The Pedagogical Seminary

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/vzps20>

Instruction in Mathematics for Gifted Pupils

Elizabeth Frayer Burnell

Published online: 30 Aug 2012.

To cite this article: Elizabeth Frayer Burnell (1917) Instruction in Mathematics for Gifted Pupils, The Pedagogical Seminary, 24:4, 569-583, DOI: [10.1080/08919402.1917.10534759](https://doi.org/10.1080/08919402.1917.10534759)

To link to this article: <http://dx.doi.org/10.1080/08919402.1917.10534759>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

INSTRUCTION IN MATHEMATICS FOR GIFTED PUPILS¹

ELIZABETH FRAYER BURNELL

Before outlining a course in mathematics for gifted pupils, an investigation was made of the provision of our public school system for students of unusual mental ability. A surprising dearth of literature on the subject was revealed. Periodical articles and Board of Education reports discussing this subject are so obscurely indexed as to be almost inaccessible. One of the most comprehensive discussions of the problem of the gifted child appears in a superintendent's report,⁽¹⁾ indexed as "Special classes for backward and feeble-minded children." Detroit avoids the misinterpretation of the term "super-normal" and reports "special advanced classes." In the report of the McKinley Preparatory School, Lincoln, Nebraska, there is no obvious heading to indicate that it was organized for pupils of superior mental and physical qualifications. Superintendent Condon of Cincinnati has recently announced a "Special Academic Class" to be organized September, 1917, "for pupils of unusual mental ability and sound health." Even a superficial visit in the Detroit schools revealed classes organized for the acceleration of small groups of pupils in the elementary grades of which there was no report available in the superintendent's office. The following investigations indicate the development of this educational problem during the last six years.

1911. Provision for exceptional children in the Public Schools. (Van Sickle, Witmer and Ayres. U. S. Bureau of Education Bulletin No. 14.) Only five cities are reported as known to have classes for exceptionally gifted children: Baltimore, Indianapolis, Lincoln, Rochester and Worcester.

1912. School organization and the individual child. (W. H. Holmes.) An exposition of plans that have been evolved to adapt school organization to the needs of individual children, normal, super-normal, and sub-normal. "Promotion classes for gifted pupils," p. 138. Discussion of the acceleration of gifted pupils in Baltimore and a list of cities which made similar provision on the order of the "six-six" plan.

¹This investigation was carried out under the direction of Professor Charles Scott Berry, at the University of Michigan, in 1917.

1912. A year's work in a "superior" class. (Flora Unrich, *Psychological Clinic*, January.) Report of a class in the eleventh school district, Cincinnati, Ohio, consisting of thirty-two pupils of whom seventeen were prepared for the fifth grade, nine for the fourth grade, and the remaining six moved away or were returned to their respective rooms. There was a gain of one year for twenty-five pupils who did two year's work in one.

1912. Some studies on "abnormally intelligent" pupils. (Yasusaburo Sakaki. *Psychological Clinic*, March.) Report of the examination of all the children in the larger normal school at Fukawka in Japan which found 79 out of 332 to show advanced degree of intelligence. These children were classified according to definite types into seven groups and it was found "that only one class of abnormally intelligent children was perfectly free from any pathological taint and that these were the only children who possessed stability of nerve power and who exhibited a uniformly progressive mental and physical development . . . the others being children of the 'nervous type,' precocious children, children mentally advanced but deficient in physique, etc. . . . Our experiments and their results serve to convince us that there is urgent need for reform in the present system of class making."

1912. Seven years with unusually gifted pupils. (Frederick E. Downes, Harrisburg, Pa. *Psychological Clinic*, March.) Before revision of the course of study it was found possible for gifted pupils to complete the second and the sixth grades in less time; 350 skipped in one year. In 1910-11 two schools were established exclusively for bright children and in 1911-12 there were three such schools in which the children completed the eighth and ninth grades in one year.

1913. Special classes for bright children in an English elementary school. (I. Shaer. *Journal of Educational Psychology*, April.) A diagrammatic representation of various types of promotion is given.

1913. The physical status of the special class for bright children at the University of Pennsylvania Summer Session, 1912. (*Psychological Clinic*, March.) "The conclusions to be drawn from the experience of the summer school are that when due attention is given to such matters as diet, rest, exercise, home surroundings and physical conditions, the life of the school may foster physical improvement and well being as it has been made to serve the purpose of intellectual progress."

