull it out any length.

Cohesion.

16. *Paper Test.* Cooley, p. 23, ex. 16. Paste two opposite edges of sheet of paper two rulers longer than width of paper. Two persons pulling, each at a roller, cannot separate the paper.

17. *Apple Halved.* Cooley, p. 24, ex. 18. Cut apple in two, press parts together, and they cohere.

18. *Bullet Halved.* Norton, p. 28, art. 48; Steele p. 49, art. 3; Silliman, p. 110, fig. 92.

19. *Liquid Cohesion Measured.* Silliman p. 111, fig. 92b; Cambridge Physics, p. 19, fig. 9. Suspend tin plate from arm of balance scales and balance. Place dish of water so that tin plate touches its surface. More weight can be put into weight pan.

20. *Drop of Water.* Silliman, p. 111, art. 148; Norton, p. 28, art. 48.

21. *Soap Bubble.* Silliman, p. 111, art. 148.

22. *Oil Sphere.* Norton, p. 28, art. 48; Steele, p. 49, art. 3; Deschanel, p. 134, art. 97c. Mix alcohol and water, drop in it a little oil. It forms into a globule at centre of mixture.

23. *Minimum Material and Maximum Strength.* Norton, p. 23, fig. 9. Make supporting beam, first, of flat paper; then of same paper rolled.

Adhesion.

24. *Rum Stealer.* Steele, p. 49, note. Invert bottle containing saltwater in tumbler containing colored, fresh water.

25. *Osmose.* Norton, p. 49, art. 104; Silliman, p. 194. Use funnel and membrane, or bladder and tube. Put brine inside, fresh water outside.

Capillary Attraction.

26. *Blotter.* Norton, p. 42, art. 89.

27. *Between Laminæ.* Norton, pp. 39, 40, figs. 11, 12, 13; Silliman, p. 149, fig. 194. Use common window panes and colored water in shallow platter.

28. *Capillary Tubes.* Norton, p. 41, art. 86; Silliman, p. 196, art. 243. Make capillary tubes as described in Ex. No. 15.

First Law of Motion.

29. *Rolling on Level.* Norton, p. 54, art. 115. Hill's Questions in Stewart's "Physics," p. 138. Roll putty ball and glass marble over smooth table.

30. *Foucault Experiment.* Norton, p. 125, fig. 90. Loomis' Astronomy.

Second Law of Motion.

31. *Rubber Gun.* Norton, p. 54, art. 117. Hill's Questions, p. 138. Propel ball from gun made of elder, in which works plunger worked by rubber elastics. Pull plunger back half an inch, notice hight of ball. Pull back twice as far, ball goes four times as high.

32. *Drop and Snap Board.* Steele, p. 29, fig. 6: Rolfe and Gillet, fig. 43. Instead of board attach snap spring about two feet long, made of thin wood to edge of table. Place in front of it three or four balls. Operate snap so that it merely pushes one ball off while it propels the others.

33. *Parallelogram of Forces.* Avery pp. 37, 38, fig. 10, 11; Deschanel, p. 18, fig. 3. Test with several weights.

34. *Parallel Forces.* Deschanel, p. 14, fig. 7. Suspend lever of first kind, with weight and power attached, by cord attached at fulcrum and running over pulley and balance.

35. *Third Law of Motion.* Norton, p. 59, art. 126; Hill's Questions p. 139. Hang ten pounds to balance suspended on nail. Suspend a second balance from nail and hang to it the first balance with its ten pounds weight attached.

36. *Reflection of Motion.* Avery, p. 44, fig. 36; Norton, p. 61, fig. 28. Shoot rubber ball along black board against ceiling, at any angles marked on black board.

Centrifugal Force.

37. *Revolving Bottle.* Norton, p. 131, fig. 94. Use globe of old lamp. Suspend by twisted string.

38. *Revolving Cylinder.* Norton, p. 133, fig. 96. Suspend pepper box by twisted string.

39. *Elastic Radius.* Use "return ball."

40. *Tumbler and Hoop.* Norton, p. 132, art. 260. Place tumbler of water in hoop and swing over head.

41. *Whirling Hoops.* Norton, p. 132, art. 260, fig. 95. Make hoops of paste board, or tin, put on axis revolved by pulling on wrapped string.

42. *Whirling table.* Norton, p. 131, fig. 93; Avery p. 32, fig. 7; Silliman p. 30, figs. 18, 19, 20.

43. *Gyroscope.* Norton, p. 133; Silliman, p. 35, fig. 24, 25. Toy gyroscopes can be bought for twenty-five cents.

Gravitation.

44. *Tower of Pisa Test.* Silliman, p. 45, art. 71. Drop weights of very different size from top of house.

45. *Galileo's Experiment.* Norton, p. 107. Use twine or wire. Make pulley of spool.

Equilibrium.

46. *Cork and Knives.* Norton, p. 68, fig. 35; Steele, p. 57, fig. 32; Cambridge Physics, p. 34, fig. 22. Use potato for cork, needle and knives, or two forks.

47. *Mid Air Suspension.* Steele, p. 57, fig. 31.

48. *Unsupported Pail.* Norton, p. 69, fig. 36.

49. *Knitting Needles and Cork.* Norton, p. 70, fig. 38.

50. *Double Cone.* Frick, p. 47, fig. 103.

Momentum.

51. *Non-Elastic Balls and Arc.* Norton, p. 6, fig. 128; Avery, p. 30, fig. 6; Silliman, p. 50, art. 112. Use lead balls of different weight. Lay off arc accurately. Illustrate, by various tests, that momentum depends upon different weights and distances (velocities). Also determine weight of ball, by momentum it produces.

52. *Impact of Elastic Balls.* Silliman, p. 146, fig. 132 Use wooden instead of lead balls.

53. *Candle and Board.* Silliman, p. 82. Shoot candle through board.

54. *Bullet and Glass.* Silliman, p. 82. Use snap sling and pebbles.

55. *Vis Viva.* Silliman, p. 78, art. 111; Deschanel, pp. 52, 77. Shoot ball up wall with snap sling. Twice force throws ball four times as high.

Pendulum.

56. *Isochronism.* Silliman, p. 55, art. 82; Norton, p. 118, art. 226, fig. 85. Swing seconds pendulum in two different arcs and let class time it.

57. *Time Independent of Quality or Quantity of Material.* Norton, p. 118, art. 236. Swing seconds pendulums of different materials and weight. Let class time each one separately.

58. *Time and Length.* Norton, p. 118, art. 237. Have pendulums of suitable lengths. Let class time them.

59. *Length and Time.* Norton, p. 118, art. 237. Let class determine relative lengths by counting vibrations of two pendulums.

60. *Compound Pendulum.* Norton, p. 122, fig. 87.

Levers.

61. *Simple Levers.* Norton, p. 77, fig. 42; Deschanel, p. 14, fig. 17.

62. *Steelyards.* Norton, p. 82, fig. 48.

63. *False Balance.* Norton, p. 83. Demonstrate rule algebraically and test it practically.

64. *Compound Levers.* Steele, p. 72, fig. 46. Make the apparatus and test with various positions of weight and power.

Inclined Plane.

65. *Power Parallel to Plane.* Steele, p. 47, fig. 54; Frick's Physical Technics, pp. 61, 62; Norton, p. 92. Elevate board at different angles. Balance weight in little toy wagon connected with power by cord running over pulley at top of plane. Measure hight and length, and determine actual weights and prove the law.

66. *Power Parallel to Base.* Steele, p. 74, fig. 54; Frick, pp. 61, 62; Norton, p. 92. Put pulley in uprights, so that it can be lowered so as to make power direction parallel to base. Test with actual weights, as above.

Wheel and Axle.

67. *Simple Wheel and Axle.* Norton, p. 84, art. 174. Construct and test with weights. Swing axle on wire pivots resting on tin supports. Test law of equilibrium by actual weight.

68. *Differential Wheel and Axle.* Norton, p. 86, fig. 53. Make small one and test with actual weights.

Hydrostatics—Transmission of Pressure.

69. *Multiple Squirt.* Norton, p. 136, fig. 98. Elder tube, with holes plugged.

70. *Cartesian Divers.* Holbrook, p. 24, ex. 43, 44; Steele, p. 105, fig. 93; Norton, p. 150, fig. 114. Balance homeopathic vial in wide mouthed bottle. Place hand tightly over mouth and press.

71. *Double Bent Tube and Water.* Cooley, p. 28, ex. 20.

Lateral Pressure.

72. *Reaction Boat.* Norton, p. 140, fig. 103. Float tube of water. Pull out plug near base.

73. *Barker's Mill.* Norton, p. 168, fig. 127; Steele. p. 101, fig. 89; Avery, p. 445. Puncture flat oyster can near bottom at diagonally opposite corners of broader side. Suspend with a string and pour in water.

Upward Pressure.

74. *Floating Marble.* Select Experiments, p. 83, ex. 6. With hand over top of glass tube, or argand lamp chimney, press it to bottom of jar of water over a marble little larger than mouth of tube. Suddenly remove hand and lift tube. The marble will rise. Or use marble smaller than tube, then when the hand is removed, the marble will jump up the tube.

75. *Floating Metal.* Norton, p. 139, fig. 102. Fit tin disk or a thick piece of sole leather to end of tube or lamp chimney, holding it there by string passing through its centre and up the tube. Press down to bottom of water in jar, let go of string. Tin does not sink.

Downward Pressure.

76. *Ball and Bottle.* Select experiments, p. 84, ex. 5. At neck of inverted bottomless bottle, or of argand lamp chimney, hold down a wooden ball. Fill with water. Let go ball. It remains at bottom.

77. *Sealed Blocks.* Fit two blocks nicely together by their broadest surface. Load one with lead and sink it to bottom of jar. Place the other upon it, holding it down close. Fill jar with water, let go the block. The upper one remains on the lower one.

Pressure on Bottom.

78. *Haldal's Apparatus.* Norton, p. 139, fig. 101. Use glass tube bent at right angle. Hold one arm vertical. To the horizontal arm, by means of rubber tubing attach smaller and larger vessels. Fill with water. Notice water rises to same level in vertical glass tube.

Pressure and Hight.

79. *Hydrostatic Bellows.* Norton, p. 142. Cut a strip from beef bladder. Tack with leather headed tacks to edges of equal boards which fit closely into the strip. In cutting the strip from the bladder, it should be in a complete circular band, so cut that the neck of bladder can be used to insert tube in.

80. *Pascal Experiment.* Norton, p. 142, fig. 105; Silliman, p. 155, art. 194. Use ordinary barrel and thirty or forty feet of gas tubing, borrowed at hardware store. Fit tube tightly into barrel filled with water. Pour water in tube from top of house. If the pressure makes the barrel leak, it is burst.

Specific Gravity.

81. *Hollow and Solid Cylinder.* Norton, p. 148, fig. 117. Use tin pepper box and make cylinder of sealing wax.

82. *Floating Principle.* Norton, p. 149, fig. 113; Select Experiments, p. 92, ex. 9; Cooley, p. 29, exs. 33—35.

83. *Floating Egg.* Steele, p. 95, fig. 84.

84. *Magic Change.* Select Experiments, p. 97, ex. 12. Fill vial with alcohol, colored, and drop, mouth, up into tumbler of water.

85. *Floating Needles.* Deschanel, p. 110, art. 79, p. 136. Drop small needles, or oiled larger ones quietly upon water. They float.

86. *Floating Power of Different Liquids.* Norton, p. 149, art. 292, fig. 114. Use coal oil, alcohol reddened, water saturated by carbonate of potassa, tinged with litmus, and mercury.

87. *Spirit-Level.* Norton, p. 146, fig. 110.

Hydrodynamics.

88. *Streams from Jets.* Norton, p. 160, fig. 120.

89. *Pressure of Flowing Stream.* Norton, p. 169, fig. 130.

90. *Archimedes Screw.* Silliman, p. 233, art. 298. Wrap rubber tubing around broom stick.

91. *Helix and Ball.* Select Experiments, p. 107, ex. 20. Coil wire and push it into argand lamp chimney. By turning it when at an angle cause a small ball to "run up" the wire to top of tube. This explains Archimedes Screw, Ex. 90.

Pneumatics. Inertia of Air.

92. *Weight of Air.* Holbrook, p. 34, ex. 73, 74; Norton, p. 183.

93. *Floating Paper.* Holbrook, p. 34, ex. 71. Drop paper flat; then pressed into a wad.

94. *Penny and Paper.* Select Experiments, p. 131.

95. *Revolving Vane.* Holbrook, p. 34, ex. 12; Select Experiments, p. 130, ex. 6. Cut vane of paste board, revolve sidewise, then edgewise, on a pin.

96. *Weight Compared with Smoke.* Put smoking cotton in receiver. Exhaust. Smoke falls.

Pressure of Atmosphere.

97. *Magic Card.* Holbrook, p. 24, ex. 41.

98. *Faraday's Card.* Steele, 115, note.

99. *Tumbler and Paper.* Norton, p. 175, fig. 135; Holbrook, p. 41, ex. 98.

100. *Leather Sucker.* Norton, p. 176, fig. 138.

101. *Tantalus Cup.* Holbrook, p. 22, ex. 36; Select Experiments, p. 105, ex. 18; Frick, p. 124, figs. 188, 189.

102. *Pneumatic Paradox.* Norton, p. 195, fig. 160; Holbrook, p. 23, ex. 38. Use spool.

103. *Magic Bottle.* Holbrook, p. 27, ex. 49.

104. *Hiero's Fountain.* Holbrook, p. 28, ex. 54; Steele, p. 106, fig. 96; Frick, p. 127, fig. 201.

105. *Air Pump.* Holbrook, ex. 1—5; Norton, p. 179, figs. 143, 144, 150.

106. *Fountain by Exhaustion.* Holbrook, p. 11, ex. 8, 9; Norton, p. 182, fig. 147.

107. *Fountain by Condensation.* Holbrook, p. 12, ex. 10, 11.

108. *Weight Lifters.* Holbrook, pp. 13, 14, ex. 12—16 and 19; Steele, p. 107, fig. 100; Norton, p. 182, fig. 148.

109. *Hand Glass.* Holbrook, p. 18, ex. 35; Steele, p. 107, fig. 97.

110. *Bladder Glass.* Holbrook, p. 19, ex. 28; Norton, p. 181, fig. 145.

111. *Rubber Glass.* Holbrook, p. 19, ex. 29; Norton, p. 181, fig. 145.

112. *Cupping Apparatus.* Holbrook, p. 18, ex. 26, 27.

113. *Sack Distended by Exhaustion.* Steele, p. 105, fig. 93; Holbrook p. 16, ex. 20; Silliman, p. 203, fig. 199. Tie sheet rubber tightly over wide mouth bottle or test-tube. Use it instead of sack.

114. *Sack Distended by Condensation.* Attach *Bladder Glass* to condense orifice of pump.

115. *Magdeburg Hemispheres.* Holbrook, p. 15, ex. 18; Norton, p. 182, fig. 146; Steele, p. 107, fig. 8; Silliman p. 206, fig. 203.

116. *Magic Transfer.* Holbrook, p. 17, ex. 22.

117. *Bolt Head.* Holbrook, p. 37, ex. 83; Select Experiments, p. 147, fig. 46.

118. *Emptying Water Upward.* Holbrook, p. 37, ex. 84.

119. *Scientific Egg.* Holbrook, p. 37, ex. 85.

120. *Transfer of Liquids with Fountain.* Holbrook, p. 37, ex. 86.

121. *Culinary Paradox in Vacuo.* Norton, p. 323, fig. 267; Holbrook, p. 29, ex. 55.

Ventilation.

Air Currents. Cooley, p. 37, ex. 56, 57.

123. *Impure Air Test.* Holbrook, p. 31, ex. 61. Put candle into jar. It burns. Remove it. Fill lungs. Hold the breath as long as possible. Exhale into jar. Introduce candle. It is extinguished.

Useful Application of Pressure of Atmosphere.

124. *Pipette.* Norton, p. 175, fig. 137.

125. *Siphon.* Norton, p. 197, fig. 156. Holbrook, p. 20, ex. 23; Cooley, ex. 48—51.

126. *Acid Siphon.* Norton, p. 194, fig. 158; Holbrook, p. 21, ex. 34; Frick, p. 124, ex. 186.

127. *Siphon Fountain.* Norton, p. 194, fig. 157; Holbrook, p. 22, ex. 35; Cooley, p. 32, ex. 40.

128. *Pneumatic Inkstand.* Norton, p. 194, fig. 157; Holbrook, p. 41, ex. 98.

129. *Atomizer.* Holbrook, p. 25, ex. 45; Norton, p. 195, fig. 159; Steele, p. 115, fig. 114.

130. *German Student's Lamp.* Borrow one, bring before class and explain.

131. *Suction Pump.* Norton, p. 196, fig. 153; Steele, p. 111. Have pupil construct small one and exhibit it and explain its workings to the class.

132. *Force Pump.* Norton, p. 192, fig. 154. Treat as above.

Sound.

133. *Tuning Fork and Bell.* Avery, p. 270, fig. 212. Sound tuning fork and let one of its prongs lie against bell.

134. *Bell and Ball.* Cooley, p. 41, ex. 69. Strike bell and watch clapper lying upon it.

135. *Resonant Jar.* Norton, p. 216, fig. 177.

136. *Jews Harp.* Illustrate reinforcement.

137. *Resonant Jar and Tuning Fork.* Avery, p. 291, fig. 230.

138. *Speaking Tube.* Norton, p. 219, art. 405. Use gas tubing.

139. *Acoustic Telephone.* Connect two collar boxes with string.

140. *Xylophone.* Cut sticks of length so that, when struck, they will sound respectively the notes of the scale. Arrange and play some familiar air.

141. *Cyathophone.* Take eight tumblers, fill with water, so that, when struck, they will sound notes of the scale.

Laws of Musical Sound.

142. *Sonometer.* Norton, p. 226, fig. 178. Stretch two violin strings across croquet box, by fastening at one end, and running over pulley at the other.

