sea products, starts from the spawn, not visible to the naked eye, a free-swimming creature at birth; is fertilized in the water; grows to the size of grains of pepper; encloses itself in a house of lime; attaches itself to some object; develops rapidly to the size of thumb-nail oysters; is tonged or dredged by man; scattered or planted on private beds; remains undisturbed from two to four years till it comes to our tables. Moreover, they may be bought for Lynn Haven Bays, Blue Points, Saddle Rocks, or any brand and yet they may have come from the same natural ground or oyster bed.

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JENNIE CLARKSON

TO DEVELOP LIFELONG READING HABITS

A professorship of books has been established in Rollins College, Winter Park, Fla., and an author, editor, and publisher was appointed to the chair. A fireplace and comfortable chairs will replace the usual classroom furnishings, and lectures on books and book making, with informal discussions in class, will take the place of formal lectures. The course is intended to develop reading habits in college students that will be lifelong. The course was inaugurated this fall.

A TENTATIVE OUTLINE FOR THE STUDY OF MODERN METHODS OF TEACHING SECONDARY MATHEMATICS

THE social conception of education is gradually serving to emphasize the idea that the subject matter of arithmetic should be based on the quantitative problems of everyday affairs. Moreover, the social need of mathematics increases with the complexity of civilization. As the foundation of government lies in taxing power, many of the problems with which every citizen is supposed to have more or less familiarity, are largely mathematical."[1]

This quotation seems to express the thoughts of present mathematicians in regard to the real social problems that must be solved by the teacher and her pupils.

According to the conclusions reached by the National Committee on Mathematical Requirements, teachers of mathematics find that their primary purpose of teaching mathematics should be to develop in the minds of their pupils an understanding of number relations as well as of space relations, which it is necessary for them to know if they expect to solve many of the problems that appear from time to time in their life work.

Such problems as are given by Raymond Weeks in his *Boy's Own Arithmetic* help to give the teacher a different outlook on his purpose. The following is a typical one:

Moving Power of a Hornet

If 1 hornet can move 1 fourteen-year-old boy 18 rods in 10 seconds (his best speed), what is the smallest number of hornets that could move the same boy from

In the preparation of this paper the writer has enjoyed the advice and criticism of Dr. H. A. Converse, head of the mathematics department in the State Teachers College at Harrisonburg.

[1] General Objectives. State Course of Study High Schools of Virginia, Vol. 7 No. 1, p. 5 (1924).

Mud Turtle Bend to Slabtown, a distance of 3¾ miles, in 9 minutes?

Before the teacher can hope for his pupils to have interest in mathematics, he must himself be interested and know how to arouse the interest of his pupils. Dr. H. H. Horne, in his *Philosophy of Education,* says that the teacher who has solved the present problem of interesting his class in the subject matter has solved the large problem of instruction. For many years girls have declared that they do not like mathematics. Educators have agreed that a number of these girls who dread mathematics can be led to enjoy it if they have teachers who are themselves interested in the subject. Psychologists have proved that girls have mathematical ability as well as boys, but because of individual differences and other influences, many of them are not led to realize it. Paul Ligda, instructor in mathematics, McClymeds High School, Oakland, California, has written *The Teaching of Elementary Algebra* with an introduction by John W. Young. Young says: "Above all, the author's method of problem analysis constitutes a real contribution to mathematical methods. He has had many years' experience in shops and industrial practice as well as a teacher in public high schools. He has thought deeply both on the need of the general citizen for mathematical training and on how to impart such training effectively."

Our well-trained instructors are the chief promoters of secondary mathematical improvements, and the result of these tendencies on our youth will largely depend upon the training that our teachers of mathematics receive. These teachers can best learn of present tendencies if they have a collection of up-to-date mathematical literature at their command.