1914. A study of exceptional children in New Orleans. (*Psychological Clinic*, p. 232, Jan.). A preliminary census was organized in 1912 to determine where and how many children of five exceptional types were to be found. Special classes recommended for gifted children.

1914-15. Special classes in Michigan for mentally exceptional children (C. S. Berry, Report of Supt. of Public Instruction, pp. 57-75). Discussion of the arguments for and against the formation of special classes for gifted pupils.

1916. Announcement of the appropriation by the General Education Board for the use of Professor Guy M. Whipple, of the University of Illinois in the study of gifted children. Professor Whipple will endeavor to find out how early in their school life gifted children can be distinguished and how much school time and energy they can economize as well as how much additional training and mental equipment they can obtain through their school years. (Note. *Elementary School Journal*, September.)

1917. Announcement of an appropriation by the General Education Board to provide Teachers College of Columbia with funds necessary to establish and conduct a school for the purpose of constructive work in the reorganization of elementary education. "The subject of mathematics will receive special consideration in the hope of working out a rational course of study which connects the study of mathematics with its use, and which also makes adequate provision for those who have special ability or desire for this subject." It is expected that the school will open with part of its classes in the fall of 1917. Both boys and girls from six years of age and up will be admitted. (*Elementary School Journal*, February.)

1917. Report of the experiment undertaken jointly by Teachers College and the New York City Board of Education at Speyer School. Beginning with 1915-16 there were admitted to the school 200 seventh grade boys who indicated, with the approval of their parents, their intention of taking the Latin course in high school. These boys were divided into classes of 25 each on the basis of extended mental and educational tests, supplemented by the subsequent judgments of their teachers. The aim was to secure as nearly homogeneous groups as possible and to adjust the work of the class to the capacities of the pupils. . . . The brighter groups will undoubtedly be able to do three years' work in two, while the duller ones will have gained a better mastery of the material than if they had been swallowed up in the ordinary mixed class. This attempt to employ mental tests in securing homo-

geneous groups is a significant step in educational procedure. (*Journal of Educational Psychology*, March.)

1917. The Arlington Plan of grouping pupils according to ability in the Arlington High School. (Frederick E. Clark. *School Review*, Jan.). Discussion on the basis of six years' successful operation in Arlington, Mass.

1917. The Supervisor's use of standard tests of efficiency. (J. Coyce Morrison. *Elementary School Journal*, Jan.). "*The bright pupils need if anything more attention than the slower children.* On the basis of these tests during the year several pupils have been permitted to skip a grade. . . . There are 18 others who are receiving special attention from teachers in order that they may be able to do three years' work in two years. . . . Arrangements have been made whereby one teacher can give at least one third of her time next year to the coaching of accelerate and backward children. She will take *special training* during the summer for the work and will co-operate with the regular teachers in caring for these special pupils. The *majority of her time* will be given to the *brighter pupils.*"

In order to determine the present situation in regard to school provision for bright children the following questionnaire was sent out in April to the Superintendents of Schools in the cities indicated.

1. What provision are you making in your school for exceptionally bright children?
2. How many special teachers of Arithmetic have you in the elementary grades?
3. Have you a supervisor of Arithmetic?

The replies to question 1 were as follows:

Atlanta, Ga.—"Semi-annual promotions and opportunity to advance as rapidly as possible."

Baltimore, Md.—"Promotion at any time. In many cases children complete the eight year course in seven years."

Boston, Mass.—"Rapid advancement classes." Started in 1913.

Chicago, Ill.—"No provision."

Cincinnati, Ohio—"Special academic class" announced for Sept., 1917. "No other provision."

Cleveland, Ohio—"Advancing by division and by individual promotions as rapidly as possible."

Detroit, Mich.—"Special advanced class. The aim is not to hurry the children through school by covering ground more rapidly but to give fuller, richer courses." Started Sept., 1915.

Harrisburg, Pa.—"Special schools for these pupils for sev-

eral years when we had a nine-year elementary course. Since we have had an eight-year course we have not maintained separate rooms and teachers for these pupils. Now we use the fast and slow section method."

Indianapolis, Ind.—"In the lower grades we try to group children according to their capacity and allow them to progress as fast as they can do the work satisfactorily. In the upper grades we frequently select classes of unusually bright children and permit them to do two years' work in one and one-half years or thereabouts. Since our grades are but one-half year apart in their work we frequently permit individual pupils or groups of individual pupils to do the work of two grades simultaneously when this arrangement can be made."

Kansas City, Mo.—"Seven year elementary school organization makes it possible for the exceptionally bright children to save a year's time."