143. *Law of Length.* Norton, p. 227, art. 421. Divide one string by bridge and test by rule and ear. Illustrate all the common cords. Norton, p. 231, art. 425.

144. *Law of Vibrations and Stretching Weight.* Norton, p. 227, art. 421. Put on four times the weight and sound the octave.

145. *Law of Weight.* Norton, p. 227, art. 421. Use heavier string.

Musical Instruments.

146. *Violin.* Box shows reinforcement. Tightening of strings shows law of stretching weight. Different strings show law of weight. Placing fingers upon strings shows law of length. Dividing strings shows "harmonics."

147. *Common Whistle.* Norton, p. 235, art. 432. Make several of different lengths, showing laws of vibrations.

148. *Flute or Fife.* Norton, p. 237, art. 436. Many whistles in one.

149. *Reed Pipes.* Norton, p. 235. Make of wheaten straw. Also use bugle or cornet.

Light.

150. *Camera obscura.* Norton, p. 284, fig. 232. Use spectacle glass and any glass. Try by throwing shawl over head as does photographer.

151. *Thaumotrope.* Norton, p. 287, fig. 234. Cut picture out of paper, divide in two parts crosswise, paste one part on one side of the card, and the other on the other side. Tie strings to card and make it revolve by untwisting. The two pieces will appear as one object.

152. *Concentric Circles.* Make several, heavy, black, concentric circles, distant from one another as far as the lines are wide. Look at it while moving it as if wrinsing a cup. The circles will seem to revolve. Scientists have not explained it.

Reflection.

153. *Total Reflection.* Norton, p. 289, art. 475; Steele, p. 156, fig. 145. Use tumbler of water.

154. *Multiple Reflection.* Norton, p. 250, fig. 194. Use two looking glasses.

155. *Kaleidoscope.* Norton, p. 250, art. 461.

Refraction.

156. *Bowl and Penny.* Norton, p. 257, fig. 205.

157. *Prism.* Norton, p. 262, fig. 210. Use one of the common "triangular" glass ornaments.

158. *Magnifying Glass.* Norton, p. 289, art. 524.

Heat.

159. *Heat by Friction.* Rub button violently on board, touch it to a bit of phosphorus.

160. *Heat by Concussion.* Pound a nail briskly and touch it to a bit of phosphorus.

161. *Heat by Chemical Action.* Pulverize potassium chlorate and white sugar. Mix. Drop on it a drop of sulphuric acid.

162. *Heat from Sun.* Concentrate, by magnifying glass, sun's rays on match or phosphorus.

Expansion.

163. *Thermometer.* Norton, p. 308, art. 551. Let pupil exhibit and explain thermometer to class.

164. *Gasses Expanded.* Norton, p. 305, fig. 258. Use test-tube.

165. *Liquids Expanded.* Put glass tube by cork airtight in test-tube. Fill with water into tube. Heat over spirit lamp.

166. *Solids Expanded.* Norton, p. 307. Have tinner rivet slips of iron and copper.

Specific Heat.

167. *Iron and Glass.* Norton, p. 313, art. 558. Heat equal pieces of iron and glass in boiling water. Transfer them to thin cake of ice. Note which melts through first.

Latent Heat.

168. *Melting Ice.* Norton, p. 317, art. 567.

Evaporation.

169. *Culinary Paradox.* Norton, p. 327, fig. 267. Use test-tube and cork.

170. *Freezing Mixture.* Norton, p. 318, art. 567.

Conduction.

171. *Iron a Conductor.* Norton, p. 333, fig. 274. Use balls of wax and iron wire.

172. *Davy's Safety Lamp.* Deschanel, p. 295. Use wire gauze and candle flame.

173. *Relative Conduction.* Norton, p. 333, fig. 274. Use iron and copper wires.

174. *Water a Poor Conductor.* Place piece of ice in bottom of test-tube quite full of water. Incline over lamp so as to boil water at top. The ice remains unaffected.

Convection.

175. *The Process of Boiling Water.* Norton, p. 336, fig. 277. Use large test-tube, putting in a little saw dust to show direction of currents.

176. *Water Boiled in Paper Bag.* Huston, p. 200, fig. 94.

177. *Lead Melted in a Card.* Make cup of ordinary card, suspend from stick by threads. Put in few shot and hold over spirit lamp.

Investigation by Drawings.

Beside the outlines and apparatus, correct drawings of apparatus and cuts from the text in use and other texts should be prepared by the pupil. This will prove a most efficient aid to instruction and complete mastery of many subjects. No exceptions should be made in this matter. *Every* pupil should, in the course of the study, prepare this material. Much talent and practical drafting power will be developed by the practice.

CHAPTER XIII.

Chemistry.

In Chemistry, as in Natural Philosophy, my theory is to have the pupils make their own apparatus, use it *themselves* and lecture upon it *themselves*. As much of this apparatus and many of the experiments can be utilized for Exposition purpose, I will give a brief account of my method of handling a class of about 60, in Chemistry.

First Recitation.

At the first meeting of the class, I divided it into nine sections—working sections. I appointed for each section as *Leader* some one who had some familiarity with the subject—or displayed special aptness for the work. Section No. 1 is appointed to meet at 5 A. M., No. 2 at 7 A. M., No. 3 at 9 A. M., No. 4 at 10 A. M., No. 5 at 11 A. M., No. 6 at $1\frac{1}{2}$ P. M., No. 7 at $3\frac{1}{2}$ P. M., No. 8 at $4\frac{1}{2}$ P.

M., No. 9 at $6^1/_4$ P. M. My laboratory is my class room. This room is open only to the class. We recite as a whole class at $2^1/_2$ P. M.; during the other hours the sections have its sole use.

Having formed the sections and appointed their times, I explain that I have prepared a list of one hundred experiments which they will find on the register on my table. The experiments are numbered and accompanied with sufficient directions and references for the guidance of the pupils. I request each leader to record between this and our next meeting, the names of the members of his or her section in a blank book supplied for the purpose and to put after each one the numbers 1 to 100.

I now place upon the board the work to be done *before*, and reported upon *at* the next recitation. I may assign the same or different experiments to each section. While assigning the experiments, I give such directions as are necessary for the special instruction of the leaders and members.

I then lay down for the observation and practice of all the following

General Directions. *First*. Each section will perform first the experiment, assigned to it.

Second. It will then begin with experiment No. 1, and perform as many as possible, but always in the order of their numbers.

Third. Before beginning an experiment, each pupil will study carefully its description in his own book, or in the book referred to in the list.

Fourth. Having thus determined what materials are needed, and how they are to be treated, he will obtain from the teacher any materials he *asks* for, and any assistance needed.

Fifth. The leader will in no case perform the experiment, but he must allow the pupil to try, and fail or succeed as the case may be, giving only such hints as are necessary for safety and economy.

Sixth. Materials should be carefully cleaned and put away, and the laboratory left in neat and orderly condition.

Seventh. Having performed an experiment, the pupil will *record* it by noting down the following stems:

1. Apparatus.
2. Chemicals.
3. Manipulation.
4. Precautions.
5. Theory of the Reaction.

After a few words of encouragement to the effect that their first efforts will most probably be failures; that all will depend upon their industry and patience; that a failure is always more instructive than a success; that care should be taken not to fritter away time in mere trifling, &c., &c.; my hour for the first recitation is closed, the class is excused and section No. 7 begins its work.

The Section at Work.

The leader requests one-half the section to "read up" upon the first experiment, the other half on the second. This takes but a moment. He then asks of the first half, what materials are needed, and as they are mentioned, supplies them. He then asks what is to be done first. One pupil says this. He is directed to do it, and so on. Thus the experiment is quickly and quietly performed. The leader then assigns a certain portion of the "cleaning up" to each pupil. The first half now become lookers on and the second half perform the second experiment—and so on with as many experiments as the time will permit. In the same manner the other sections accomplish their work.

Second Recitation.

All pupils come prepared with paper in which to record all the experiments performed by the different sections. The teacher calls upon some member of a section to give the first items of the first experiment performed in his section. So with other pupils. These reports are critized and corrected by both, pupils and teacher, and placed upon the board from which all copy them.

The discusion of these experiments is the most practical instruction in Chemistry, as is the laboratory practice the most practical study of it. Here I discover any difficulties, failures or disasters. Here I give additional explanations and suggestions. Here we discuss the theory and application of the experiment, keeping in mind, that the experiment is nothing only as it illustrates principles and laws.

Having thus discusssed and recorded the experiments performed, I now assign the next lesson, just as I did the first, giving new experiments or redistributing the old ones, including those not performed successfully.

In this manner successive recitations are conducted. Such experiments, as would be suitable for Exposition, are noted. The records of the experiments are also preserved for Exposition. Besides this material from laboratory practice, other recitations, reviews and examinations are taken and preserved.

CHAPTER XIV.

Botany.

Management of Outlining.

There is perhaps no department of science in which nature more beautifully reveals herself as proceeding according to logical method, than in the vegetable world. Here the the study of her phenomena has discovered that she is the great systemizer. Here, therefore, outlining as a method of study, is especially delightful and satisfactory.

The grand theme "Plants" should occupy the whole course, and the entire study should be to dispose every important idea under this head.

There will be *tentative* and *final* papers. Both should be preserved, the first to exhibit the "undress" work of the pupils, the second to indicate in neatness and thoroughness the "fixed up" results.

On the *final* papers should appear in the proper place copies of the cuts given in the text to illustrate the different definitions.

The facility with which the pupils will draw these and the practical instructions which their attempts to draw them will convey, will be exceedingly significant both to teacher and pupils.

It is understood that these outlines are a *means*, not an *end*, to study and investigation. Each subject, and so each outline, will be completed step by step. For instance, the outline of calyx will be entirely completed before that on corolla is begun, and so on.

The tentative outlines will be "Study" exercises, but, where special drill is required on certain terms, "Recitations" should be taken, and, ordinarily, the lesson will be written in outline.

Pupils properly trained upon these outlines will recite upon any subject, discuss it logically and thoroughly, without a question from the teacher. This is not cramming. The teacher who makes it so, blunders. No *effort* at committing to memory need be made by the pupil. The investigation necessary to complete an outline on any given subject, the discussion of the outline in the class, and the final copying of the outline, will sufficiently impress all important facts upon the minds of pupils and entirely by a *reasoning* memory, not by a *mechanical* or "carrying" memory.

The study and preparation of these outlines should begin with the first recitation and should *always* be accompanied, with the plants or parts of plants under discussion.

Every technicality should be looked for in the specimens in hand and its absence or presence carefully determined.

Without these accompanying objects, the peculiarities of which shall suggest and illustrate technicalities, the whole course is a cruelty and a farce.

The practice, in many schools, of *beginning the study of Botany in the Winter*, is so utterly hollow and absurd, one is not surprised that enemies and even friends of the schools, are sometimes heard to exclaim: "The greatest fools about teaching are teachers!"

The proper time to form the class in Botany is in September, when there are multitudes of simple plants, representing the striking families, and possessing, in mature state, flower, fruit and seed, organs positively essential to the *real* analysis of any plant.

The most unsuitable time to begin the study of Botany is the Spring, and I wonder that it is necessary to urge such a proposition. Yet, in a majority of the high schools and colleges of the land, Botany is begun in the Winter, and the first analysis, if any is attempted, is pretended to be had on spring flowers.

Now every one knows that the spring flowers are, as a general thing, small, immature, and therefore lacking the organs referred to in the first steps of the "keys," so that the teacher, in conducting a class, must really defeat the object of the analysis, by himself telling what the pupils should by the examination of the plant determine for themselves, or, by letting the pupils engage in the farcical, dishonest, and utterly profitless practice of taking the *name* of the plant and by means of index and flora, tracing it *backward* in order to trace it forward.

Furthermore, the weather is such in the early spring as to make it little less than dangerous for pupils to botanize in the fields. In spite of all precautionary advice, they will sit in damp places and chilly air, after rapid walking or running, for the purpose of examining the new plant gathered, and so do great injury to their health. While in the Fall, the atmosphere and earth are warm and bad results from exposure are much less liable to ensue.

The following outline will aid the teacher in giving the subject such a cast as will provide for the logical mastery of its important features:

Outline of Plant.

- 1^1 Definition.
- 2^1 Parts.
  - 1^2 Cells.
  - 2^2 Tissues.
  - 3^2 Organs.
    - 1^3 Reproductive.—Maintaining the Species.
      - 1^4 Flower.
        - 1^5 Definition.
        - 2^5 Parts.
          - 1^6 Non-essential.
            - 1^7 Torus. 2^7 Calyx. 3^7 Corolla.
          - 2^6 Essential.
            - 1^7 Stamens. 2^7 Pistils. 3^7 Ovules.
        - 3^5 Kinds.
        - 4^5 Inflorescence.
      - 2^4 Fruit.
      - 3^4 Seed.
    - 2^3 Productive.—Maintaining the Individual.
      - 1^4 Root. 2^4 Stem. 3^4 Leaves.
- 3^1 Kinds.
  - 1^2 As to Duration.
  - 2^2 As to Habit.
  - 3^2 As to Habitat.
  - 4^2 As to Organs.
    - 1^3 Phænogamous.
      - 1^4 Exogenous. 2^4 Endogenous.
    - 2^3 Cryptogamous.
      - 1^4 Acrogenous. 2^4 Thallogenous.

4^1 Growth.
1^2 Germination.
1^3 Organ. 2^3 Process. 3^3 Products.
2^2 Extension.
1^3 Organs.
1^4 Root. 2^4 Bud. 3^4 Stem. 4^4 Leaf.
2^3 Processes.
1^4 Absorption.
2^4 Circulation.
1^5 Accumulation. 2^5 Elaboration. 3^5 Appropriation.
3^4 Assimilation.
3^3 Products.

5^1 Propagation.
1^2 Natural.
1^3 By Flower.
1^4 Fertilization. 2^4 Fructification. 3^4 Deposition.
2^3 By Stem.
3^3 By Root.
2^2 Artificial.

6^1 Determination.
1^2 Examination and Record.
1^3 Order. (See page 70.)
2^3 Purpose of: To prepare for analysis.
2^2 Analysis. (Use Key.)
3^2 Record completed. (See Record Book p. 71.)

7^1 Preservation.
1^2 Pressing. 2^2 Mounting.
8^1 Utilization: Economic Botany.

Determining Plants.

Let it not be supposed, because I have discussed outlining first and separate from the practical determining of plants, that these two forms of class work should be carried on separately, or that outlining should be made the most important.

On the other hand, the important work of the Botany class is the analysis of unknown plants, for the purpose of learning their names and peculiarities.

This should begin with the first recitation, in connection with outlining, and continue through the whole course. It should proceed according to a fixed routine, made up of three stages: (1) Examination and Record. (2) Analysis and Record. (3) Record completed.

(1) *Examination and Record.* The plant to be determined being in hand, it should be carefully examined in a regular order (See Outline, below), all its peculiarities noticed, and as many of them noted at once in the proper place in the record book as the pupil can command terms to express, while those marks, for which he does not know the proper technicality, may be kept in mind until, while analyzing, it is found in the text, when it should be promptly noted down.

A regular order in this examination should be insisted upon. It is the only means whereby the pupil can be aided to form the *habit* of examining systematically and consequently with thoroughness. I have found it best to begin at the bottom of the plant and take everything just as it comes in passing up to the flower. This gives the pupil the thread of "position" to follow, and insures pretty rigid work.

The following, I have adopted as the best:

Order of Examination of Plants.

1^1 Habitat. Notice where it is found and in what surroundings; its general appearance as it stands where nature placed it. Put notes under "Specific Marks" in record book.

2^1 Root.

1^2 Axial. 2^2 Inaxial.

3^1 Stem.

1^2 Caulescent or Acaulescent.

1^3 Hight.
2^3 Exogenous or Endogenous.
3^3 Texture.
4^3 Surface.
5^3 Erect or otherwise.
6^3 Simple or Divided.

4^1 Leaves.

1^2 Opposite or Alternate.

2^2 Stipulate or Exstipulate.

3^2 Petiolate or Sessile.

1^3 Length. 2^3 Other peculiarities.

4^2 Venation.

5^2 General Form.

6^2 Form of Base and Apex.

7^2 Form of Margin.

8^2 Surface and Texture.

9^2 Difference in Lower and Upper.

10^2 Length and Breadth.

5^1 Inflorescence.

1^2 Arrangement.

2^2 Pedunculate or Sessile.

1^3 Length. 2^3 Other peculiarities.

3^2 Bracts, Involucres, &c.

6^1 Fruit.

7^1 Flower. (For points, see Record Book).

1^2 Calyx. 2^2 Corolla. 3^2 Stamens. 4^2 Pistils.

The examination being carefully completed, then, and not till then, should begin the next step.

(2). *The Analysis and Record.* This is, of course, done with the "Key," and will proceed easily if the examination has been patiently made.

The first analysis being undertaken when the pupil is entirely unfamiliar with the technicalities, and being made for the purpose of enabling him to become practically familiar with the technicalities by studying their definition in the text and examplification in the plant at one and the same time, must proceed quite slowly. It may take four or five recitations before the species of the plant is reached. But, one analysis being thus patiently accomplished, the others will be comparatively easy.

During the analysis, when any technicality descriptive of any mark observed or unobserved during the examination, for which the proper term could not be then commanded, is recognized, it should be placed on the record as soon as found.

This exercise should often be required as a "Study," instead of an oral recitation. The steps should be written in form of outline, the co-ordinate *used* being written in full, the other co-ordinates being indicated only by indices. In each co-ordinate or heading, those portions particularly true of the plant should be underscored.

These written "Studies" will correctly indicate the actual work of the pupil and will be easily and quickly examined and graded at the recitation.

This may be done by exchanging papers; having different pupils read successive portions; putting at the margin of the paper a plus mark for every error discovered by class and teacher as reading proceeds. When the examination of the papers is completed, the teacher calls for the largest number of errors; from these he determines a fair scale of grading; tells the critics how many to mark off from a hundred for each error; the pupils at once grade the papers; the teacher calls the roll and records each grade; the papers are then returned.