After making a careful study of the mathematical needs of both the secondary teachers and pupils, and many mathematics books other than those listed in the State Course of Study for High Schools of Virginia—Mathematics. Bulletin, 1924, No. 1

I have been able to list books, periodicals, etc., which will, in my opinion, be of value to the present-day teacher of mathematics. This list follows:

GENERAL MATHEMATICS

Barber. *Teaching Junior High School Mathematics* (1924). Houghton Mifflin Co., Boston, Mass.

Evans. *Teaching of High School Mathematics* (1911). Houghton Mifflin Co., Boston, Mass.

Shultz. *Teaching of Mathematics* (1912). The Macmillan Co., New York.

Young. *Teaching of Mathematics in Secondary Schools* (1912). Longmans Green & Co., New York.

National Committee on Mathematical Requirement (1923).

The Reorganization of Mathematics in Secondary Education. It is distributed through The Dartmouth Press, Hanover, N. H., at a nominal charge of twenty cents a copy.

Cajori. *The Teaching of Mathematics in the United States.* Superintendent of Public Documents, Washington, D. C.

A Problem of Mathematics in Secondary Education. Bulletin 1920, No. 1. Superintendent of Public Documents, Washington, D. C.

State Course of Study High Schools of Virginia. Mathematics Bulletin 1924, No. 1. State Department of Education, Richmond, Virginia.

Periodicals

Mathematics Teacher. Published by National Council of Mathematics Teacher, 41 North Queen St., Lancaster, Pa.

School Science and Mathematics. Smith and Turton, Mount Morris, Illinois.

Tests—General Mathematical Ability[2]

Jones. *Mathematical Wrinkles* (1912). Samuel F. Jones, Gunter, Texas.

ARITHMETIC AND HIGH SCHOOL MATHEMATICS

Lennes. *The Teaching of Arithmetic* (1923). Macmillan Co., N. Y.

Roantree and Taylor. *An Arithmetic for Teachers* (1925). Macmillan Co., N. Y.

Weeks. *Boys' Own Arithmetic* (1924), E. P. Dutton & Co., New York.

Wells and Hart. *New High School Arithmetic* (1919). D. C. Heath & Co., New York.

Gugle. *Modern Junior Mathematics* (Books One and Two, 1920). Gregg Publishing Co., New York.

[2]Material for standard tests and measurements may be secured from Public School Publishing Co., Bloomington, Ill.; Bureau of Publications, Teachers College, Columbia University, New York; Scott Foresman & Co., and other textbook publishing houses.

Wentworth-Smith. *School Arithmetic* (Book Three, 1920). Ginn & Co., Boston, Mass.

Hart. *Junior High School Mathematics* (Books One and Two, 1920). D. C. Heath & Co., New York.

Campbell. *Workaday Arithmetic* (1924). The Century Co., New York.

Schorling-Clark. *Modern Mathematics.* Eighth School Year (1924). World Book Co., Yonkers, N. Y.

ALGEBRA

Schorling-Clark. *Modern Algebra.* Ninth School Year (1924). World Book Co., Yonkers, N. Y.

Wells and Hart. *Modern High School Algebra* (1923). D. C. Heath and Co., New York.

Smith and Reeve. *Essentials of Algebra* (Complete Course 1924). Ginn and Co., Boston, Mass.

Comstock and Sykes. *Beginners' Algebra* (1922). Rand McNally and Co., New York.

Rugg. *Scientific Method in the Reconstruction of Ninth Grade Mathematics.* University of Chicago Press, Chicago, Ill.

Ligda. *The Teaching of Elementary Algebra* (1925). Houghton Mifflin Co., Boston, Mass.

Barber. *Everyday Algebra for the Ninth School Year* (1924). Houghton Mifflin Co., Boston, Mass.

Tests

Rugg and Clark. *Rugg and Clarks' Standardized Practice Exercises in First Year Algebra.*

Hotz. *First Year Algebra Scales.*

PLANE AND SOLID GEOMETRY

Smith. *The Teaching* of Geometry (1911). Ginn and Co., New York.