Lincoln, Neb.—"McKinley Preparatory School established in 1909, provides for exceptionally capable children."

Los Angeles, Cal.—"They are always given opportunity to work ahead in the next grade and are encouraged to do so. We also have *ungraded classes* in which bright pupils may work ahead."

Nashville, Tenn.—"Principals may promote children at irregular times if they believe them capable of doing advanced work."

New Orleans, La.—"No special classes. Special promotions on recommendation of teacher and principal."

New York City—"No special provision except to allow principals to organize classes for rapid advancement. Each principal is at liberty to have a teacher take her class over three terms' work in two terms."

Oakland, Cal.—"We have formed a few classes in the upper grades where we try to secure more than the normal rate of promotion."

Philadelphia, Pa.—"No special provision except that children may be promoted at any time during the year. Last year there were 6,545 incidental promotions of this kind during the two terms."

Rochester, N. Y.—"We have a number of classes for the exceptionally bright children in various schools and in one of our high schools."

St. Louis, Mo.—"No special classes but opportunity for rapid advancement through frequent individual promotions and by means of quarterly promotion scheme."

San Francisco, Cal.—"We let them cover two grades in a year if their progress and ability justifies this."

Seattle, Wash.—"We have auxiliary teachers in a number of the buildings who assist pupils capable of making up a semester's work. In all schools exceptionally bright pupils receive additional help in order that they may advance as rapidly as they are able."

Washington, D. C.—"Exceptionally good pupils from the seventh grade whose parents are willing for them to do extra work, and whose teachers recommend the trial are given the opportunity to make the eighth grade in half a year. The most of these are able to do so without difficulty." Special class organized in 1912.

Worcester, Mass.—"At the end of the sixth grade work we offer Latin and French or German to brighter pupils in addition to their regular work. Less attention is given to technical English grammar."

Of the twenty-three school systems, thirteen cities specifically indicate special class organization. Chicago is the only city to report no provision. Detroit alone emphasizes the general development of the gifted child rather than acceleration of his school work. The provision made by the remaining twenty-one cities for bright children may be summarized by the following six types in all of which economy of time is an important if not the primary object.

1. Special ungraded classes. (Los Angeles.)
2. Auxiliary teachers. (Seattle.)
3. Introduction of additional work into the elementary grades. (Worcester.)
4. Rapid advancement classes. (Boston, Cincinnati, Indianapolis, Lincoln, New York City, Oakland, Rochester, Washington, D. C.)
5. Fast and slow divisions. (Cleveland, Harrisburg.)
6. Irregular promotions. (Atlanta, Baltimore, Kansas City, Nashville, New Orleans, Philadelphia, St. Louis, San Francisco.)

Public sentiment in favor of making any provision for exceptionally bright children has been slow in developing. In April, 1915, the Michigan Superintendent of Public Instruction sent out a questionnaire to the school superintendents of all cities and towns of Michigan of 1,000 inhabitants and over, and included the following question:

"Do you believe in the formation of special classes for exceptionally bright children? Give reasons for your answer."

Dr. Berry has made a detailed summary of the replies with arguments for and against such grouping(1). Of the 217 replies only 58% advocated organizing such classes, 23% were

opposed and the remaining 19% were undecided or failed to answer.

In April, 1917, thirty-five teachers representing grades from the first through the eighth, and twenty-one teachers of high school mathematics replied to a questionnaire relating to the grouping of pupils according to ability. Of these fifty-six teachers, fifty expressed the opinion that grouping would be to the advantage of pupils of superior ability and six were opposed to such grouping. Thirty-two teachers thought that pupils of less ability would benefit by such groupings, twenty-two believed that it would not be beneficial, while two were doubtful. The replies from these fifty-six teachers indicate considerable scepticism in regard to the benefits derived by poor sections as a result of grouping and much experimental evidence is needed to confirm that of schools which have already found grouping successful. The report of the Speyer School, New York City, (*Jour. of Ed. Psy.*, 1917, p. 182), is significant in showing that the duller groups as well as the superior pupils gained as a result of this grouping. In the Arlington plan of grouping pupils(4) in slow, average and bright sections it was found that the slow and bright sections benefited while the average sections probably neither gained nor lost. In 1912 the Ann Arbor High School experimented with a class of 'failures, but did not regard the grouping as a success and similar experiments have not been tried since. In the High School of Cass City, Michigan, at the end of the first semester, this year, a class was made up of failures in plane geometry and the grouping was found to be beneficial. Grouping according to ability has been reported in Menominee, Michigan, and in Ithaca, New York. While interest is being shown by teachers in the elementary and secondary schools in the question of grouping, University professors are less ready to recognize the existence of a similar problem relating to freshmen students.