(3). *Completing the Record.* Having now analyzed the plant, the record can be corrected and completed. During the examination many terms will have been used that are either incorrect or unnecessary. The analysis will develop the correct and important ones. These should now be substituted, by scratching out or erasing if necessary.

But the important feature of completing the record is selecting the specific and family marks. For these, the book will be relied upon mainly; but the pupils will soon begin to discriminate as to the importance and character of different peculiarities as marking the species or family.

Only a little practical faith and work in this direction are needed to show the teacher how soon and how well pupils will *learn* the families and species of plants.

Mounting the Plants.

It should be the understanding that when a plant is gathered for analysis, there should be, at the same time, a suitable specimen carefully put in the press for drying and mounting. It should also be understood that every plant analyzed is to be mounted. Let there be no exception. The point and scientific character of the study are lost otherwise. Nothing helps so much to give the whole work practical interest to the pupils. Nothing will so surely fix on the pupils a purpose to continue the study of plants for a lifetime. Nothing will so conclusively demonstrate to the patrons of the school, the friends of the pupils, and those interested in science, the practical character of the class work.

In many schools, bound books are used, on the leaves of which the plants, after having been pressed and dried, are pasted. This is child's play. The plants should be in such form that they can be handled, classified, shipped, &c.

I have devised for this purpose, "*Herbarium Sheets*" which I have found very useful. Suitable headings and blank forms for record are on the first page of the sheet. The plant is neatly strapped to the third page of the sheet with strips of paper, or better sowed upon the sheet. At the time the plant is mounted the blank record form is filled out from the notes taken during analysis and preserved in the record book. Thus the pupil's knowledge appears on exhibition with the plant itself.

I consider my "Field Record Book" and "Herbarium Sheets"* indispensable aids to the practical study of plants.

Exposition Material.

The outlines and herbarium sheets make a very interesting and beautiful feature of the Exposition. The outlines are mounted as are all the other written exercises. The herbarium sheets, though, will make the most attractive display if sewed to tape and hung around the walls of the room. The tape should be sewed only to the leaf of the herbarium sheet holding the plant; the other leaf should fly loosely, so that the record on the first page may be examined, or the plant on the third page.

The following is the blank record which I have found best adapted to my classes. It is based upon Prof. Henslow's forms, and is intended to display the striking family marks together. It will be noticed also that the last items require a summary of the specific and family marks, thus letting the important characteristics form the last impression of the plant.

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ORDER............................ *No.*............

Com. Name............................ *Tech. Name*............................

ORGANS.	No.	COHESION.	ADHESION.	FORM.	COLOR.	DURATION.	ETC.
CALYX. SEPALS.							
COROLLA. PETALS.							
STAMENS.							
PISTIL. CARPELS.				FRUIT. .... INFLORESENCE.			
LEAVES.							
STEM.				ROOT.			
SPECIFIC MARKS							
FAMILY MARKS.							

The following is the first page of the "Herbarium Sheet," reduced from foolscap or from larger sizes, if desired. The blank form is omitted. It is of the same size and character as that given on preceding page.

No..........

Herbarium of the Flora in the Region of.........................

(At this place should be the form given on preceding page.)

Collected by..............................

Date.............................. ....

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With these aids and suggestions a teacher will be enabled to arouse in his neighborhood a practical interest in the flora and begin the accumulation of materials which are always valuable to science.

It must be understood that while the study of the "Botany" may occupy but one term, the collection and preservation of plants should proceed through the *whole* year.

There will be no question that pupils so trained will continue their Botanical work after leaving their school.

The following are a few items concerning the Botanical display at my last Exposition (1880).

Pupils in class	58
Herbariums of mounted specimens	58
No. of specimens in largest herbarium	173
No. of specimens in smallest herbarium	20
Weeks of regular class work	10
Total specimens mounted	2580

The exposition was given in a large public hall, the walls of which were completely covered to the tops of the high windows with herbarium sheets.

CHAPTER XV

Geology.

Cabinets. Natural Science, in any of its departments, is exceedingly interesting, when it is made a study of *things*,—things in the hands of the pupils; things which they have gathered or made themselves. In Chemistry, the pupils must *do their own experimenting.* This may necessitate simple experiments and cheap apparatus, but that is just what is needed. Pupils in these subjects are not scientists, they are not professors; they are beginners, and the beginning must be made, where scientists themselves began,—with the things. Teachers are so anxious about the *principles, the grand principles, the eternal principles!* Nature does not teach principles first. She gives us the facts. It is our privilege to study them and if they become sufficiently familiar, the principles will be revealed.

So in Natural Philosophy, as I have described in Chapter XII, apparatus made by the pupils, handled by the pupils, explained by the pupils, will instil more principles than all the lecturing professors in the world could elucidate.

So in Botany, the collection of the plants, the study of the plants, the mounting, naming and preserving of the plants, will give principles not only a name but a familiar habitation in every mind.

Now we reach Geology. The text-books on this subject are usually very interesting reading, and a class may recite page after page, week after week, with *some* interest, but the teacher who will conduct a class through the subject, by merely having them recite the text, is criminally ignorant of his duty, or criminally negligent in its performance.

Pupils do not come to school to *read* charming books; they are there to learn facts, to learn how to investigate facts. The "Story of the Earth," though fascinating as told by Dana, is infinitely more entrancing as told by *Nature.* Prof. Dana has talked familiarly with Nature. No wonder he is entertaining. Let the pupils have the story at first hand. They will be entertained and entertaining.

I insist upon it, that if pupils do not gather from the fields their own cabinets, the Geology they learn is useless, and its study is a waste of time, which could have been more profitably put upon some other subject. I believe this to be true, even if there is a school cabinet to which they *really* have access.

The first and last consideration, in the Geology class, is the minerals and fossils actually collected by the pupils.

To manage this properly, *time must be taken;* progress *through* the book must be delayed; indeed, portions of the book will have to be entirely omitted. All this is a great bug-bear to the quiet, orderly, "thorough," easy-going, dignified teacher, who scrupulously devotes the stipulated six hours and no more to his work; who, when he locks the school house door at night, locks "school" out of his mind and heart until he opens up the next morning. To *teach* Geology, the teacher must go into the fields with his pupils; he must examine carefully quantities of "truck;" he must direct the labeling and mounting of the specimens; he must examine and record the work of each individual pupil, and give them suitable credit therefor; he must encourage the feeblest attempts of lagging pupils.

If the teacher is unwilling or incompetent to do all this, then he should not butcher and befowl, and make hideous that which, but for him, would be full of life, sweetness and beauty—he should not brutally pretend to teach Geology. The same is quite as true of any of the other Natural Sciences.

The usual texts in Geology mention the common rocks and fossils which may be found in most neighborhoods; some *in situ*, some as drift, some as material brought into the vicinity for economic purposes. Let the teacher investigate his surroundings, and direct the study of the text and the field work with reference to these most common and accessible materials. He should then so arrange that the collection, mounting and inspection of these specimens may be attended to by him and by the pupils as regular class work. As far as possible, *school* time must be taken, and taken regularly.

To illustrate:

Suppose that *Limestone*, *Sandstone* and *Quartz*, are the first three minerals to be gathered. Suitable specimens of these, collected by the teacher, and mounted just as he wishes the pupils to mount them, are placed in the school room where the pupils can examine them closely.

At the recitation preceding the excursion, the teacher hears a lesson on these rocks, and applies it to the specimens on hand. He furthermore directs the pupils where they can be found, and gives particular instructions as to how they shall be gathered. The collection of these specimens is the next *lesson.* Each pupil is to bring to the next recitation a good specimen of each mineral assigned.

It may or may not be necessary for the teacher to accompany the pupils on this excursion. He may be able to give directions, sufficient without his presence.

Still, if the teacher accompany the pupils on this excursion, he will probably run across suitable material for the next excursion; thus be able to enjoy the air with his pupils, and at the same time prepare himself for his next lesson.

Some of the happiest recollections, for all teachers, must be of these out-door frolics in search of plants, and minerals and fossils. Need I suggest that on these occasions, the teacher should unbend from the rigidity of his office. Need I whisper, that he should not unbend too much? Better too much, than too little, though.

At the next recitation, these specimens are presented for inspection. The teacher should not hesitate to take the time to examine the collection of each pupil, asking questions as he passes along, sometimes of the class, sometimes of the pupil. This questioning, while examining, will be quite necessary after the collections have increased, in order to review the earlier ones. At this recitation, having "passed upon" all the specimens, the teacher gives explicit directions as to mounting and recording specimens.

Mounting and Recording. The simplest and least expensive method of mounting a cabinet is to write the number of each specimen on a "speck" of paper, paste it on the specimen, then in a little blank book, or sheet of paper, devoted to this purpose, write the number and, opposite it, the name, locality, &c. This record will constitute the "Catalogue." Every pupil should be expected to keep his own catalogue, and to present it with his new specimens, for the inspection of the teacher.

If the pupils wish to get little boxes, such as jewelers keep, and put their specimens in them, it will add much to the appearance of the cabinet. If this is done, the number should be pasted on the specimen and on the box; but on the lid should be placed the number and the name. This will enable persons handling the specimens to replace them in the box to which they belong, and will keep each lid on its proper box. A catalogue should also be kept in connection with the boxes. It will serve many important uses.

Let it be understood that the boxes are not essential. Many pupils will not be able or care to incur that expense. But every pupil should number and keep a neat, correct catalogue of his specimens, while they are collected, not after they are all collected. A catalogue that is going to be made never is made.

The directions for mounting and recording here given, the teacher will give as the next lesson; *first*, to mount and record the specimens brought in and passed upon at this recitation; *second*, three new specimens to be collected. At the next recitation, the pupil will bring to class the three new specimens collected, and the three specimens mounted and recorded with their catalogues.

At succeeding recitations, the pupils will regularly bring the new specimens collected and the new specimens recorded.

The cabinets thus accumulated, should be kept at home, excepting when the teacher thinks a review of the whole collection, as far as made, would be beneficial, when the pupils will bring all their material, and, after school, spread it upon the desks where the teacher can inspect. At these reviews, the pupils should pass around and examine one another's cabinets, compare, exchange, &c., &c.

It will be found best to have the same numbers on each catalogue indicate the same specimen, so far as the neighborhood material goes. A cabinet of twenty-five minerals and as many fossils, properly labeled and catalogued, would be a good work.

In addition to the neighborhood specimens, there will be many from distant and foreign localities which will be obtained by exchange and as gifts, or as purchases. It is wonderful what pupils can rake and scrape together, when interest is once aroused in these matters.

It will be seen that these cabinets will form a most interesting and instructive feature of the Exposition. They should be displayed on tables placed in charge of owners of the cabinets, or their representatives. The specimens should be spread out in neat order, having beside them the catalogue, so that visitors may find the name of any specimen. If boxes are used, they should be uncovered, and their covers placed next to them, so as to show the names.

Such a display will popularize science, and will frequently contribute to it new materials and new facts.

For the interest and encouragement of teachers, I will give a few items of the geological specimens exhibited by the members of my last class (1880) in Geology, at my last Exposition:

Number in class,	69
Weeks given to class work,	6
Cabinets of more than 500 specimens,	1
Cabinets of less than 500, and more than 200,	8
" " " 200, " " 150,	10
" " " 150, " " 100,	23
" " " 100, " " 50,	25
" " " 50,	0
Total number of cabinets,	67

The two cabinets less than this number of the pupils was owing to the fact that two gentlemen with their wives, who were members of this class, collected only two cabinets.

The largest cabinet was collected by Mr. W. F. HARBISON, of Spencerville, O. It numbered 650 mounted species. He had many other species which he did not present, because not properly mounted. Many of the pupils exchanged fossils collected here with parties in different portions of the United States.

While but six weeks were given to my regular class work, I should mention that I gave one regular period once a week, through some twenty weeks, to the collection and inspection of specimens, before the regular class was formed. It will readily be seen that pupils who had been in the field so much before beginning the study of the text, were well and practically prepared to enjoy the text when they undertook it.

I should say further that the pupils who collected the largest cabinets were the ones who stood among the highest in the other studies, and who had the full quota of other duties.

It should be the pleasure and the business of every teacher thus to "work up" in *his* locality, a permanent interest in scientific collections and investigations.

Nothing is more needed for the further progress in general science than just such local cabinets and local associations as such teaching as here suggested, would tend to establish and perpetuate.

To many teachers the above directions will be utterly impracticable because they do not themselves know enough about the common rocks to conduct such work, although they may be graduates of colleges and universities, of which splendid museums was the proud boast. It is a standing reproach upon many ot our higher institutions that their pupils go out in such condition.

The practical knowledge necessary to carry out the above suggestions with good success, can be easily obtained in eight or ten weeks, if the subject is properly taught; yet many schools spend much more time in teaching Geology in such a manner as to leave the pupils unable to recognize quartz if they should see it in the field.

Schools and armies continually shoot too high.

CHAPTER XVI.

Zoology.

The system-loving character of Nature is here again most beautifully exemplified. The animal kingdom can neither be presented nor comprehended without the aid of classification.

Nothing will more relieve the study of the new and difficult terms, than the exercise of transferring them, with their etymology, definition, example and subdivisions on the slate, and then on paper. Thus will their spelling and most important significations be secured.

With much of the subject, the mastery gained by such a study will be sufficient.

As soon as the general outline of the animal kingdom is sufficiently familiarized, the efforts of the pupils should be given to some particular division, for which the locality is most favorable.

There is no greater sham than to keep pupils reading page after page of the ordinary Zoology. The information supposed to be gained is not of the slightest real interest or pratical importance.

No scientific specialist pretends to be able to recite what teachers compel pupils to recite under the pretence of scientific instruction.

Supposing that pupils could give years to the subject, it would be unwise to scatter over so much territory, but when it is remembered that but a few months is allotted to the study, and, in many instances, the instruction is by lectures, the least effective of all methods, it is little less than dishonest waste of time to require young people to memorize and recite the strange mixture of fiction, scientific guesses, and undigestible facts that make up the ordinary text-book on Zoology.

Such a summary of the whole animal kingdom as will leave a decided impression of its general outlines, should be immediately followed, in most localities, by the collection and mounting and study of insects. This would convey some definite knowledge, cultivate real habits of research and power of observation, but, better still, it would serve a very useful purpose to agriculture in a direction where comparatively little is known and the call for further light is exceedingly urgent.

I shall not attempt to give particular directions for this collection and preservation of insects, but shall be content to say that if the humblest country school teacher would put himself in possession of one of the many works on entomology, he could, without the aid of a teacher, soon prepare himself to lead his pupils on regular excursions for bugs, teach them their names and habits, and soon form an entomological cabinet that would be exceedingly interesting and instructive to the whole neighborhood.

Such a collection would form a most attractive feature of the Exposition.

CHAPTER XVII.

Algebra.

So much *in*formation is given by our teaching and so little *ex*formation! It is perpetual ingoing, while outcoming is the exception. What a pupil knows is unimportant. What he can tell, of his knowledge, is essential. In many Algebra, as well as Arithmetic Classes, the simple solution of the successive examples, as a mere process of imitation, is the outside limit of the instruction.

I look upon Algebra as pre-eminently a Rhetorical study. It is here that thought is put in exact phraseology. It is here that the argument upon a proposition is exactly stated, vigorously evolved, and undisputably conducted. It is here that language is precise, logic is clearly defined, and the processes of thought are practically "materialized." And although so many examples may not be solved, it is of the first importance that the teacher give his pupils power to think thinking, to discover in themselves a new consciousness of mental processes. He should train them to expose to their own view and to his inspection written evidence of the workings of their own minds. It was a grand conclusion Des Cartes reached: "I think, therefore I am." It was the foundation of faith. Slightly modified it becomes the very foundation of all certain knowledge: "I know how I think, therefore I think right."

This will be partially secured by having the pupils write out their examples in a strictly logical form. The following outline will be found useful for this purpose.

Outline of Solution of Example.

1^1 Statement=Conditions.

  1^2 Granted. 2^2 Required.

2^1 Operation.

  1^2 Synthesis=Forming the equation.

  2^2 Analysis=Solving the equation.

  3^2 Proof=Verifying the equation.

3^1 Conclusion.

  1^2 Granted. 2^2 Obtained.

I will present for illustration the following outline of the solution of Ex. 7, p. 95, Schuyler's Algebra:

1^1 Statement=Conditions.

  1^2 Granted.

    1^3 (1) A left town at rate of 4 miles an hour.

    2^3 (2) B left 12 hours later at 10 miles an hour.

  2^2 Required.

    1^3 (3) Number of hours till B overtook A

2^1 Operation.

  1^2 Synthesis=Forming the equation.

1³ (4) x=hours B traveled. by (2).

2³ (5) $x+12$=hours A traveled. by (1)&(2).

3³ (6) $10x$=miles B traveled. by (2).

4³ (7) $4(x+12)$=miles A traveled. by (1).

5³ (8) $10x=4(x+12)$ by (2)&(3).

2² Analysis=Solving the equation.

1³ Clearing (8) of parenthesis, (9) $10x=4x+48$, by Post. 3.

2³ Transposing, (10) $10x-4x=48$, by Art. 129.

3³ Reducing, (11) $6x=48$, by Art. 132.

4³ Div. by Co-eff., (12) $x=8$, by Art. 135.

3² Proof=Verification of equation.

1³ Sub in (9)=(13) $10.8=4.8+48$.

2³ Reducing. (14) $80=80$, by Ax. 9.

3¹ Conclusion.

1² Granted.

1³ A left town at 4 miles an hour.

2³ B left 12 hours later at 10 miles an hour.

2² Obtained.

1³ The number of hours till B overtook A is 8.

Such forms are easily acquired, and, though at first they may apparently retard progress somewhat, it will be invariably found that, at the last, the advance will be much more speedy and the whole work more thoroughly done.