Final Report of the National Committee of Fifteen on Geometry Syllabus. Proceedings National Education Association, 1912, and Mathematics Teacher, December, 1912.

Wells and Hart. *Solid Geometry* (1916). D. C. Heath and Co., New York.

Wells and Hart. *Modern Plane Geometry* (1926). D. C. Heath and Co., New York.

Smith. *Essentials of Plane and Solid Geometry* (1923). Ginn and Co., Boston, Mass.

Tests

Minnick. *Minnick's Geometry Test.*

Starch and Hemenway. *Starch and Hemenway's Geometry Test.*

TRIGONOMETRY

Baker. "Pedagogy in Trigonometry." *School Science and Mathematics,* Vol. 13 (1913), pages 118-120.

Jackson. A Simplification in Elementary Trigonometry. *Mathematics Teacher,* Vol. 3 (Sept., 1910), pages 21-23.

Mitchell. A Method of Demonstrating and Teaching the Trigonometric Functions. *School Science and Mathematics,* Vol. 17 (1917), pp. 245-247.

Brackenridge. Mathematics Teacher Use of the Slide Rule. *Mathematics Teacher,* Vol. 9 (Sept., 1916) pp. 1-2.

Counselman. Logarithms and Some of Their Applications for High School Pupils. *School Science and Mathematics,* Vol. 18 (Jan., 1918), pp. 21-24.

Ponzer. A Slide Rule for Classroom Use. *School Science and Mathematics,* Vol. 10 (1910), p. 776.

Wells. *Complete Trigonometry* (1911). D. C. Heath and Co., Boston, Mass.

As a result of this reorganization of secondary mathematics there is developing in this country a new mathematical instruction for the junior high school. This in turn made it necessary to change the senior high school textbooks. Junior high school mathematics thus has an important rôle in the process of linking together the elementary school and the senior high school, because the gap between the mathematical courses of these schools has been great. The pupil was usually taken right from the seventh grade arithmetic to the abstract idea of algebra. This gap can be successfully filled only if the pupils acquire in the seventh, eighth, and ninth grades certain correct mathematical ideas and habits, and an interest in the subject. This gives rise to junior high school mathematical textbooks containing a simple but interesting introduction to algebra, geometry, and trigonometry. Likewise many proposals for reorganization have been advanced and have been embodied in the new text and methods books. Then through the instrumentalities of psychologists and mathematicians, new secondary textbooks of mathematics have been made to differ from the old ones somewhat in organization of material, in point of view, and in the purpose and aim of the subject. That has been especially true of algebras.

In order to make these changes more nearly realized I shall contract Well's *Essentials of Algebra* published in the year 1897 and Smith and Reeve's *Essentials of Algebra* published in the year 1924 in regard to the above suggested changes. In the former algebra one finds that the author simply followed the arrangement of the arithmetics, putting in nothing more or nothing

less than was given in the arithmetics at that time. In studying the subject the pupils' minds are overloaded with abstract ideas that seem to have no real value attached. The pupil is faced with definitions and problems at the very outset. Then he turns a few pages and comes to positive and negative numbers, and next to the seven cases of factoring. The pupil meets problems, many of which are of the puzzle type, such as: A woman sells half an egg more than half her eggs; a tank can be filled by two pipes in three hours, etc. These problems are valuable and could be profitably solved had the pupils an abundance of spare time. Such problems can be understood, but are not real situations to the average citizen. In fact, eggs are never sold in such a manner.

In modern algebra textbooks the pupils are first introduced to the subject through simple formulae with applications that are real and tangible. Arithmetic and algebra are compared so as to show them the connecting link. Next, familiar graphs are studied, and after interest has been kindled, the positive and negative numbers are cautiously introduced. Among the special features that add to a greater usefulness of this modern algebra in the classroom may be mentioned the improvement in print by which the eye strain is greatly lessened; the introduction of carefully devised tests; the simple steps of approach to algebraic theory; and the motive for the pupils' progress established in connection with each new topic. This newer textbook provides for two special needs. Chapters one to five include the fundamental topics with which every well educated citizen should be familiar, and chapters six to eighteen present to the student phases of the science which are necessary for understanding more advanced work. And so the real aim of the best mathematicians now is to make algebra, as well as other secondary mathematics, seem more real to the pupils by eliminating non-essentials, and in meeting more successfully the needs of people in all walks of life. It

aims to prepare the pupils for college entrance as well as for community life.