With the whole question of grouping still in the experimental stage it is not surprising to find that little has been done in determining the most advantageous grade for the introduction of grouping. As far as reports at hand indicate classes are not now being organized for children of superior ability earlier than the seventh grade. The McKinley Preparatory School, Lincoln, is made up of pupils from every Sixth A and Seventh B grade in the city. The "advanced classes" in Thirkell School, Detroit, are doing seventh and eighth grade work. The question of the organization of such classes earlier in the elementary grades seems not to have been considered in Detroit. The two teachers of these special

classes at Thirkell School do not advocate such grouping earlier than the sixth grade even though it might be possible to surmount the difficulties which are obviously very great in a city the size of Detroit. It is significant, however, that of 35 teachers representing all the grades from the first through the eighth, three who thought grouping according to ability would not be to the advantage of superior pupils were seventh and eighth grade teachers. With the growing emphasis on the early education of the child, it would seem logical to introduce grouping much earlier than has yet been done.

Closely involved with the problem of the grouping of bright children is that of the size of the group. The replies of fifty-seven teachers to the following question indicate the wide divergence of opinion and the necessity for experimentation:

"How small a class of exceptionally bright pupils would you consider ideal for accomplishing the most for the individual?"

- 1 advocated class 6-10.
- 20 advocated class 10-15.
- 30 advocated class 15-20.
- 5 advocated class 25-30.
- 1 advocated class 35.

The classes in Thirkell School, Detroit, and in McKinley Preparatory School, Lincoln, are each twenty-two in number. The special class in Washington, D. C., has forty pupils.

While the question of grouping according to ability, the size of the group, and the age for introduction of grouping are problems of prime importance from an administrative standpoint, perhaps none is so fundamental for the development of the gifted child as the problem of the content of the course itself. The conservative fear any attempt to crowd a precocious child in his school work. The reformers are urging the necessity for greater economy of time.

It is significant that of the twenty-three school systems listed in answer to the first questionnaire, Detroit is the only one in which emphasis is placed on "providing more material and covering it more rapidly," as quoted from the report(5) of Miss Elizabeth Cleveland, director of the "special advanced class." If it is desirable that these special advanced classes be organized chiefly with a view to saving time, then the course in mathematics will obviously not differ in amount from that ordinarily given. If, however, the grouping of bright children is introduced in the first elementary grade, there will be involved a correspondingly greater conservation of enthusiasm, interest and energy as well as of time and it

should be possible to enrich the course in many directions. Under such circumstances it would be possible to modify the instruction in mathematics more effectively than even the most ambitious reform is now attempting for non-homogeneous groups.

One of the problems which the precocious child has to meet is that of being associated with older and more mature children with whom he is not altogether companionable. Anyone who has followed the careers of the precocious children who have been much discussed in the papers (6) must feel dubious about the scheme of education of which they are demonstrating the results. By grouping children of exceptional ability during their secondary school education this problem will obviously be merely postponed until they complete their high school course. Parents will then need to provide a solution for the next step in the education of the child whose acceleration has prepared him for the University much younger than the average. The opportunities for the symmetrical and harmonious all-round development of the child, which Miss Cleveland hopes to provide in the "advanced classes" at Thirkell School, and which the Phebe Thorne Model School, Bryn Mawr, Pennsylvania, offers for the normal child are a happy solution of this particular problem. On the other hand, economy of time is urged by Dr. Flexner in "A Modern School." (8) He says: "Not only do American children as a class fail to gain either knowledge or power through the traditional curriculum—they spend an inordinately long time in failing. The period spent in school and college before students begin professional studies is longer in the United States than in any other western country. An economy of two or three years is urgently necessary." At the same time professional schools are becoming more and more highly specialized and there are those in Engineering Schools, for example, who recommend entrance at nineteen, giving a boy opportunity to do practical work after graduation from high school in order to determine his interests and qualifications.