One or two examples of each lesson, prepared in this way, should be brought in, sometimes on paper, usually on the slates at each lesson. The whole work can be quickly examined, graded, and records of the grade taken, as described in Chap. ——, p. —. These exercises may be "study," "recitation," "review" or "examination."

I submit it to the judgment of teachers, if preparing examples and exercises in such orderly form, would not serve to improve the slovenly, scrawling work that is more the rule than the exception in our schools?

CHAPTER XVIII.

GEOMETRY.

What has been said of Algebra as a Rhetorical study is just as true of Geometry. Pupils, in beginning this subject, are frequently in great bewilderment, owing to their failure to appreciate the new technicalities and the logical limitations which the exact demands of the study place upon their reasoning. Although definitions, postulates and axioms may be faithfully recited, although the demonstrations of the theorems may be conscientiously parroted off, yet, the beautiful, clean, clear-cut connections and relations are utterly incomprehensible, and the pupil is as likely to consider the demonstrandum the hypothesis, and to know as little about where he is to conclude as about where he is to begin.

I have found it to be a certain cure or prevention of this, to present to the class and have them copy the following

Outline of the Demonstration of a Theorem.

1^1 Statement.
  1^2 General=The theorem.
    1^3 Hypothesis=Things granted.
    2^3 Demonstrandum=Things to be proved.
  2^2 Special=Diagram drawn and explained.
    1^3 Hypothesis=Lines, &c., granted.
    2^3 Demonstrandum=Things to be proved.
2^1 Proof.
  1^2 Construction=Explanation of lines added to aid in the proof.
  2^2 Argument.
    1^3 First Step=State and give authority.
    2^3 Second Step " " " "
    3^3 Third Step " " " " So on to
    4^3 Last Step, which should always be preceded by "Therefore" or its sign, and followed by the symbols "Q. E. D."
3^1 Conclusion.
  1^2 Special.
    1^3 Hypothesis. 2^3 Demonstrandum.
  1^2 General.
    1^3 Hypothesis. 2^3 Demonstrandum.

At the same recitation, and immediately following this, I have them turn to a theorem, and by questions enable them to direct me in placing upon the board a complete outline of the theorem, just as I expect them to do in preparing the lesson. A sufficient model of this will be found in the following:

Outline of Demonstration of Prop. IX, Loomis' Geometry, p. 24.

1^1 Statement.

  1^2 General.

    1^3 Hypothesis:—If from a point within a triangle two straight lines are drawn to the extremities of either side;

    2^3 Demonstrandum:—Their sum will be less than the sum of the other two sides of the triangle.

  2^2 Special.

    1^3 Hypothesis:—Let two straight lines BD, CD be drawn from D, a point within the triangle ABC; (the drawing should always appear here.)

    2^3 Demonstrandum:—Then will the sum of BD and DC be less than the sum of BA and AC, the other two sides of the triangle.

2^1 Proof.

  1^2 Construction:—Produce BD until it meets the side AC at E.

  2^2 Argument.

    1^3 First Step, $CD < CE + ED$, by Prop. 8.

    2^3 Second Step, $CD + BD < CE + EB$, by Ax. 4.

    3^3 Third Step, $BE < BA + AE$, by Prop. 8.

    4^3 Fourth Step, $BE + EC < BA + AC$, by Ax. 4.

  $\therefore 5^3$ Last Step, $CD + BD < BA + AC$, by A. Q. E. D.

3^1 Conclusion.

  1^2 Special.

    1^3 Hypothesis:—Let two straight lines, BD, CD, be drawn from D, a point within the triangle ABC, to the extremities of the side BC;

    2^3 Demonstrandum:—Then will the sum of BD and DC be less than the sum of BA, AC, the other two sides of the triangle.

2[2] General

1[3] Hypothesis:—If, from a point within a triangle, two straight lines are drawn to the extremities of either side;

2[3] Demonstrandum:—Their sum will be less than the sum of the other two sides.

The preparation of a few such exercises seems to enable the particulars of a demonstration to adhere to the mind, as merely reading it over or committing it to memory does not. The rigid separation of the argument into steps with the faithful citation of authority, not by reference, as above, but by full quotation, clears away the fog thoroughly.

The teacher should usually reletter the diagram, but require the whole class to use the same lettering, so as to expedite the examinations of the papers.

The most thorough review of any given part will be accomplished by outlining it. Pupils will thus get the juice of Geometry in being led to discover that it is a beautiful evolution which needs only to be understood to be appreciated.

There are many other devices which the ingenious teacher will originate to give his pupils opportunity to subject their knowledge to the test of written expression. These exercises should make a splendid history of the progress of the class and the methods of the teacher.

CHAPTER XIX.

TRIGONOMETRY.

In this subject, many important ends are attained by having exercises written. Most of the examples should be solved and written out according to the best and neatest form. This insures accuracy and rapidity. Diagrams should always be neatly drawn. The papers of this class will always be interesting.

CHAPTER XX.

Astronomy.

There are innumerable requisitions for written exercises in this study, such as representation of heavens at different latitudes, with explanations; diagram and explanation of equation of time; diagram and explanation of phases of moon; diagram and explanation of transit of Venus, &c., &c. Great power of clear and correct explanation can be thus cultivated. "There is no test like the written test."

CHAPTER XXI.

Calculus and Mechanics.

The demands of the class will here, as in every other subject, suggest the preparation of "*Studies*," "*Recitations*," and other exercises which will be valuable for examination and preservation. It should not be supposed that pupils in these higher subjects are superior to the demand of Exposition methods. They never can be. Systematic and thorough instruction in any branch will suggest these practices and the teacher as well as pupil will find his work simplified and diminished.

CHAPTER XXII.

The Languages.

In no department have the Exposition methods aided me more as an instructor than in the Languages, particularly in Latin and Greek. The paradigms, parsing lessons, and translations should all proceed by written "*Studies*," "*Recitations*," &c. I have had a class of beginners at the first "Review" upon the five declensions, as a whole, write out all the terminations without an error of importance. When pupils thus assure themselves of their thoroughness, they acquire a confidence in their own power and in the skill of their teacher which is the best aid to genuine thoroughness. I have had as a "*Review*" the terminations of the four conjugations in all the various moods and tenses, and so secured a thoroughness which would hardly seem possible. The paper, for these memory exercises, is always prepared by neat rulings, before the pupils come to the class. In this preparation, the pupil will exhibit much neatness and business style.

CHAPTER XXIII.

RHETORIC.

In my suggestions upon Reading I have indicated the best practices upon this subject. They will be varied according to the class and teacher, but all teaching in this subject should be rather of *practice* than of *principle.* The latter should be learned only by means of the former. All original efforts should be *critisized* by the teacher, then *corrected* by the pupil; that is, the critic should merely indicate the errors, leaving it to the pupil to correct. A list of the usual errors should be made out, each one numbered, and that number placed upon the exercise where the error occurs. The pupil sees the number, refers to the list, notes the character of the error he has made, and is so enabled at once to correct it intelligently.

The best list of such errors, or "scale of criticism," will be found in "Holbrook's Complete Grammar, Appendix." The following is a list of a few of the exercises engaged in by a Rhetoric Class in a Public High School under my direction. Refer also, in this connection, to what has been said above in Reading.

1. Outline of Webster's Unabridged Dictionary.
2. Short essays upon the different portions of the Dictionary, beginning with the binding, copyright, prefaces, &c., &c.
3. Outlines of Clock.
4. Essays assigned from topics included in the outline.
5. Hamlet's Soliloquy copied, (Study.)
6. Comments on Hamlet's Soliloquy.
7. A paper giving the incorrect sentences of another pupil's essay, with the same sentence corrected.
8. The Story of Hamlet, (Study.)
9. The Story of Hamlet, (Recitation.)
10. Life of Shakespeare, (Recitation.)

11. Hamlet's Soliloquy, (Recitation.)
12. The passage on "Mercy," from "Merchant of Venice," copied, (Study.)
13. The story of "Merchant of Venice," (Study.)
14. The story of Snowbound, (Study.)
15. Allusions to persons, places, &c., in "Snowbound" explained, (Study.)
16. Lowell's "True Nobleness," (Study.)
17. Lowell's "True Nobleness," (Recitation.)
18. Lowell's "First Snow Fall," (Study.)
19. Lowell's "First Snow Fall," [Recitation.)

CHAPTER XXIV.

Resume.

In the preceding chapters of this article are given hints as to methods of teaching most of the subjects already taught in schools of all grades. These points have been brought within the proper limits, and yet it is thought the enterprising teacher will find them practical and full of suggestions. They are not theories. Every one of them is a statement of what has been done repeatedly and successfully and easily. It will be noticed that through them all runs the unifying idea of the "Exposition," but let me caution teachers against making the "Exposition" an *end*. This it should never be. It is always and only a *means* of making the work of both pupil and teacher more definite, more systematic, and more thorough. It will be found that these methods will themselves teach the teacher, bringing before him in distinct and orderly manner multitudes of facts in his work, which in the ordinary management entirely escape the attention. The continual danger to be guarded against will be the tendency to let the "Exposition idea" become formal, and therefore hateful and harmful. I do not fear that it will not be used nearly so much as I do that it will be abused. It should inspire and enliven; it may easily be made a tiresome routine and a baneful drudgery. This must depend upon the teacher. There is no method which is proof against a stupid or a lazy teacher.

On the other hand, the better the method, and the more capable it is of good results, the more liable it is to be outraged by some poor teacher who expects to find in it a remedy for his own incompetency. The only guard against abuse and extremes in using these methods will be found in the caution which I have already repeated several times: *Let no exercise be taken which the needs of the class do not really suggest.*

PART IV.

Mounting the Material.

CHAPTER I.

INTRODUCTION.

It will be found that the best method is the easiest, and that the proper preparation of the work so that it will be expressive of all that is possible, and at the same time clearly self-explanatory, will take less time than any unmethodic practices. Order and system are here, as ever, great time savers, as well as great helps to morality. The suggestions which are to follow are the result of many experiments and faithful tests. Not one has been untried, and every one represents the results of many approximate efforts. Just what items to record, in order to express the most, and what items to omit, because practically unnecessary, could only be determined by careful tests and experiment. No mere suggestion of theory or untried plans would meet the case.

"Mounting" means the placing of such marks on the individual papers, and upon collection of papers, and such disposition of the papers, as will make their examination easy and profitable. Let us consider, in order:

1. Mounting of Individual papers.
2. Mounting of Papers of a Class.
3. Mounting of Papers of the Whole School.

CHAPTER II.

Mounting Individual Papers.

At the top of every exercise, placed low enough to permit binding, should be a heading consisting of a statement of such facts as are important to any one examining the paper. These facts should be so disposed as to stand out distinctly and strike the eye easily.

The following items are important in this connection:

1. *The name of the pupil.* This should occupy the first line and the center of the heading.

2. *The age of the pupil.* This should follow the name.

3. *The standing of the pupil* as obtained by this exercise, and stated in figures according to the scale common to the whole class. This should occupy a prominent place so that it may strike the eye quickly.

4. *The rank of the pupil* in the class in this exercise. This I do not deem important and may be omitted without harm.

5. *The number of the exercise* as one of a series from this class in this branch of study. This will show the amount of work done and, partly, the point of progress at which it was done.

6. *The grade of the pupil*, or the year of the school course. In an ungraded school this will, of course, be omitted, but the other items of the heading will enable any one familiar with the school gradations to determine approximately the grade.

7. *The branch of study* from which the exercise is taken. This should occupy a conspicuous place.

8. *The date of the exercise*, that is, the day of month and year. This item is very important as it, with the number, enables the inspector to determine when in the progress of the school it was prepared, and how much of similar work was done, and it forms a part of.

9. *How prepared.* That is, whether it was done as "Study," "Recitation," "Review," "Periodical Examination," or "Final Examination." This is one of the most important, and with the next item will form the key to any correct judgment of the exercises. Some care should be taken by the teacher to inform the public of the full significance and importance of these items.

10. *Time used.* This item will be of especial importance to the teacher in the management of his school, in assigning lessons, &c. It is of course, indispensable to any correct estimate of the value of any work presented. The time should be expressed in hours and fractional parts of an hour.

11. *The name of the teacher.* This is important when the work of many teachers is exhibited.

12. *The subject of the lesson.* This should have its usual place at the center of the page, and immediately preceding the exercise itself,

In these items we have sufficient data upon which to base an adequate and fair judgment of the work of the pupil in every given exercise.

Arranged in the most systematical and effective manner these items will form the following heading:

No.... *Pupil*............ *Age*.... *Standing*...... *Rank*......

Year of Course.......... *Branch*............... *Date*..........

Teacher................. *How Prepared*........ *Time used*......

Subject:

....

....

This heading may be neatly put upon the paper by the pupils themselves, or the teacher may arrange to have the booksellers furnish their paper with this heading properly printed upon it, at the same rates as they furnish the paper itself. This I have done without any trouble. The heading should be about one and a half inches from the top of the paper, and the space given to each item must be according to its character; the proper relative spacing is shown in the accompanying form. The paper should be of uniform size; foolscap is the most economical.

Now it is not insisted that every one of these items in this heading must necessarily be used. Some teachers may retain some and omit others, yet I am quite confident that if a full history is desired of the work and its preparation, that no one of these data will be found unimportant, and that the spacing and disposing of the items is as good as possible.

CHAPTER III.

Mounting the Papers of a Class.

There are two methods by which the exercises of a class may be grouped. The first may be called the *Class Method*. It is to collect the exercises of all the pupils upon any given subject, arrange them according to their standing, putting the highest first, and binding them. This arrangement presents a species of instantaneous view of the class, which is not only very useful to teachers but interesting to patrons, since it compares all the children in such exercise.

The second method may be called the *Individual Method*. It is to collect all the exercises of each pupil in each class, and arrange them according to number. This will enable each pupil at the close of the exposition to get possession of all his own papers without difficulty, while, in the other arrangement, they will be distributed through many bundles, each one of which will have to be unbound to get any one pupil's papers.

The benefit of comparison which comes from the first method will recommend it; besides, it will often be an object with the teacher to see that the papers are not restored to the pupils, but carefully put away and preserved for comparison with papers prepared by the same school and other schools in future years.

In this is the great value of the Exposition, and the true teacher will emphasize its importance. There will be few who will have enterprise enough to accomplish an Exposition. When it is once done, the time which is likely to intervene before another one is prepared by another teacher or superintendent, will be enough to make the comparison of work very instructive.

It may be well to combine both methods. The work of the lower grade pupils being mounted by the first, the higher by the second.

When the first method is adopted, a neat cover should be adopted for each bundle of exercises.

For instance, suppose a written recitation has been had on the Principles of Common Fractions. The papers of the class have been examined and marked by the teacher, have been returned to the pupil, and they have reported corrections of the errors made. Now the teacher collects all these papers into one bundle, placing the highest first, and over the first one lays the cover, punches holes through cover and all, passes through binding points and so fastens them. Now this cover should have displayed upon it the important facts, with reference to this class and this exercise. Besides number, date, grade, branch, subject, how prepared, time used, name of teacher, which are given in the individual heading, it will exhibit the name of the school, the termini of the school year, the average age of the class, the number in the class and the name of superintendent. The following is the form which I finally adopted. I had this printed at my own expense on tinted paper and supplied it to my teachers. My trustees finally assumed this expense.

SECOND ANNUAL EXPOSITION

OF THE

VINELAND PUBLIC SCHOOLS.

For the School Year Beginning............. *Ending*..............

REGULAR WORK. No selections made—Every Pupil represented.

No...... *Date*..........................

Grade.................... *Year of Course*.................

Subject.................... *Average Age*...................

Lesson.................... *No. in Class*...................

Preparation, { *Manner*.................................. / *Time used*.................................

Teacher.................. *Average Standing*...............

R. H. HOLBROOK, Superintendent.

This form may be easily adapted, with a few changes, to the needs of the individual method. In a country district school, or in a small graded system, it will abundantly repay the teacher or superintendent to have these covers printed on neat paper; still, they may be written with ink without much effort. The covers of my first exposition were all thus prepared.

CHAPTER IV.

Mounting the Material of the Whole School.

It will be remembered that the school work was to be so placed upon exhibition that it could be examined comfortably and conveniently.

First, then, *comfortably*. This is best accomplished by displaying the work upon the regular study desks, so that visitors may examine it while seated, and so give to it any length of time desirable.

But to lay the work loosely upon the desks would soon bring it into confusion and disarrangement. Means must therefore be adopted to fix it upon the desk. To accomplish this, when binding let the binding pin at the under side pass through a tape loop, and fasten it with the paper; the loop should be so short as not to show from above; then pass string through these loops and so tie the bundles to the desk; they will thus be kept in their place and in the proper order.

Second, *conveniently*. This means that the work should be so disposed as to enable any one to find easily any work of any given pupil or grade. Some system must be accepted.

There are here two methods: The horizontal and the vertical.

The *horizontal* method would place the first year's work first, the second year next and so on. If the school is small, the primary work would occupy the first tier of seats, the second year's work the second and so on; or, if the school is large, the Primary work would appear in one room, the Grammar School in another, the High School work in another; or, for room substitute building, if the schools are quite large, though usually the central or High School building will sufficiently serve the purpose. In arranging the work of any class of any grade, the different exercises may be arranged according to number, separately, or, many exercises, each having its cover, may be bound together to economize space, or the same work done by different teachers may be thus bound together or so arranged that they may be compared easily. This parallel work is always very interesting, particularly to the teachers involved.

The vertical method would group all the materials of any one branch throughout the different grades together. For instance, in one room would be placed the Reading of all the grades, from the Primary to the High School. So another room would contain the Mathematics, another the Geography, and so on. This method is more logical than practicable. It so scatters the work of any given child that its friends will have difficulty in finding it, and since the purpose of the exposition is to make the material as accessible to the patrons as possible, this objection is sufficient to give the other method the preference. This vertical method is perhaps more scientific, and would afford members of the profession more interest, but this is not reason enough for its adoption.