One is also well aware of the fact that very few changes have been made in the organization and content of our geometries. However, the number of proved theorems has been reduced and the number of exercises has been increased.

To contrast the old and the new methods of teaching mathematics I shall give the following fable which Harry C. Barber, supervisor of mathematics in the public schools of Newton, Massachusetts, uses in his book —*Teaching Junior High School Mathematics:*

Hammers

Once three men undertook to teach three boys how to use a hammer. The first man was an old time teacher who used the definition method. After writing his definitions and descriptions of the hammer on the board, he called the boy, who set dilligently to work learning about the hammer.

The second man was a carpenter. He gave the boy a hammer and told him to go to work.

The third man was a friend of boys. He discovered that his pupil wanted to build a boat. A hammer was among the things needed. When all was ready they set to work, the pupil being allowed to do most of the work while his teacher acted as the guide, leading his pupil on to do the new tricks that had to be done to complete the job.

At the end of the lesson the examiner came. When the first boy was summoned, he repeated fluently all the definitions of hammers and the rules for using hammers, while his teacher smiled his approval. The examiner, pointing to a broken table, said, "Fix that." The boy looked at the table, shook his head, and replied, "I did not study that."

When the second boy came, the thumb and finger of his left hand were wrapped in bandages. In answer to the questions about

the hammer, he had little to say beyond pointing to a hammer and saying, "That is one." "Fix the table," said the examiner. The boy tried to do so, but his blows fell so awkwardly that the table was soon in worse condition than before.

The third boy came. The first question was, as before, "What is a hammer?" "A hammer is what you use to drive nails with, and you can pull nails with it, too. And you can set nails in places that are hard to reach." Before he was through telling all that could be done with hammers, the examiner smiled and said, "Fix the table." The boy did so with ease.

If we had just those teachers of mathematics who understand their pupils and provide for them as the latter teacher did in the fable, they would gain the real values from their mathematical study. Teachers must realize that "An ounce of practice is worth a ton of theory."

Why the methods of teaching secondary mathematics have changed and the real basis for their revision have been questions widely discussed. The importance of this movement was so realized that the National Committee on Mathematical Requirements under the auspices of the Mathematical Association of America was organized. As a result of this committee's study and experiments, there was published a report on "The Reorganization of Mathematics in Secondary Education." Following this movement, many proposals for reorganization have been advanced, some of which have been embodied in new textbooks as Smith and Reeve's *Essentials of Algebra* and Schorling-Clark's *Modern Mathematics for Eighth School Year*. The result of the unpreparedness of teachers to meet the current demands has been another big factor that has shown the need for a revision of the methods to be used in presenting mathematics to our high school and boys and girls. Even though our best modern textbooks give suggestions for effective lessons with the real purposes in mind, the real needs of pupils are teachers who can correctly interpret the different branches of mathematics. Pupils will be much more likely to want to master their lessons of mathematics if they have set before them good reasons why these special topics must be mastered at that time. William Asper, in his article[3] on *Mathematics and Efficiency in Secondary School Work*, illustrates this point when he tells how a teacher was coaching a boy in trigonometry, a subject that he thought was of no value to him. "The teacher learned that his student's ambition was to become an artillery officer. He gave him a few problems relating to military science and that changed his mind. Then he saw that trigonometry was indispensable to his future profession, and in spite of his poor ability in mathematics he spared no effort in struggling through his course."