The courses of instruction as announced for special classes of bright children do not indicate any readjustment in Mathematics. Superintendent Condon announces the following curriculum for the "Special Academic Class" to be organized in the Lafayette Bloom Junior High School, Cincinnati in September, 1917:

<i>Subject</i>	<i>Hours</i>
Physical Training and Hygiene	5
Latin or First-year German	5
General Science	5

578 INSTRUCTION IN MATHEMATICS FOR GIFTED PUPILS

Mathematics	5
English	5
Music	$\frac{1}{2}$
Penmanship	$\frac{1}{2}$
Drawing	2
Household arts (girls)	
Industrial arts (boys)	2
Total	30

In the McKinley Preparatory School, Lincoln, the course of study is the same as in the regular seventh and eighth grades except that music and art are omitted and the addition of one year of high school work is done during the two years in preparatory. In the special class for bright pupils, Washington, D. C., the instruction in mathematics "does not vary at all from that given in ordinary class work." In the Thirkell School, Detroit, the "advanced class" does the regular seventh and eighth grade arithmetic and in addition one semester's work in Algebra with a good start on the next, in two years.

The growing dissatisfaction with the present curriculum in mathematics and the widening movement for reorganization of subject matter and psychologizing the presentation are factors that should result in special application to the interests and needs of the child of exceptional mathematical ability. Since 1903 the University High School, Chicago, has been developing a solution of the problem of reorganization of mathematics along lines of correlation. The course of study is outlined in detail by E. R. Breslich and others in *School Review* (Nov., 1916). "In three years the student has accomplished the work usually given in three and one-half years, due mainly to the correlation of the various subjects of mathematics, to the reorganization of material usually taught during the first three years, and to the training obtained through supervised study." The pupil, gifted in mathematics, seems well provided for in this high school course which, in the third year, lays the emphasis mainly on algebra and trigonometry and in the fourth year offers a semester of college algebra supplemented by reading and reports. It is significant that the outside preparation expected of the students is an average of fifteen minutes a day, the first year, thirty minutes for the second year, and thirty-five minutes a day for the third and fourth years. An average of fifteen minutes of the one hour class period is devoted to supervised study. The courses are uniformly five class periods a week.

The following extracts from periodicals indicate along what line pioneers in teaching classes of gifted children may revise

the instruction in mathematics and yet be in harmony with educational movements:

"It is evident from this report that the impression is entertained in many quarters that the arithmetic as now taught in the seventh and eighth grades is not satisfactory. Clearly implied also is the position that the introduction of higher mathematics will encounter some difficulty and that the subject matter of algebra and geometry must be largely reorganized before it can be used in the lower schools. . . . It may be predicted with great assurance that in the long run geometry will be found to be a very practical and stimulating subject for students of the Junior High School age. Such a modification of the mathematics course as would follow the introduction of geometry in this intermediate school would serve large intellectual and social purposes."(7)

"Elementary school courses are ejecting extraneous material thus placing emphasis on minimum fundamental essentials of Arithmetic. Assuming that the primary grades by means of informal games and other familiar devices inculcate fundamental number combinations, the fundamental essentials of Arithmetic may be thoroughly taught in four or at most five years. The facts submitted by certain schools no longer permit us to regard this as an experiment."(15)

"For the present we should devote our best efforts to the organization of a course—very flexible and very alluring—in general science for youths from twelve to fifteen years of age. One hopes that a similar course in mathematics could be worked out but with the traditions of that subject crystallized as they now are, the situation seems hopeless. Certainly from the point of view of any sound theory of liberal education the thing is possible and most highly desirable."(18)

"To a very considerable degree general mathematics will be found to facilitate the educational movement to provide for individual differences in ability and rate of progress. . . . An important movement is epitomized by the advent of the junior high school which is going to force the adoption of general or union mathematics. . . . General mathematics is in harmony with the attempt to organize a course of instruction which shall be properly graduated and progressive from year to year with close regard to maturing abilities of pupils."(13)

Twenty-two university and high school instructors in mathematics answered the following question in April, 1917:

Given a class of exceptionally bright students, and with no consideration for the practical difficulties involved, would you cover the ground in less time or enrich the course? The work

might be arranged by terms for sections of superior ability and by semesters for classes of less ability.

Course	No. who advocate completing in less time	No. who advocate enriching the the course
Elementary algebra..... $1\frac{1}{2}$ units.....	7	15
Plane geometry.....1 unit.....	10	12
Solid geometry..... $\frac{1}{2}$ unit.....	10	12
Trigonometry..... $\frac{1}{2}$ unit.....	8	12
Plane analytic geometry...3 semester hrs.	4	14

It will be seen that there is no uniformity of opinion to guide the reformer who is revising courses in mathematics for bright pupils. One university professor believes that the college entrance requirement is sufficient preparation for more advanced work and therefore there is no need to enrich the courses if they are thoroughly mastered. Another professor believes that bright pupils would profit by the addition of a large number of problems and exercises and therefore he does not advocate completing the course in less time. Both professors have sons who are gifted in mathematics and are completing their secondary education at an age younger than the average.