An engraving of a room with material so disposed in it is shown in the frontis-piece. Besides the written exercises on the desks, there appear on the wall tbe Herbarium sheets of the Botany class. On tables provided for the purpose should be displayed the zoological cabinets of the pupils. In some part of the room or some separate room, should be the apparatus of the Natural Philosophy class, also the experiments of this class and the Chemistry class. These should be in operation by the pupils during the Exposition.

In addition to the school work, there will be flowers in vases, pots and baskets, evergreen trimmings, pictures, bird cages and other ornaments, such as the children will bring in an over-abundance. Ushers, selected from the pupils, will be on hand to show visitors to any work and explain it if necessary.

The Exposition should continue from one to three days. In my own practice it was held in the High School building, and was open the first three days of the week after close of school. The rooms were thronged during the time by multitudes who could under no other circumstances be persuaded to give work of their children in the schools the slightest attention.

Among the most patient and careful visitors are the school children themselves who delight to seek out their own work and that of their comrades.

PART V.

APPENDIX A.

EXTRACT FROM REPORT OF THE STATE SUPERINTENDENT OF EDUCATION OF NEW JERSEY, 1877,

Being the description of the School Exposition of the Vineland Public Schools, as reported to the State Superintendent, by R. L. Howell, County Superintendent of Schools, Cumberland County, N. J.

I have made my usual rounds of visits, though in two or three instances I have failed to visit some remote schools more than once; while in other cases I have visited the schools very often, in one instance as often as twenty times, though this was where the school was near at hand, and I was much inlerested in the methods in use.

This was the High School in Vineland, under Prof. Holbrook, and I speak of it particularly, because I have watched there the development of an idea new to me, and one that I deem very valuable, and to which I wish to call the attention of the educators of the State as producing very valuable results with very little extra labor.

District No. 44 embraces the central portion of the town of Vineland, and has seven school buildings and fourteen teachers, all being under the supervision of the Principal of the High School. When Prof. Holbrook took charge of the schools he instructed the teachers of the primary grades to secure short specimens of the writing of each of their scholars, on separate slips of paper, properly headed, to enable the same to be classified and identified, and to preserve these slips carefully.

In his own room much of the work done was written, and all papers prepared by his students were kept.

The regular written examinations of all the schools occurred at the close of each term, and the papers prepared by the students on those occasions were preserved. The heading of the papers, giving the subject, grade, name and age of the pupil, teacher, &c., were at first written, but to secure neatness and uniformity, printed blanks were substituted during the second term.

As these papers accumulated, the Professor conceived the idea of an exposition, and this was carried out at the close of the schools.

All the papers from the different schools were brought to the Central High School building, and were neatly and conveniently arranged for inspection, according to grade, in the four school rooms.

This exposition was kept open two days, and excited much interest and attracted many visitors, among them the Millville teachers, who went in a body, by permission of the Board of Trustees (their schools being still open), and at the invitation of the Vineland teachers, by whom they were cordially welcomed and hospitably entertained.

It richly merited all the attention it received, for it was unique.

It was an exposition, not of the selected work of the picked scholars, prepared for show, but an exposition of the actual school work of every one of the 748 scholars enrolled in District No. 44, in each branch studied by them, and showed not what they *could* do, but what they *did*. It told its own story, and showed exactly what advancement had been made by the pupils of each school during the year. It obviated all necessity of questioning as to what had been done; the parents could go and see for themselves. So complete was this exposition, that I was able to respond to your request for work for the Educational Department of the Permanent Exposition, selecting from it over 1800 papers what I deemed of sufficient interest to forward to you. I might have sent as many more, but thought these sufficient. All the papers of a class, on any given subject. were bound together, thus rendering reference to them possible. It is easily seen that this imposes but little additional labor on the teachers, since all that was necessary was to secure, occasionally, written recitations, and to preserve the papers so written. Of course this safe keeping with the arranging the binding, and the final arrangement for exhibition, did involve some additional labor, but no teacher who saw the good effects of the plan would for a moment begrudge the time necessary.

The knowledge that all their work is kept to be shown to the public is a powerful incentive to do good work, and to exhibit as much improvement as possible; for the youngest of the pupils soon come to understand that their work at the beginning of the year will be shown side by side with that done at the end of the year, and they take pride in showing how much better they can do.

Again, the exposition had a powerful influence in holding the pupils in school to the close—a very difficult object to accomplish, as all teachers know.

Each pupil wanted his work to be among the exposition work of the last term, and so really wished to remain through the final examination—a condition of things that is hard to realize as existing with the average school boy after the season of "spring fever."

I have devoted considerable space to this exposition, but I think no more than its results on the schools demand.

SECOND VINELAND SCHOOL EXPOSITION

[From Vineland Weekly.]

Almost everybody who attended the exposition at the High School building on Monday, Tuesday and Wednesday, spoke of the great superiority of the present display, and amount of real work accomplished over that of last year. The rooms were all tastefully decorated with flowers, pictures, etc., while on the blackboards in each were crayon sketches illustrating subjects of the last lessons recited. For instance, in the room devoted to philosophical experiments, were excellent representations of the hydraulic press, the siphon, sections of the common pump, etc. In another room maps of various countries, while some of the boards were devoted to original designs for calico patterns, book-covers, window curtains, and specimens of writing. The examination papers of the pupils, which were neatly covered and arranged systematically on the desks, showed the improvement each had made during the school year, and in many instances the progress made was simply wonderful, and showed not only the ability of teachers, but most earnest application on the part of the pupil. The different grades are now fully established, in good working order, and we hope that the next principal will not make a radical change, but keep on the work which has shown such good results. Hundreds of our citizens visited the exposition, and also many strangers, not one of whom, that we have been informed of, but what was pleased with what he saw. Let the good work go on.—*Vineland Weekly.*

EXPOSITION OF PUBLIC SCHOOLS AT VINELAND, N. J.

[From Vineland Advertiser.]

Any person who attended the Exposition of last year could not fail to observe the great difference and improvement in every way. Last year the people labored under the difficulty of not fully understanding the full working of the system, while even the scholars and the teachers themselves did not seem to fully appreciate and work so completely together. It was, in a great measure, an experiment, and therefore those most closely interested did not grasp it heartily and fully. The Exposition this year shows that not only is it no longer an experiment, but even the very lowest in the lowest grade took hold of the idea and strove to bring it to perfection.

Of course it has been hard work—both for teachers and pupils. It has necessitated a constant pushing on all sides and by all. For the teachers it has been continual watching and supervision—day and night—and nobly have they answered to the call on them. Night after night have they been compelled to bend over their work—correcting and revising—in order that nothing should interfere with the regular work in school hours. They deserve all the kind words and encouragement that can be given to them, for they have not worked merely for the salary they received, but as teachers should: with a deep feeling of the responsibility resting upon them, a real teachers desire for the advancement of the pupils in their charge. They have all worked—not, perhaps, attaining the same position—but all showing the same marked progress from last year.

Vineland will have to look for a long time and be the sufferers of many failures before getting together as efficient a corps of teachers as have graced our schools for the part year. It is to be greatly hoped that for next year, there will be none—unless of necessity—and even then as few as possible, breaks in the chain of unity of purpose that now binds the schools of District 44 together.

To the principal—Prof. Holbrook—(who is the originator of the system) there is more due from the people than they can hope to repay. He has been untiring in his efforts, unflagging in his zeal, to bring out perfection—guiding, exhorting, stimulating, suggesting—seeming to take in the whole situation at a glance.

Nor have the pupils fallen one whit below. To every call on them they huve heartily responded; they have urged on each other and engaged in friendly rivalry in attaining the coveted position; they have seemed to get a glimmer of what was desired of them and strained every nerve to reach the point.

Taken all together, this has been a year of work—hard work for the whole school, from principal down, and the papers spread on the desks in the High School on Monday, Tuesday and Wednesday of this week show it plainly. There can be no comparison of one pupil with another, as the progress is strikingly the same over all the schools. But the work of any one pupil compared with the work of a year ago is very strongly marked. Even taken in that direction, it is difficult to compare the progress made by one student with that made by another. In every direction the beauty of the system most plainly shows itself. A pupil can be followed from one grade to another—ascending from the first scribble and pot-hook to the last grade of the graduate—every turn, every improvement, with no break or anything to mar the steady onward and seemingly resistless march. Some departments, especially those who were not removed from their own appropriate rooms, showed greater care in arrangement than others, and each teacher's particular beat could be clearly distinguished, while many times we discovered all the scholars of a room taking a course that was neither that of the teacher nor the text-book they were using. To illustrate this: In Miss Eldridge's room, we observed that in the writing the pupils did not take either the system that headed their copy-books nor their teacher's—but rather a middle course embodying both. The writing of all is strikingly similar, yet just as strikingly a deviation from the copy.

Throughout the whole can be traced the effort—and successful, too—of the teachers to make the students think for themselves. The motto of the philosophy class (adopted by themselves) is "Why?"—showing that they had a lively appreciation of their position. In room "D" we came across some strikingly original business ideas, showing a knowledge of business requirements often lacking in persons much older. In another room the pupils had for a lesson the getting up of "newspaper items"—under given heads. They were largely composed of "serious injuries" and "deaths," but seemed to prove an excellent lesson. [We feel much like encouraging that branch of study, as there would be fewer who would have an idea they could "run a newspaper" and many more who could appreciate in some slight degree, the work of an editor.] Even in the work that did not attain high marks on the rolls, does the same fact of every one standing on his own merit and exerting the powers of observation to the utmost, appear.

The black-board exercises (which were merely the last day exercises) were such that pupils, class, teachers and schools could well be proud of them—showing an intimate knowledge of the details of the subject they were dealing with.

The rooms were all tastefully decorated with pictures and flowers, all the work of the pupils of the different roome and the ushers —a detail made from each room to exhibit the work—were thoroughly familiar with their duty, making it a pleasant thing to do to look over the papers.

The Exposition is still more of a success than last year. It commends itself even to the superficial observer as being eminently the touchstone of true advancement of the pupils and the practical application of the lessons of the school.—*Vineland Advertiser.*

APPENDIX B.

OUTLINE OF THE MATERIAL SCIENCES.

1^1 Mind.	
2^1 Matter.	
1^2 Considered abstractly, or Conditions.	Mathematics.
1^3 Time.	
1^4 Particular.	Arithmetic.
2^4 General.	Algebra.
2^3 Space, Place or Position.	
1^4 Particular Magnitude or Fixed Position.	
1^5 Extent and Direction.	Geometry.
2^5 Direction and Extent.	Trigonometry.
2^4 General, or Motion or Changing Position.	
1^5 Direction and Extent.	Analytics.
2^5 Time, Direction and Extent.	Calculus.

2^2 Considered Concretely.	
1^3 Particular.	
1^4 Inorganic.	
1^5 Celestial: Cosmogony.	Astronomy.
2^5 Terrestrial.	
1^6 Crust.	
1^7 Structure.	
1^8 Mechanical.	Geology.
2^8 Chemical.	Mineralogy.
2^7 Surface.	
1^8 Description.	Geography.
2^8 Measurement.	Surveying.
2^6 Envelop.	Meteorology.
2^4 Organic.	Biology.
1^5 Vegetable.	Botany.
2^5 Animal.	
1^6 General.	Zoology.
2^6 Special.	Physiology.
2^3 General.	
1^4 Substance.	
1^5 Properties.	Somatology.
2^5 Constitution.	Atomology.
2^4 Force.	
1^5 Physical.	Natural Philosophy.
1^6 Mechanical.	Mechanical Physics.
1^7 Molar.	
1^8 Attraction.	
1^9 Terrestrial.	
2^9 Gravity.	
2^8 Pressure.	
1^9 Balanced or Equilibrium.	Statics.
2^9 Unbalanced or Momentum.	Dynamics.
2^7 Molecular.	
1^8 Vibratory or Sound.	Acoustics.
2^8 Attraction.	
1^9 Adhesion. 2^9 Cohesion.	
2^6 Chemical.	Chemical Physics.
1^7 Vibratory.	
1^8 Heat.	Pyronomics.
2^8 Light.	Optics.
2^7 Attraction.	
1^8 Electricity.	Electricity.
2^8 Affinity.	Chemistry.
2^5 Vital.	

APPENDIX C.

First Principles.

The right of the state to educate need not be questioned by the practical educator or legislator. It is a fact—the grandest fact of American civilization. It is coeval with our country's birth and continuous with its growth and development. Our nation itself is not more a fact. Question this right and you make American society and all its institutions a fiction and without settled foundations. The right and duty of the state to educate was a germ planted by the earliest colonists; but, as has been well said, "The tree which has sprung from the germ would amaze the original planters. Its development is not due to the argument of any philosopher or the wisdom of any legislator. It has been gradually influenced by the ecclesiastical, political and social requirements of the country. Theoretically, it has many defects; practically, it is adapted to the circumstances of the land. No European country is likely to adopt it; the American will not abandon it. It is the pride of the people, the satisfaction of the poor man, and the protection of the rich man. Its influence in the promotion of intelligence and prosperity in the northern and eastern states has been rated so high that every new state adopts i twithout question."*

If then, in the spirit of Des Cartes, the educational philosopher seek an unquestioned basis, he must find it in the fact of state education. The state *does* educate, therefore it *must* educate. "Does" implies the *right*, "must" implies the corresponding *duty*.

The nature of this duty and the method of its accomplishment are prime questions.

What are the Public Schools to Do?

It is important before setting out upon any enterprise to determine clearly the end towards which we are striving. To have no definite purpose or object would be bad; to have a wrong one would be worse.

* "Education in America." North American Review, Jan., 1871.

What is the true and legitimate end of public school work? must ever, then, be a problem of vast moment to the voters and tax payers of a nation whose only hope is in its public schools; but it presses home with signal force upon the educator who is called upon to originate and organize a system of such schools for the benefit of a distinct and large community. It behooves him to consider well whether he has a sufficient answer to a question fraught with so much of prosperity or misfortune to the society that has entrusted him with so vast a responsibility. At such a time the schools under his charge are at the crisis period of their history. They are at that formative stage when the blundering hand may mar or the skillful hand may make them for all their future, and he will, therefore, see to it that the form in which they are cast is moulded in the spirit of a proud philosophy; that it is not warped in the crookedness of prejudice; that its parts are not misplaced in the blindness of ignorance, or jostled in the waste of haste.

Upon no subject are there greater differences of opinion and consequently greater misconceptions than with regard to the objects and aims of our public School. The history of education is the story of successive ideals raised each for its own time and special needs, but all to be swept away only to be replaced by others.

> "God sends his teachers into *every* age,
> To every clime, and every race of men,
> With revelations *fitted* to their growth
> And shape of mind, nor gives the realm of truth
> Into the selfish nile of one sole race."

So each form or view of education that has swayed the life of man "and given it to grasp the master key of knowledge" "unfolds some germ of truth and right;

> Else never had the eager soul, which loathes
> The slothful down of pampered ignorance,
> Found in it even a moment's joyful rest."

I remember reading an account of the exercises of a prayer meeting, the subject before which was the personal appearance of

Paul. It was a notable fact that Paul was lank, lean and long, in the opinion of the lank, lean and long brother; portly, loud and amiable to the brother of that description; and so the grand old apostle partook, in every case, very largely of the characteristics of the brother who described him.

In the same manner, views as to what our public schools are to do, take their color too frequently from the individual who states them.

The professional gentleman, who desires his children to be scholarly, claims that the public schools should prepare for the professions. On the other hand, the mechanic is just as certain that the schools should fit childred to be artisans, and that teaching Latin, Greek, Rhetoric, etc., is a great mistake. In like manner the farmer, who barely sees even the utility of three R's, is clearly of the opinion that the public money should not be expended in teaching subjects, which his own experience has proved unnecessary to make a good farmer. And again, the merchant insists that a commercial education should be arrived at by the schools.

To meet all the demands of all these parties is, of course, impossible.

It would be interesting to consider how far, in its past history, the public school work has been warped into special channels, but let it suffice to confess that the professions have had the preponderating influences. As a result, much more consideration than is their due is given to the so called claims of the industrial classes. These claims are made by many in good faith, by many more in bad faith, under the name of *Industrial Education.*

Professedly, it is the proposal in behalf of the poor for their protection against the rich; while, really, it is a plan of the rich against the indefinite advancement of the poor. It is a plan whereby the laboring man shall be trained—to labor; that is, to manual labor. It is an arrangement whereby the schools shall be estopped from teaching the common people their possibilities toward a higher and nobler life. It is to provide that children shall be taught merely the routines and requisites of the manufactories. It will simply be the smoothing out and straightening out of the groove by which the masses shall be surely and safely run into the shops—where they belong, according to the Industrial Educators. It is, or ought to be, well known by all well informed educators that in those nations where education is most industrial, the walls of caste are highest and most impassable. The educational system of Germany, so much lauded by shoddy Americans, is a brutal machine which dooms its children to their own level as inexorably as a dread destiny. Industrial education is a trick of the envious upper classes to keep back the ambitious lower class talent that continually displaces and surpasses them. "We lawyers, we doctors, we preachers, we teachers are losing our high salaries and comfortable positions by letting this tide of underling upstarts rush up into competition with us. Let the schools keep them back and force them into competition with blacksmiths, machinists and the laboring classes. They can or ought to suffer the misfortunes of skilled competition. We ought not to suffer, and the schools ought to stop this work of preparing the youth of the land for professional or some business pursuits."

The object of the school is not to make machinists any more than it is to make Presbyterians. It is to make men—to stir the loftiest aspiration of which the humblest soul is capable—to point the lowliest plodder to the highest walks in life and say, "You can go there if you will. This school will help you!" Why, when you rob a teacher of the inspiring thought that some one or more of the pupils of his class may become grand and great men, you take from him that which not only crushes his pupils into the death of hopelessness, but makes him a drudge indeed. This Industrial education will not only blight the masses, but it will doom our profession to a cruel machine life that would drive out of it all but the veriest slaves. Teachers should fight it as they would tyranny. Our soldiers have been the best the world ever knew, because they were educated as men—not soldiers. Our machinists and laboring classes are now more intelligent, more inventive, than those of any civilized nation, because they have been educated as *men*, not as laborers. Our nation has made its unparalleled progress because its masses have been educated as *men*, free and competent to do what their ambitions and desires and capabilities suggest. Have we these glorious teachings right before us only to sink into the deathly caste contrivances of continental aristocracies?