College teachers have found that high school graduates are poorly prepared for college mathematics and the students have little or no increase of practical ability. Likewise the increase in enrolment in the secondary schools has partly been responsible for the unsatisfying status of mathematics. Furthermore, this is an age of science and now mathematics is the handmaiden of science. As a result of these changes mathematics comes to be a tool that is used to solve problems in all subjects.

However, the revision of the course of study in mathematics, according to Harry C. Barber, may have its basis in a study of the country's use of mathematics, or in a study of the child. Even though the algebra textbooks of twenty years ago are convenient for the teacher, a revision based upon this alone would surely be inadequate.

The problems of citizens of our country point to a more practical mathematics. The psychologists have reached the conclusion that we learn most readily the things we feel the need of knowing.

Both of these contribute to the new pro-

[3]*School Science and Mathematics.* Vol. 17. January-June.

gram, but the principal basis for the reform lies in the study of the pupil. The teacher, therefore, must regard the subject matter as ideas which he can use to get his pupils to think; to develop his mental power; and to help give him mastery over his life problems. This more human point of view gives the teacher more fun, some of which will be imparted to his pupils. Furthermore, the various topics are being arranged, and the spirit of the presentation of mathematics is made more real to both the teacher and pupils.

Today, teachers of mathematics, more than ever before, need to know when to use their mathematical tools and how to use them at the right time. Even though some of our teachers of mathematics have an understanding of mathematics, and can make it real for their pupils, there comes a challenge to the rest to secure and to make useful these modern mathematical facts and methods that exist about us; these that will keep one informed about modern methods of teaching secondary mathematics.

ANNIE K. MOOMAW

WHAT IS THE MATTER WITH TEACHING?

LAST fall the *Delineator* offered prizes to the amount of $2,000 for the best articles on "What Is the Matter With the Teaching Profession and How May Its Evils Be Cured?" The prizes offered to teachers were $500, $300, and $200; to other persons who are interested in education prizes of the same amount were given. The following persons were appointed as judges: Dr. David Starr Jordan, president-emeritus of Leland Stanford University; Ada Comstock, president of Radcliffe College; Livingston Farrand, president of Cornell University; Superintendent William McAndrew, Chicago; Katherine Lee Bates, professor of English literature, Wellesley College, and author of "America the Beautiful"; Angelo Patri, principal of a public

school, New York City; Mrs. A. H. Reeve, president of the National Congress of Parents and Teachers; Mary McSkimmon, president of the National Education Association; Dr. John J. Tigert, U. S. Commissioner of Education; Edwin Lee Hulett, dean of St. Lawrence University; Mrs. William Brown Meloney, editor of the *Delineator*. Dr. John Dewey prepared an article which served as an introduction to the contest. His article on "What Is the Matter With Teaching?" was published last October in the *American Educational Digest* concurrently with its publication in the *Delineator*. The article was noteworthy and attracted wide attention. Thousands of letters were received by the *Delineator*, in which Mr. Dewey's statements were attacked and defended. Announcement is now made that the judges of this contest have prepared a report which shows that 3,283 answers in the form of articles were submitted. These articles were analyzed by the judges, and interesting tabulations were given out by Mrs. Meloney, the editor of the *Delineator*, who says that "these opinions, given by teachers, parents, and others interested in the development of education in America, constitute one of the most complete and valuable critical summaries yet applied on this important subject." The tabulations in part follow:

STATISTICAL SUMMARY

ANSWERS FROM TEACHERS AS TO WHY TEACHERS LEAVE THE PROFESSION

The System—
"Mass" teaching bad; no individuality possible 391
Too large and too mixed classes.......... 221
Too much supervision................... 166
Too many subjects taught by one teacher.. 53
Too much bookkeeping, too many drives, etc. 372

Total 1,203

Attitude of Community—
Loneliness 318
Living conditions 209
No place to entertain men............... 30
Inferior social position................. 241
Personal criticism and lack of freedom in private life 175
Less chance to marry................... 52