Industrial education is not only undemocratic, it is impracticable. Let us try it. Which trade shall we introduce? Will the carpenters be content that blacksmithing shall be taught and carpentering receive no favors? Will blacksmiths be satisfied that the schools shall be run for the benefit of the farmer? Will the farmers agree that they shall be molded to the interests of mechanics? What right has any trade, from ditching to architecture, that its interest should be favored at the expense of others? The only fair management will be to introduce them all, and thus the absurdity of the whole matter is reached.

But it will be urged "Nothing but the merest principles of the industries should be taught. It is not intended to convert the school rooms into machine shops and manufactories."

So we are to teach the principles of machinery without machines, the theory of industries without an industry, the elements of a practical art without the practice. In the name of all the formalism that is now blighting our schools, isn't there enough of this sham already? Greater folly than this cannot be conceived, unless it be further urged that these principles be taught to the children by *lectures*.

But I claim that the *principles* of all trades, industries and professions are being taught in the schools now. These are Reading, Writing, Arithmetic. These have been selected from all time as the common branches, the branches which include the principles common to all the possibilities of life. Doubtless drawing should be added to these, as it is in most of our city schools, and many of our country schools. The schools should be as colorless of any trade or profession as they are of religious sects. It would be just as fair to give them some denominational bias as to give them an industrial bias. Neither Methodist nor mechanic has any *special* right which the schools are bound to respect. 'Twould be as just to convert them into Sabbath Schools as into shops. The schools are not to make farmers, or tradesmen, or manufacturers, or mechanics. They are to make *men*. This is their high calling. Degrade them to any lower purpose and their power is gone. The schools consecrated to the production of mechanics, will send out poor mechanics, and poorer men. There is something better than *skilled* labor. There is something better than a trained workman.

It is an ambitious workman. The immense development of our America during the last century in every department of labor is proof sufficient of this. There is something better than shops, it is schools.

Let it be understood that these objections are not against Industrial Education, but against Industrial Education in the public schools. Industrial schools are needed and would serve a good purpose to society, to the arts and the trades, but they should be established by artisans and traders. As denominational zeal has founded many magnificent institutions for the propagation of special religious opinions, so should the numberless millionaires, who owe their entire wealth and rank to mechanical business, be animated by a sufficient regard for the humble laborers by whose hands these millions have been achieved to endow and maintain institutions within which the children of these mechanics could be made better mechanics. Not the State, but Religionists must provide for sectarian promulgation. Not the State, but the Manufacturers, must provide for the training of skilled workmen in the different trades. When it is right for the State to make appropriations for special denominational institutions, then will it be right for the State to make appropriations for special mechanical interests.

A majority of practical farmers, merchants and mechanics accept this conclusion. Consult a sensible one of each class and the instant verdict is: The farm, not the school, is the place to learn farming; the shop, not the school, should teach the trade; in the store, not in the school, should young men learn mercantile affairs. It is only the amiable enthusiast, fired with an over zeal for popular education, or the pliable school-board man, filled with an overgreed for a profitable job, that saddles upon the public school cause the stupendous blunders represented in many huge structures devoted to the numberless educational extravaganzas that serve the sole purpose of teaching the folly of pretending that the schools should teach everything.

But these conclusions are little more than a negative answer to our question. Its affirmative consideration elevates us at once to vastly larger and grander issues. From the various claims of guild and rank we pass to those of humanity itself. Our question of education becomes that of civilization.

And what is more wonderful than this, our Western civilization? —rumbling in her manufactories, dashing steam-driven over land and sea; shouting, with her printing press, her doings from Dan to Bursheka; flashing her lightning-sped secrets over earth and through water; this wonderful, whirling, whirring, Western civilization! whose temple is the school room, whose altar is the teacher's desk, where blazes, fed by her faithful priests, the teacher, her never dying flame, at which the coming generations are ever lighting their night-piercing torches to follow her into the reluctantly retreating darkness of ignorance and superstition, there to establish new temples, new altars, and so to save mankind.

What is the clue to her spell? What is the secret of her resistless might and power?

We point to the steam engine, the telegraph, the newspaper, the railroad and say: They have done it! But let us not mistake. They are the effect, not the cause. They are but the sign, the symbol. Back of them is the secret. We point to the public schools and say: They have done it! But let us not err. They are the effect; not the cause. They are but the sign, the symbol. Back of them all is the secret. Behind them is the grand, ceaseless ongoing, whose resistless current the telegraph, the schools, man may direct, but never create. What does it demand of the educator? What is the profound, common inspiration that it requires of the common schools for every child of humanity?

Wise is the educator who realizes that he is humbly to learn by humbly yielding to its guidance. Happy the teacher who first and last confesses he is more to be taught than teach; who is more ambitious to direct than to create; who will rather clear the way for its free course than obstruct by his futile buildings; who will devotedly surrender to its leadings and hopefully join with its movements; who will freely submit to it the open channels of his warmest heart and deepest soul, trusting thus to receive most of its influence and power, and so be best fitted to become the beneficent medium through which it may again be communicated to others.

Let us now to the answer of our question: What are the public schools to do? They are to serve mankind, not a class. The public schools are to educate the *public;* not the poor, not the rich, but both poor and rich; not scholars, not sellers, not servers, but scholars, sellers and servers. They are not to raise, but to level all sectional walls. They are not to build up aristocracies, but to merge the ties of family and blood into those of humanity. They are not to breed clannishness and caste, but to awaken a common sympathy and a cosmopolitan sentiment. They are to take a brutish man and convert him into a humane man. They are to release man from the domination of his grosser self and put him under the influence of his grander self. They are to change the slave of every changing passion and passing impulse into a free man inspired by a majestic idea of duty arising within his soul. They are to reveal man to man. They are to make man call every other man his brother and claim that

> * * * his father land must be
> As the blue heavens, wide and free.

This is what our public schools are to do. They are not to make scholars, not to make merchants, not to make farmers; but to so mould and mix the elements of character in every prospective lawyer, merchant, mother, that enters their doors that "nature might stand up and say to all the world:" This is a man, a woman; a capable, a willing, a free individual.

Here is the true mark of the high calling of the public schools. Should they reach this they could do no more , for they have led to freedom.

Let us now formulate this conclusion so that we may have in the fewest words a sufficient statement of the object or end or purpose of education. Such a statement should present in clear relief the central, invariable, essential objective point towards which all educational efforts should tend, and with reference to which the youngest and oldest teacher may consciously plan and execute his every method. It should be a pole star towards which the needle of enterprise in every department of educational effort should faithfully point. In other words it should be a practical and practicable

Definition of Education.

Education is the systematic process of training the growing mind toward the pleasure-giving power of spontaneous, unselfish, self-improvement.

Let us examine briefly a few terms in this definition, reserving for a coming division of our discussion their fuller explication.

First, then, education is *systematic;* that is, it is to proceed according to definite and logical principles founded in nature, obtained from her phenomena by intelligent observation and formulated in unifying and simple terms. It is not mere empiricism, mere guess work, mere experiment, mere theory. The day of blind luck or ignorant experimenting is past. Many principles are as settled in educational matters as they are in mathematical.

Second: Education is *training;* that is, is the intelligent directing and stimulating of the inherent powers of the mind in those channels in which its own energies most freely and happily display themselves.

Third: Education has to do with the *growing* mind or soul. The activity of the soul is the energy of nature implanted within it, seeking its own outlook and manifestation, and increasing in power and versatility by its own inherited, inherent laws and necessities. A soul that is not growing is dead, and the teacher has no more to do with it than has the farmer with a rotten stump.

Fourth: Education is to result in *power.* Power comes from practice or use by the mind of its own energies. It does not come from cramming; it does not come from reciting from memory; it does not come from passivly receiving instruction from a talking teacher or lecturing professor; it does not come from passing examinations; it *does* come from the continued practice of converting all knowledge received into skilled expression by spoken words, by written words, by action upon real objects, by useful hands, by philanthropic effort, by an exemplary life.

Fifth: Education must train to a *pleasure-giving* power. The performance of duty, however irksome, however difficult, however painful, should be pleasure-giving, and the teaching which in spirit and results does not fix this *habit* of action is radically wrong and vicious.

Sixth: *Spontaneous.* The effort of the mind or soul toward improvement should be spontaneous, easy, unrestrained. This does not mean that it should not involve effort; on the other hand, the more effort it requires the more enthusiasm and intensity should it evoke.

Seventh: *Unselfish.* An education which involves self improvement for self's sake is utterly bad. The best and most practical philanthropy is that which accumulates self power for benevolence and goodness. A true education will encourage ambition, encourage the accumulation of wealth, the acquisition of mental, moral and social power—but always toward the end that it shall be useful for mankind.

Eighth: *Self improvement.* This is the terminus of all formal educational effort. When a young man or woman has the power of improving himself he is ready for life, and the school should dismiss him to work out his own work. To hold him longer is to rob the world of power. Many of our higher schools are continually plundering society of needed available energy by their long courses of study. Our great men are those who have grown up in their *business*, not those who have grown up in the schools.

Thus we have established the mark at which our public schools should aim. It is high, but not too high. If anything higher can be thought, then that is the true mark.

Having thus briefly replied to the question: What are our public schools to do? let us consider a second question:

How are they to do it?

The answer to this question must be the statement and exposition of a complete system of education. It is expected only to point out a few fundamental principles, which, if duly regarded, will ensure a safe and comely superstructure.

The infinite variety and complexity of nature must here, as in other departments of science, be resolved into that unity and simplicity which always characterize her phenomena. And if we are enabled to summarize her multifarious developments in a few simple, practical principles, will not their very fewness and simplicity argue their proximity to absolute verity?

Our question involves three things: (1.) The nature of the learner. (2.) The methods of the teacher. (3.) The materials of the teaching. And this is their natural order. The cultivator of a plant considers first the nature of the plant; decides upon the method of treating it; and then proceeds to supply himself with the proper materials. A mechanic studies the character of his job, determines how he will proceed, then provides himself with the needed materials and instruments. Let us be as wise with our problem.

The Nature of the Learner.

First, then, man as a learner is an activity; and like all vital activities of nature is destined, impelled by its very being to *grow;* in other words, to increase in power; in other words, to *improve,* all doctrines, dogmas to the contrary, notwithstanding. Why should the churches, which are themselves the noblest evidences of this, be the ones to mislead us? It is the nature of the mind to be active, and to be active in the right direction; to be active toward increase of power and goodness. To admit that it is a vital activity is to admit this. Schools, like the churches, are disposed to belie nature in order to magnify themselves. Let us not make this terrible blunder. The children in our schools are naturally disposed to be good, to improve. Go into any school room, point me out one bad one and I will show you twenty good ones. Are we to judge all human nature by these exceptions? Go into yonder forest, find one ugly, gnarled oak, and I will find a score of grand, towering specimens. Shall we conclude that oaks are naturally ugly and gnarled? Does any farmer preach that fruit trees are naturally unfruitful because one out of fifty, or twenty, or ten, fail him? Man as a learner is one of nature's growing activities. Has she blundered in this, the grandest, noblest of her works? Nature is wise, beneficent, good. The great Creator, I am willing to maintain, knew his business, and it little behooves man to set himself up as am improver upon his works. Let the teacher, as he stands before his children, humbly recognize in their every soul the energy, the effort, the purpose of a good God, whose great will as expressed through them he should patiently study and learn; not to correct, but to give it free course; not to repress and crush, but to free from every hindering obstacle and encumbering weight.

The human being learns, all the way from the cradle to the grave; whether he wills to or not; whether he goes to school or not. It is just as impossible for him not to learn as it is not to grow physically. Learning is mental growth. It should never be anything more, it can never be anything less.

We are ready now to affirm two universal, indemonstrable truths or axioms:

1. *The Axiom of Activity.*—The mind is inherently active.

2. *The Axiom of Improvement.*—The mind is inherently improving.

The second is really a corollary of the first; but they are separately so important and undeniable as to warrant for them an equal rank.

But the phenomenon, the learner, posesses not only properties, but possibilities. A true analysis of the mind must recognize not only its indemonstrable properties, but indemonstrable possibilities; not only what the mind is, but what may be done with it. Thus we pass from the theoretical to the practical aspect of our phenomenon.

Activity implies something to act against—an environment which seems to direct and stimulate; conditions which may be effects towards which the mind, as a cause, tends, or causes which may work their effects upon the mind. The relation of the mind to its externals, or of its externals to the mind are facts of nature; fundamental, primary facts. They are the very rootage of all formal education. The action of matter on mind, mind upon mind, is no artificial device of intelligence. It is the common phenomenon of all animal nature. It existed probably in the brute creation long before the animal reached man's estate. It is the first induction, conscious or unconscious, from all sentient phenomena, that the environment of the mind may be so adjusted as to give direction, or to act as a stimulus. The recognition of these facts, and the systematic consideration of what adjustments are most favorable or most unfavorable to these ends is the whole science of formal education as distinguished from natural education. Every process in the art of education is here postulated. We are therefore lead up to the two universal, indemonstrable problems, as we were above to two universal, indemonstrable theorems.

(1.) *Postulate of Bias.* The mind can be directed.

(2.) *Postulate of Stimulus.* The mind can be stimulated.

Notice, now, how we have corroborated our definition of education. We have found *in nature* all the facts necessary for its full realization. We can act upon it, build upon it, knowing that we act and work with nature; nay, knowing that we are letting her work with us, that we are linking our weakness to her might.

Out of these two axioms and two postulates will proceed the science and art of education. (Vide appendix E.)

Though we have reached the basal beams of our structure, we have not yet determined the nature of the mind sufficiently to predicate distinct methods of procedure.

The method of the teacher or how to deal with man as a learner must come from a study of the manner in which nature herself deals with man as a learner, or stated a little differently, how this activity grows of itself within its natural environments—what are its simplest stages, its elementary modes. Having determined these, we must let them suggest what educational appliances should be adopted, and how they are to be used.

Man as a learner is a very complex growing activity, involving all the possibilities of the entire man, physical and spiritual. Now by passing from this the highest to the lowest growing activity, or from the most complex to the least complex, we shall find the elementary phases, (for, nature is ever true to herself,) just the same, but less encumbered and diversified. A plant is the lowest and simplest form of a growing activity. Its growth involves three stages of processes: 1st, *Absorption*, by root and leaf; 2d, *Assimilation*, by all its internal organs, and 3d, *Fructification* or reproduction. In these three processes the cycle of vegetable activity is completed.

The same trinity of processes is manifested and maintained in all the higher growing activities. Man absorbs the materials of his growth by his lacteals and lungs as the plant does by its roots and leaves; the main difference being, that in the one the organs are internal, in the other, external. Man assimilates from his blood the materials thus absorbed, as does the plant from its sap. From the materials thus absorbed and assimilated, the individual man is enabled to reach the culmination of his physical existence in the reproduction of his kind, as does the plant in its fructification.

The animal man, therefore, as a growing activity exhibits a trinity of processes corresponding closely to the infinitely less complex processes of the vegetable as a growing activity.

Passing now to the educable man and reasoning by analogy, that, as a growing activity he partakes of the essential characteristics of all growing activities, we reach a very significant trichotomy of the nature of the learner.

Corresponding to Absorption of the physical cycle we have, 1st, Acquisition or observation; corresponding to the Assimilation we have, 2d, Reflection; corresponding to the fructification we have, 3d, Expression. Now the vegetable terms are really the better, for Acquisition, Reflection and Expression will tend to confine us to the growth of the mind, which is only an important third of the subject in the hands of the educator. Nevertheless we shall use these terms, but with the breadth of signification which their origin warrants. They underlie the whole man; applying with equal force to physical, intellectual and moral growth, and as expressive of the natural growth of these several capacities, furnish us an all important index to the manner of using aids which we may wish to apply to them.

And I cannot therefore emphasize too strongly the value of this trichotomy to the science of pedogogics, in whose domain there is so much that is purely empirical, so little that is permanently, philosophically established. Education, the mother of all the sciences, has been the most neglected of all her daughters. Under her auspices methods are tried, thrown aside, buried, only to be resuscitated in the next generation as new and feasible, which, under the touchstone of a few firmly fixed principles would at once be finally consigned to eternal oblivion. Teachers have been studying the science of mathematics, the science of physics, the science of language, whlle the science of teaching, the science of all sciences, they neglect, so that to-day it is no science, but is yet begging for some master to penetrate its accumulated details with the eye of a philosopher, discover its underlying, controlling principles and fix them for all time as those of mathematics or physics are fixed, so that they may be sure guides to the youngest and poorest of teachers as well as to the oldest and most successful—faithful tests which can be applied at once to all practices and methods to prove their worth or worthlessness. Had we such guides and tests, it could not be said, as it has been, that our schools are to-day, pedagogically speaking, great Augean stables, encumbered and befouled with accumulated masses of effete methods which would be removed in a day by the Herculean agency of some few established principles.

I am bold to maintain that the investigation just completed has reached results which partake somewhat of the character of such a pedagogical magnet, which if applied to this or that method by the teacher of any subject, will separate the good metal from the surrounding dross.

The Methods of the Teacher.

Nature is the first great teacher. To her we must ever look for guidance; with her we must ever work. The phenomenon man as a learner is a phenomenon of nature; growing, putting forth its activities under the direction and stimulus of its natural environment. Let us now proceed to predicate some few general principles upon these conclusions:

The trichotomy of the *educable* man, as an activlty, into the three stages of Acquisition, Reflection and Expression can be made not only a test of the value of present practices, but a guide to new and correct processes and methods. Not only to teachers, but to parents; not only to parents, but to those who are training themselves, (and who of us is not) do I urge it as a key to proper development; and claim that, in every lesson learned, be it in business, in the office, in science, in physical culture, in intellectual training, if it be carefully seen to, that such lesson is a completed cycle, comprising invariably the three partial processes, Acquisition, Reflection and Expression, there will be derived from it the utmost good of which the learner is capable.

How many impressions or acquisitions we receive. How few of these do we think to digest or reflect upon, to mentally incorporate —but how many less do we attempt to give expression to.

Most teachers see that their pupils cram, absorb; some require reflection; less give opportunity for expression. Yet a failure in any one of these steps is disaster to all. Acquisition is made thorough by reflection; sure by expression. Reflection is impossible without the materials of acquisition. Cogent expression is impossible without the preliminary stages of acquisition and reflection. To those who visit our schools, I would recommend these processes as a test of the true teacher. Especially should you observe the success with which the last stage, expression, is accomplished on the pupils. This is the so-called drudgery of teaching. It is so much easier for the teacher to recite the whole lesson, and more beside, than to wait for the hesitating, stammering efforts of the children. It is so much easier to lecture ones self than to hear one's pupil's lecture. But it is taking the intellectual bread out of the mouth's of the pupils; and the talking, lecturing teacher, whether he be in public school or college, is the murderer of the minds of his pupils and deserves himself summary decapitation.

I wish I had the time to stop right here and show how the most of us are unwittingly intellectual suicides in the fact that we content ourselves in our reading, in our observations and experiences with hardly the first step in this cycle. For instance, how many books we read, absorb, without the slightest reflection, and so far as expression or reproduction of them is concerned, it never enters our minds. Whereas, if a book is worth reading, it is worthy of patient, mental incorporation, or reflective assimilation. But not only should it be absorbed and assimilated, it should be reproduced by telling it to some one, or by writing out recollections of it, or by writing out something original which it has, as healthy food, stimulated to; there should be some firuitage. "Who eats should work," is the law of health for the mind as well as the body.

Intellectual dyspepsia is a thousand times more prevalent than physical dyspepsia. If infinitely less were eaten, mentally speaking, and what were eaten were digested, and finally, for here is where we all fail, if something were *produced* as fruitage in the way of expression, flabbiness of mind, and sickliness of conversation would not be so prevalent. In this matter we manage ourselves better physically than we do intellectually, because perhaps our physical lies nearer the strength of our natural instincts.

The application of this trichotomy to moral teaching is most edifying, in that it explains why so much of the morality which is taught in homes, in schools, and from the pulpit, produces a maudlin sentimentality, rather than a vigorouus, Good Samaritanism.

Many brilliant preachers are poor teachers of morality, because they accomplish only the first, or at most the second stage of their instruction. Apply to their management the test of our trichotomy.

In moral growth, just as in intellectual, there are the three stages of Acquisition, Reflection, and Expression, represented respectively by the familiar terms, moral precepts, moral sentiments, moral practice. Moral precepts may be learned perfectly by children who, not comprehending them, will not feel as a result the slightest moral sentiment. Moral precepts may be faithfully inculcated which may result in the most beautiful, tearful sentiments, and yet fail utterly to reach their true end, in a good deed, in a moral action, a product.

It does not follow that because a child knows the right he will feel the right; nor does it follow that because he *feels* he will *do it*. The eloquent preacher may so portray the right that many a handkerchief will attest the resulting sentiment; but if he lazily or carelessly omit to direct these sentiments to real action upon the poor and unfortunate in his parish; unless he faithfully lead these charmed and tearfully sympathetic listeners to actual cases of distress, and there give them opportunity to carry on their moral growth from the complacent stage of mere sentiment, to the productive stage of deeds of real charity and benevolence; he not only fails to teach morality, but he really teaches *immorality*. He cultivates in his hearers the *habit* of letting whatever moral motives he or any one else may arouse, terminate within themselves, and so establish in their lives not a practical morality, but a sickly sentimentality that is ever ready to weep over an immaginary unfortunate, but is never ready to work for a real one.

It is the so-called drudgery of preaching, as it is of teaching, to see that learners produce, practice; to help them to practice, to bear patiently with their blunders as they try to practice that which it is so luxuriously easy to repeat in eloquent precept or illustrate in touching narrative.

And the minister who maintains that his duties are concluded with his pulpit discourses, no matter how studied, how instructive, how charming they may be, is really a shirk and a criminal, for he is a practical teacher of immorality. As the lecturing teacher is a mental murderer, so the preaching minister is a moral destroyer.

Thus do we apply with certainty our trichotomy, as a test, and thus does it not only point out, but explain errors and suggest their remedy. Its application to physical education will be manifest without explication.

Let every method in every subject have reference to and complete in its procedure processes corresponding to the natural processes of Absorption, Assimilation and Reproduction, and the manner of our school work will be the best possible. A simple maxim, but an all important one. In it we have Nature's multiplicity and complexity unified and simplified, so far as the method of teaching are concerned. I care not what particular methods the Normal School may offer; I care not what magnificent structure of pedagogical philosophy may be established; I care not what panacea some one-ideaed institution of learning may vend; if a young or old, inexperienced or experienced, ignorant or scholarly teacher will faithfully complete in every idea, lesson or course of instruction, these three phases of the cycle of natural growth, he will succeed and do good, because he is working with nature. Nature and the humblest pedagogue is a majority over all the possible armies that can be mustered of theoretical professionals that have deserted nature.

Materials of the Teaching.

Having thus briefly considered the nature of the learner and the methods of the teacher, let us now seek to determine the character of the materials to be used and the order of their application.

This leads us to an investigation of the environment of man as a growing, learning activity. As already said, activity implies something to act against or upon. The mind or soul acts against or upon two things. Matter and mind.

It is not too materiaistic to maintain that, so far as our existence here is concerned, mind, without matter, could not manifest itself. We are so conditioned that the physical is the indispensable carrier of the spiritual. And the educational system which would ignore the material could in viciousness be equalled by that system alone which should ignore the spiritual.

The progress of the individual, as that of society, is ever upon the principle that the more thoroughly do we subdue and subjugate matter, the more thoroughly do we exalt and enthrone mind and spirit. Not by ignoring the material, but by placing it as step-stones under our feet do we attain to the spiritual. The vile morality of the monasteries and the bookish scholasticism of the dark ages taught lessons we should not forget.

But here, as heretofore, we must study nature. It is her child we have to teach, it is concerning her that we must teach. In determing the method of the teacher we found the clue to our solution in the nature of the learner. We found that methods of teaching should be made for the learner, but that the learner should not be made for the methods of teaching.

By the same criterion let us decide what are the materials of teaching or what is to be taught.

The answer to the question should supply principles upon which a course of study should be formed, pointing out distinctly what studies should be pursued at one time, or the lateral arrangement of the course; and in what order they should be taken up, or the longitudinal arrangement of the course.

First, then, as to the lateral arrangement of a course of studies, or what studies should the pupil engage in at any given time.

Here our trichotomy is again our guide. All the subjects taught at any one time to a pupil, whether he be in primary, high school or college should keep in view the tripartit character of the learner. One class of subjects should have reference to his powers of absorption, or observation or acquisition; another should have reference to his power of assimilation or reflection; another to his power of expression, of reproducing. The usual studies of a scholar fall easily into these three divisions: Natural Sciences, Mathematics, Languages. The first especially affects the first stage or that of observation, the second has reference to reflection especially, the third aims at the reproductive faculties. In the primary school, therefore, the A-B-C-Darian by regular lessons upon real objects should be taught the elements of science, should be taught to observe with all his senses and faculties. This division of school work is too much neglected *throughout* the usual curriculum, and especially so in the lower grades, so that by the time the pupil has reached the higher grades his powers of observation and acquisition are blunted by neglect and inactivity. Studies are so confined to the school book or school room, that the pupil is really trained in the habit of *not* seeing, *not* hearing, *not* feeling. This is the greatest defect in our school systems, and is a relic of the scholastic bias. They do not sufficiently train these faculties which are indeed the main sources of supply, the gateway to the other capabilities of the active man.

Again the abcdarian must be supplied with materials which will especially act upon his reflective capacity. For this purpose, simple, sensible lessons in numbers should be given him at the first, and would that our teachers could understand why they teach arithmetic to beginners! It is not to make mathmeticians, it is not to have them commit to memory dead tables and deader defiinitions—it is merely to train them to reason, to reflect upon abstractions, and when a teacher requires pupils to recite in arithmetic what is beyond their power of reasoning, he does not teach, he crams, he stuffs, stupifies, stultifies. Nevertheless arithmetic should be taught to abcdarians, at first and always, for they are at first and always reasoning beings.

Finally, the abcdarian should be cultivated in the power of expression, in the use of language. This division of the work is provided for in the reading classes, but I have seen teachers teach reading as if they had entirely forgotten the purpose it was to serve.

So I might pass along the whole course of studies and show how, laterally considered, the subjects taught have, or should have, reference to threefold activities of the learner. The first and last stages are too generally neglected. The first in the lower schools, the last in the higher schools. Comparatively few colleges provide any regular instruction in the original expression of ideas.

Thus we see that, as our trichotomy indicated how each subject should be taught, so it clearly points out the simultaneous features of what should be taught. It may not be necessary further to remark that, while the natural sciences are acquisitive, they should of course be taught with reference to reflection and expression as well. This is implied in the discussion of the methods. Everything should be taught with reference to the tripartite nature of the learner. Yet each subject leans in one of the three directions, and is therefore more favorable to the development of that side of the learner.

The longitudinal arrangement of materials is also dependent upon the nature of the learner. The earlier part of a man's life is given to acquisition. As he comes to maturity he is more reflective, and finally, having attained his prime, he becomes a reproducer; that is, gives expression to his acquired and assimilated products in the form of his life work.

The earlier part of the course of studies, therefore, should be of an objective character, and devoted especially to the acquisition of ideas. The middle portion should call forth the reasoning powers. The higher course should conserve and utilize all the materials absorbed and assimilated in the constant practice of expression.

Thus, again, does our trichotomy lead to the solution. And is it not clear and simple? Nature is ever so. She speaks as plainly to her humblest as to her proudest child. Cannot the poorest member of our profession see in these conclusions practical suggestions for his own self-management and for his school? Will not our wisest teachers find something of truth and practical wisdon in this study?

How nearly the aims, methods and courses of study in our public schools approximate to or how much they depart from the ideal thus formed, I shall not at present consider; yet, that they are in the way of its realization cannot be denied; but that they need and are ready for some considerable reconstruction and modification is also true.

Let us now recapitulate:

To our first question: What are our public schools to do? we have answered: They are *not* to make specialists, but to produce capable, willing, free individuals.

To answer the second question: How are they to do it? we first determined that man, as a learner, is a growing activity, whose cycle is completed in the three processes of Acquisition, Assimilation, Expression, and from this analysis have we inferred the *manner* of the public school work and the nature of its *materials* and their arrangement laterally and longitudinally. It has been my object to present for inspection, the elements of the philosophy of school organization—to show that our public school system, although almost entirely an empirical product, is yet the creature of fixed principles, which, consciously or unconsciously to those who are managing it, control and shape it. Whether I have even partially succeeded in my undertaking must now be left to the kindly and intelligent judgment of the reader.

APPENDIX D.

Outlining.

This *means* of investigation and review is a clearly defined science. That is, it involves certain technicalities for which fixed names must be furnished, and certain principles which may be systematically presented.

While the following logical discussion should not be given or imitated by the teacher in first presenting the subject to the school, it will, I hope, furnish such aid as will ensure a consistent use of terms, and so make more effective any efforts to introduce what I consider one of he *healthiest* methods of investigation and instruction.

Outline of Outlining.

1^1 Systems.
  1^2 Brace. 2^2 Position. 3^2 Exponential. 4^2 Letter. 5^2 Composite.
2^1 Nomenclature.
  1^2 Notation.
    1^3 Brace. 2^3 Index.
      1^4 Arms. 1^4 General.
      2^4 Apex. 2^4 Special.
        1^5 Co-ordinal. 2^5 Subordinal.
  2^2 Headings.
    1^3 Superordinate. 2^3 Co-ordinate. 3^3 Subordinate.
3^1 Divisions.
  1^2 Definition. 2^2 Partition. 3^2 Division. 4^2 Description. 5^2 Exemplification. 6^2 Comparison and Contrast. 7^2 Narration. 8^2 Applications.
4^1 Principles.
  1^2 No *heading* should be introduced which has no co-ordinate.
  2^2 Ordinarily, all co-ordinates should stand in a vertical order. Sometimes a lateral arrangement of co-ordinates (as in this outline) will economize space.
  3^2 Subordinates should stand underneath and to the right of their superordinates.
4^2 The theme should not be indexed, unless it is itself subordinate to some superordinate.

Elaboration of the Outline.

DEFINITION.—Ontlining is that method of investgating a given subject which consists (1) of the determination of its important divisions and subdivisions, and (2) of their arrangement in a systematic order, preparatory to elaboration.

The subject to be investigated is called the *Theme;* the divisions and subdivisions, *Heads* (or Headings) and *Subheads;* the Theme with its subheads properly arranged, an *Outline.* The term Head or Heading is applicable to the Theme or any of its Subheads.

The process of arranging the heads according to their *Rank* or logical relation is termed *Ordination* or *Ranking.*

1^1 SYSTEMS—A system of outlining is a method of indicating the rank of the heads and subheads by certain *Notation*, that is, by certain logical marks, such as braces, headings, etc.

1^2 The *Brace* system ordinates headings by Brace notation; that is, uses Braces, thus:

Tables. (Theme.)	Parts.	Top.	
		Body.	Sides. Drawers.
		Legs.	
	Kinds.	Dining.	
		Parlor.	
		Billiard,	

2^2 The *Position* system ordinates by placing heads of equal rank *vertically* or horizontally, and those inferior to a certain head underneath and to the right of it, thus:

- Tables.
  - Parts.
    - Top.
    - Body.
      - Sides. Drawers.
    - Legs.
      - Dining. Parlor. Billiard, etc.

3^2 The *Exponential* system, kinds invented by A. Holbrook, ordinates by position, but also indicates the logical rank of each head by a number (Index) composed of a basal figure (Co-ordinal) and an exponential figure (Subordinal), thus:

Table (Theme)

I^1 Parts.

1^2 Top. 2^2 Body. 3^2 Legs.

1^3 Sides.

2^3 Drawers.

2^1 Kinds.

1^2 Dining. 2^2 Parlor. 2^2 Billiurd, etc.

4^2 The *Letter* system ordinates by position and by letters or simple figures, thus:

Table.

A. Parts.

a. Top. b. Parlor. c. Billiard.

1. Sides.

2. Drawers.

B. Kinds.

a. Dining. b. Body. c. Legs

5^2 The *Composite* system, taking the Position system as its base, ordinates with any or all the others, according to the space to be occupied on the paper.

2^1 NOMENCLATURE is that division of our science which treats of the technical terms or names used.

1^2 *Notation* is that peculiarlty of a system by which it indicates the logical rank of the headings.

1^3 The *Brace* consists of the 1^4 *Arms* and 2^4 *Apex*. The apex of a brace always points to the heading, the subheads of which the arms are made to include. The *Reverse* brace and *Double* brace are sufficiently defined by their names. The apex or arms of a brace may be extended to any length and in any direction.

2^3 The *Index* is the numeral used in the Exponential system. Every head has a 2^4 *Special Index*, which is composed of the 1^5 *Co-ordinal*, which numbers the heads of equal rank, and the 2^5 *Subordinal*, which indicates the degree of logical inferiority or *Subordination* of that he head. Thus the special index of "Drawers" is 2^3. The Co-ordinal, 2, indicates that it is the 2d of the two equal rank heads under "Body." The subordinal, 3, indicates that it is in the 3d degree of subordination to the Theme, "Table." Every head has also a 1^4 *General Index*, which is a collection of those special indexes, starting from the Theme, which will completely indicate the heading in the position of the general outline; or, it is the Special Index of the heading preceded by the indexes of its successive superordinates, thus, $1^1\ 2^2\ 2^3$ is the *General Index* of the heading, "drawers."

2^2 *Headings*. The nomenclature of the headings is very simple. The heading next superior to a certain head is *its* Superordinate. Any *superior* head is *a* superordinate to its inferior, thus: "table" is *the* superordinate of "parts" and "kinds," it is also *a* superordinate to every head in the outline.

A head inferior to a certain head is its *Subordinate*. Any inferior head is *a* subordinate to all its superior or superordinates, thus, "parts" and "kinds" are *the* Subordinates to "table." Any subhead is *a* subordinate to the theme.

A head equal in rank with another, and included under the same immediate superordinate head is its *Co-ordinate*, thus, "top," "body" and "legs" are *co-ordinates*, and each one is said to be co-ordinate *with* the others. Notice the propositions, superordinate *to*, subordinate *to*, co-ordinate *with*.

3^1 DIVISIONS.—These are general heads to be used in outlining subjects. All of these can be used with most subjects. The most of them with all. They are suggestive of the main lines of thought to be taken in the discussion of a theme. For instance, if table is the theme upon which I wish to write, I will first outline it, using these eight divisions for my subheads or subordinates. I should indicate in the outline that it should be *defined*, by the head, *Definition;* second, that its *parts* should be given by the head, *Partition;* third, that the *kinds* of table should be given by the head, *Divisions;* fourth, that a table should be *described* by *Description;* fifth, that some good *example* of a table should be given by *Exemplification;* sixth, that certain tables, for instance, that of a poor man and that of a rich man, should be *compared* and *contrasted*, by *Comparison* and *Contrast;* seventh, that the history of a certain table, or of tables generally, should be given by *Narrative;* eighth, that the uses of tables should be by *applications*. Of course these main heads would then be each divided and subdivided, which would be the further *expansion* of the outline. After thus outlining the subject, an essay upon the theme "tables" would be an easy matter; at any rate, "nothing to write" would not be the complaint.

APPENDIX E.

IS THERE A SCIENCE OF EDUCATION?

(1). What is meant by the term, Science? It has different significations, apparently. Geometry and Physiology, for instance, are called Sciences. Yet they are very unlike, so far as their Scientific characteristics are concerned.

(2). Geometry presents a systematic evolution of principles from principles with a rigor of logic as beautiful as it is exacting.

(3). In Physiology, on the other hand there is, apparently, no such orderly procedure, and no pretense is made, seemingly, of establishing a multitude of propositions by authority of a few higher ones.

(4). Is Physiology, then, strictly speaking, not a science? Is no body of knowledge to be ranked as a Science until it attains the formal exactness of the Mathematics? Is it to be expected that every so called Science is approximating to, and will finally reach this Mathematical perfection?

(5). By answering these questions we shall be enabled to determine the true status, present and prospective, of the Science of Education.

(6). A Science is a body of systematised knowledge, with regard to a given subject-matter.

(7). The subject-matter of any given Science is a defined phenomenon.

(8). A phenomenon is an assemblage of properties, expressed by a fixed name.

(9). Knowledge is the determined relation of equality between the properties of a given phenomenon under their various possibilities.

(10). Systematized knowledge is a collection of the determined equations between the properties of a given phenomenon, grouped according to some *unifying* principle.

(11). The limits of a given Science are determined by the definition of its subject-matter. The extent of a given Science depends upon the complexity of the subject-matter and the number and variety of its possibilities.

(12). The rigor of system with which the body of knowledge of any Science may be presented depends upon the number and complexity of the properties under their possibilities of the defined subject-matter, and our familiarity with them.

(13). Let us examine the subject-matter of a few familiar Sciences to determine their Scientific character. This will furnish us the requisites of Science.

(14). Then, by examining the body of knowledge known as the Science of Education, we may decide whether it possesses the requisites of a true Science. When, if any of these are lacking, we may decide what they are and determine how they shall be provided. Preliminary to this are a few considerations which will aid us.

(15). We have said that the subject-matter of a given Science was a phenomenon (7) and that a phenomenon is an assemblage of properties expressed by a name (8). The more common word for a phenomenon is a *Thing*. Any thing is a phenomenon. That every object of the mind which can be designated by the word, Thing, is a mere group of properties, a moment's thought will show.

(16). Take *snow*, for instance. What is it? It is a group of certain properties such as whiteness, crystalline structure, falling from the clouds, melting into water, etc., which when recognized by different minds as forming a group, their common expression will be Snow. What it is that possesses these properties we do not and cannot *know*, except by faith. It is the *substantia*, "the thing itself," the consideration of which in this connection, is unnecessary, fruitless and misleading. We learn what snow is by determining its properties. So with every other object of the human understanding.

(17). Let us go farther. We *determine* the propeties of any given phenomenon by simply deciding that they are like or unlike the observed properties of other phenomena. When we say snow is white, we mean that in that regard it is like some other phenomenon which makes a similar impression on the retina. When we say snow will melt, we mean that it undergoes a change from solid to liquid form, which is familiar to us in other phenomena, and so on.

(18). In other words, whiteness expresses a recognized likeness, or an *equation* between the manifestations of certain phenomena. *Every word that expresses a property is an equation, or an expression for a relation of equality or likeness recognized by two or more minds as existing in certain phenomena.*

(19). The relativity of all human knowledge is thus sufficiently indicated.

(20). We now come to the consideration of a few of the different so called Sciences.

(21). *Arithmetic.* What is the property which the mind first abstracts from things first presented to its consciousness? Observe the infant when it first opens its eyes to its surrounding environment. It sees nothing because it does not see something. Its first indication of consciousness, so far as this sense is concerned, appears after a few weeks, when it begins to fix its eyes on *one* object. It sees *some* thing when it notices *one* thing. The world at first, to its infantile gaze, is a great single whole, the first knowledge of which comes from discovering some of its *many* parts, or from discovering that it is composed of parts. The properties of these parts are not recognized at all. It will follow a light part as separate from the surrounding dark part. It will follow the face of its mother as a part separate from the continuous whole which first impressed its retina. While the face of its mother is recognized simply as a part of a continuous whole, it is not *distinguished* until as a *single* whole its many parts are again separated. So that the first process of learning is the separation of the single whole into its many parts, and, at the same instant, the grouping of the many parts into a single whole. The same observations are applicable to the first tactile impressions, or other primary sensations.

(22). Now the property abstracted first in all these phenomena is not light, nor color, nor form, nor size, but simply *unity* and *plurality*—the one, the many.

(23). We see, then, that in these, the earliest of the intuitions of the human mind, we have the properties that constitute the phenomenon *Number*, which is the subject-matter of Arithmetic.

(24.) Arithmetic, then, is the Science which treats of the phenomenon, Number, which phenomenon has only the two properties *unity* and *plurality* and the two possibilities of *increase* and *decrease*.

(25). We have said (12) that the rigor of system with which any body of knowledge may be presented depends upon the number and complexity of the properties under their possibilities of its given subject-matter and our familiarity with them. See how this is illustrated in the Science of Arithmetic. Its subject-matter is the simplest of all phenomena, because it has the fewest properties subject to the fewest possibilities. These properties being the earliest intuitions of the mind and their possibilities being those which, from the necessities of human experience, are most frequently considered, they are the most thoroughly understood, and the number and order of the relations of equality existing between them have become better established than those of any other science. Arithmetic is therefore the most systematic, that is, the most logical and therefore the most scientific of all the Sciences.

(26). *Geometry.* After Number, what abstraction is next accomplished by the mind? Immediately succeeding, or perhaps at the same time of, the recognition of parts as constituting a whole, is the recognition of the contour of those parts and of the whole as limiting portions of space and presenting the idea of space and position in space. In other words the property of magnitude is abstracted, which is soon discovered to be a phenomenon of two properties, *extent* and *position* with the possibilities of change of position and increase and decrease of extent, forming a new subject matter for a Science.

(27). Geometry is, therefore, the science which treats of the phenomenon, *Magnitude*, whose properties are position and extent with the possibilities of change (of position) and increase and decrease of extent.

(28). From the property, position, springs the idea of motion and direction. The property of extent involves linear, superficial and volumetric extension. The relations of equality found to exist in these properties under their different possibilities form the body of knowledge which constitutes the Science of Geometry. Since these abstractions are among the earliest intuitions of the mind and their possibilities of change, increase and decrease, from the necessities of experience, are constantly in the observation of man, they are well understood. Their relations of equality have been carefully distinguished and the order of these equations thoroughly unified. In other words, the knowledge of Geometry has become quite clearly defined and thoroughly established; that is, it has attained a rigor of logical procedure which makes it a truly scientific Science.

(29). The very limited extent of this Science should not pass unnoticed. It must be remembered that out of the infinite number of magnitudes only the few regular ones have been made the subject of equations.

(30). Neither should it be supposed that the system of Geometry is fixed beyond question. Euclid has done most to give it logical form, but many improvements have been made upon his system, and every new Geometry has for its mission the founding of a new set of definitions, axioms and postulates and a better order of procedure. Attention is here called to this, for the reason that the claim is often made that the foundation of Mathematics and their order of procedure is fixed and exact. They are fixed, but not beyond question. They are exact, but only approximately. The advantage, therefore, which they have over other sciences in this regard is due to the simplicity of their subject-matters and their more frequent occurrence in human experience.

(31). *Qualitative* and *Quantitative Geometry*. Another distinction arises in Geometry which could not have arisen in arithmetic, because it is dependent upon it.

(32). So long as the equations of Geometry are between properties only, without relation to *units*, the discussion is purely qualitative, that is, it is a discussion of qualities, but the moment a *quantity* of linear, superficial or volumetric extension, or of angular divergence is introduced, it becomes *quantitative*; that is, the discussion is of *amounts* and *quantities* of properties involved, which quantities must be expressed in terms of an assumed *unit* of the property under discussion. The introduction of units is the introduction of Arithmetic, the Science of units.

(33). The dividing line between qualitative and quantitative Geometry, is the proportion. At this point the Science of Geometry becomes Mensuration and Trigonometry, the latter science being merely an extension of Mensuration by an ingenious invention whereby the measurements of angles is made homogeneous with the measurement of rectilinear magnitudes.

(34). It will be best at this point to draw the important conclusion, that what has been pointed out concerning Geometry is true of all the Sciences. *They are qualitative until they involve units,* (and *so the Science of units, Arithmetic*), *when they become quantitative*.

(35). In the development of any Science, the qualitative stage invariably precedes the quantitative.

(36). During the qualitative stage, relations or properties are classified, while during the quantitative, they are measured or expressed abstractly in terms of some assumed units.

(37). The classification of relations is the unification of these relations, with reference to their origin, or with reference to antecedent and consequent.

(38). Having examined the subject-matter of two leading mathematical Sciences, let us now consider two typical Natural Sciences.

(39). Natural Philosophy is a very indefinite term, expressing a group of Sciences, but as it is the popular designation in a majority of our text-books of a somewhat determined body of truth, it will answer the purpose of our present illustration.

(40). The difficulty one experiences in attempting to state the subject-matter of this Science is the best indication of its un-scientific character. Is it the extrinsic properties of matter, is it motion, is it force, is it machinery, is it the molecular motions, heat, light, and electricity?

(41). Now, if Natural Philosophy were a clearly defined system of truths, the area of its investigations would not be thus ill-defined and scattered; the tendency, therefore, as it progresses, is to fix limits by defining subject-matters. So that, now, instead of Natural Philosophies we have distinct texts on Mechanics, Optics, etc., etc.

(42). These new works simply indicate a more complete unification of the properties and relations involved. Each text treating upon a group, formed by reason of some common similarity.

(43). Let us notice now the character of this progress. At first, Natural Philosophy was a mere collection of truths with reference to matter, motion and force, exhibiting little order or system in their statements.

(44). Further investigation of these truths lead to a better arrangement of them and introduced groupings, or classification.

(45). Where the practical demands of life have required it, certain phenomena have been especially studied and have reached the quantitative stage; for instance, the lever, motion, weight, light, heat, etc., etc. The law of gravitation was but the quantitative statement of a qualitative phenomena. It is simply a proportion whereby units may be applied to that force. The laws of the machines, of light, sound, hydrostatics, etc., are all so many proportions which make an arbitrary unit the means of expressing quantities of the different phenomena.

(46). But notice what a heterogeneous, ill-assorted mass of material is still in our Natural Philosophies. See how muddy and illogical are even our latest treatises on the sub-divisions of this subject. Do we as a consequence hesitate to call it a Science, because the rigor and beauty of the Mathematics are considerably absent?

(47). Yet there are departments of this Science which are assuming a mathematical rigor. Newton, in his Principia, cast much of it into this form. His genius penetrated the incoherent inexact facts and generalized to laws all of which are theoretically correct, none of which is practically exact.

Long before him, Archimedes divined the abstract ideals of Statics and Dynamics which to-day are the foundations of all the scientific rigor of which these sciences are capable.

(48). Let it be known that the abstractions of these physical sciences are not unlike those of Geometry—in that they are exact only in theory, never in practice; yet are the necessary data of all exact reasoning.

(49). For instance, as line, surface, volume, etc., are abstractions impossible to *realize* in practice, yet indispensable to all reasoning, so, for instance, the lever and its law are impossibilities in practice. There never was such a thing as a mathematical lever; nor was there ever a lever to which the law of the lever was exactly applicable. Real levers are never more than *approximations* to the ideal lever.

(50). The abstractions of both Geometry and Physical Sciences could be regarded as impossible, inconceivable absurdities, yet they are the *necessary* starting points of all quantitative deductions.

(51). This anomally is so familiar to us in these departments, and has so long carried the stamp of such respectable and unquestioned authority, it is next to impossible, by calling attention to them, to awaken mistrust in their applications.

(52). Let us now anticipate, a little, in regard to Educational Science, and lay down a canon with regard to its abstractions. All the fundamental abstractions upon which a Science of Education is to be built, will be exact only in theory, never in practice. As the real lever is an ever approximating one, but never perfect one, so the real phenomena of Educational Science must ever approximate to, but never reach the exact abstractions which must form its foundation.

(53). When authority and time have determined and fixed these abstractions, they will be no more liable to disturbance than are the familiar abstractions, line, levers, falling bodies, light, etc., etc.

(54). Concerning Natural Philosophy we conclude that its subject-matter is so complex and ill-defined that it is truly scientific only in spots as it were, and much of the body of truth for which it stands is in a very chaotic, unclassified condition, while portions of it have attained the quantitative stage, and can be expressed with mathematical rigor.

(55). We do not therefore reject it from the Sciences, but engage the more earnestly, first, in verifying its phenomena with reference to cause and effect, and, second, in applying to them units whereby they may be more thoroughly reduced to a quantitative condition.

(56). We come now to Physiology. Is it a Science? Our conclusion is easily anticipated. The subject-matter of Physiology is the Human-Body. Could there be a more complex phenomenon? It involves all nature, in a sense. Inanimate and animate phenomena are here united and lead on to the most complex and difficult of all phenomena—the intelligence, the soul.

(57). When we consider of how much greater practical necessity to human existence is the knowledge of the lever than of the muscle, or even the intelligence that wields it, we can readily understand why the phenomena of Physiology are comparatively new as subjects of human study.

(58). Again, since the study of these phenomena is clearly in its youth, we should expect that the Science would be yet in its qualitative stage, and that the unification of its phenomena would be the engrossing object.

(59). When the relations of food, heart, blood, nerves, mind have been sufficiently investigated, and, as so many causes and effects, are approximately understood, when units of food, units of muscular action, units of nervous power, units of intelligence have been assumed and their laws of relation and inter-relations abstracted and affirmed; Physiology will then have reached a quantitative stage.

(60). Strange as it may seem, this stage is more nearly reached by stock-dealers, gymnasts and pugilists than by Scientists. The feeding and clothing of armies is helping to give it some practical impetus.

We have now investigated very briefly, the characteristics of a few Sciences as Sciences, let us proceed to make application of our conclusions to the solution of our question, "Is Education a Science?"

(61). The phenomenon, (7), of which the Science of Education most treats, is the human mind as as an object of training.

(62). This phenomenon represents an assemblage of properties the most varied and complex, with possibilities as unlimited as they are indeffinite. (8).

(63). The limits and extent of the Science will therefore be ill defined until the phenomenon and its possibilities are better understood. (11).

(64). The rigor of system which characterizes the mathematics (4) we need not look for, as the complexity of the phenomenon is too great, and our familiarity with its properties and possibilities too slight. (12).

(65). The Qualitative stage (34) of an Educational Science is just being reached. We are passing out of the purely recording, or historical, or empirical phase into that of unification or classification. The unity of origin (37) is being searched for and will be fixed upon during the present decade.

(66). The Quantitative stage (36) will undoubtedly be reached in certain divisions of the science, while other portions will long, perhaps always, remain merely qualitative, just as has been the case with Natural Philosophy. (43) Quantitative Educatlonal Science will first appear in the department of Logic, some portions of which Jevons and other authors have already reduced very nearly to a quantitative condition.

(67). We conclude then, distinctly, that there is soon to be a Science of Education; not in the sense that Geometry is a Science, but in the sense that Physiology is a Science. Many works upon education have been published already which are quite as entitled to be called scientific treatises as are many other texts treating of other departments of knowledge.

(68). The Science of Education must be the outgrowth of Teaching, or the process of education. By studying the process, and by this means alone, we shall be able to fix the principles involved.

(69). Teaching is a *process*, controlled by *principles*, ariving at *products*.

(70). Teaching being a process, is therefore an art, not a science.

(71). A treatise upon, or systematic arrangement and presentation of the *principles* controlling the *process* or art, would be the Science of Education.

(72). The *product* of the process of teaching is the power of happy, unselfish self improvement.

(73). The *Art of Teaching* is, then, the systematical process of training the growing mind toward the power of happy unselfish self improvement.

(74). The Science of Education is the systematic arrangement and presentation of the *principles* which control the process of teaching.

(75). The principles of education must be bold abstractions never to be realized, but ever striven toward. (48, 49, 50).

(76). When first stated these principles may be violently opposed, yet being axiomatic, they will gradually sink into human consciousness there to remain no more liable to the disturbance than are the axioms of Geometry, or Newton's laws of motion, or Archimedes' principles of Mechanics.

(77). The fundamental principles of education will be of three kinds, Definitions, Axioms, Postulates.

(78). The definitions will fix distinctly the nature of the phenomenon by giving its fundamental properties, technical names.

(79). The Postulates will assert the elementary possibilities upon which all other properties or training processes are based.

(80). The Science of Education is not the Science of the Mind. It will depend upon that science for many of its terms and technicalities, but these terms and technicalities will be taken without other explanation than mere definition.

(81). The Science of Education treats only of those properties of the Mind involved in its development, or simply of the mind in reference to its training. (61).

(82). The Principles of the Science of Education will be merely the *general* statement of processes which will have their *special* applications or realization in particular methods or processes detailed in the Art of Education.

(83). In the process or method of solving an equation, transposition is a principle by which it may be reduced; but again transposition is a method or process, depending upon the principle, "If equals be subtracted from equals, the results are equals." So that principles are simply the most general processes—and processes or methods are the aggregation of exemplifications of principles.

(84). The Science of Education will therefore include the few most general methods or most universal principles.

(85). As the principles of machines apply clearly to very few and the most elementary machines, yet are involved in all (50); as the principles of Geometry apply clearly to very few and the most regular magnitudes, yet are involved in all (29); so the principles of education will apply clearly to but very few and the simplest of cases, yet they will be involved in all.

(86). As the magnitudes of Geometry and the machines of Mechanics are perfected ideals (49, 50) impossible to realize in practice (for a perfectly straight line or a frictionless machine are ever impossibilities), so the mind which forms the subject matter of the Science of Education must be a perfected ideal never to be realized in practice.

(87). As we do not discard the Science of Geometry because we can never draw a straight line, or the Science of Mechanics because we cannot have a lever without weight and without friction and in a vacuum, neither should we discard the Science of Education because we do not find the theoretical mind of which it must treat.

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