With the revision of subject matter must come also training of teachers, especially of those engaged in secondary mathematics, which has been called the most serious mathematical problem in America to-day.(11) In the mathematical survey of the Chicago school system in the spring of 1914 the committee reported more favorably on the teaching of arithmetic in the elementary schools, than on the teaching of mathematics in the high schools.(19) The preparation of mathematics teachers of various grades was to have been the main topic of discussion at the conference of the "International Committee on the Teaching of Mathematics" to have been held in Munich, Germany, August, 1915. Dr. Flexner points out clearly the present failure in Mathematical instruction:

"In examinations held by the College Entrance Board in 1915, 69.7% of those examined in algebra from quadratics on failed to make as much as 60%; 42.4% failed to make 60% in plane geometry. What would the record be if all who studied these subjects were thus examined by an impartial outside body? . . . It is therefore useless to inquire whether a knowledge of Mathematics is valuable, because pupils do not get it; and it is equally beside the mark to ask whether the effort to obtain this knowledge is a valuable discipline, since failure is so widespread that the only

habits acquired through failing to learn Latin or algebra are habits of slipshod work, of guessing and of mechanical applications of formulas, not themselves understood.(8) Mr. E. R. Breslick also recognizes the present need of reform. "The failures in mathematics as recorded show a very much higher percentage than in most of the other subjects of the curriculum. . . . We must admit on the basis of scientific studies that it is extraordinarily difficult, even for good teachers, to keep mathematics in the high school at the same level of success as the other subjects that are taught."(3)

While it is generally recognized that there must be specially trained teachers for classes of backward and delinquent children, yet the exceptionally bright child has received only incidental and usually very haphazard attention. The organization of mathematics clubs such as those in Marion, Ohio(9) and in Hyde Park High School, Chicago,(17) offers one solution of the problem "What shall we do for the bright students?" The University High School, Chicago, has endeavored to make provision for students gifted in mathematics by its organization of mathematics contests,(16) its generous mathematical equipment, (20) and by proper library direction of supplementary reading. These various devices may constitute a part of the larger technique that needs to be developed to direct in the most efficient way the enthusiasm and the energy of the fast worker in mathematics.

Only seven of the twenty-three cities listed in answer to the first questionnaire report special teachers of Arithmetic in connection with departmental work, Cincinnati having 25 and New Orleans 60. The only supervisor of arithmetic is reported by East Cleveland, Ohio, where Superintendent Kirk finds a supervisor necessary in order to train teachers in the Speer method of teaching Arithmetic. The reorganization of subject matter with the introduction of new methods and text-books(10) urges the necessity for a more universal introduction of departmental work with teachers specially trained in mathematics. The need of a supervisor is more apparent during our present experimental stage of mathematical reform than it has been in the past. While the grouping of students in slow, average, and bright sections promises to meet some of the difficulties which confront mathematical instructors, other problems are introduced for which the co-operation with a supervisor would be invaluable.

Much experimental work is being done in establishing standards in arithmetic and incidentally the bright child is profiting by this growing emphasis on the individual training which the use of all standard tests accomplishes.(12). Tests in stand-

ardization are also being applied to the teaching of algebra and a definitely worked out experimental plan has been published by H. O. Rugg of the School of Education of Chicago.(14) Standards designed for non-homogeneous groups of children will require revision to be most effective when applied to slow, average and bright sections.

One of the most important phases of experimental work is that of standardizing tests for the measurement of general intelligence. The teachers of the "advanced class" in Thirkell School, Detroit, regard the selection of the children as one of their most difficult problems and one in which they have not been altogether successful. Mr. S. T. Courtis is revising tests for the selection of these pupils of superior ability.

In conclusion it is seen that a course in mathematics for students of superior ability must be harmonized with present educational reforms. It must be built up as part of a carefully constructed scheme which is yet to be evolved with the scientific help of the experimental educator. Before courses can be planned satisfactorily for the gifted child in mathematics or in any other subject, the following problems must be solved:

1. Revision of tests for measuring general intelligence.
2. Determination of the time required for the elementary and secondary education of the gifted child, involving either an enrichment or acceleration of the present school course.(2)
3. Determination of the earliest grade in which the gifted child will profit by grouping.
4. Size of class most advantageous for the individual child.
5. Amount of drill necessary for superior students.
6. Standards for superior students.
7. New texts in the elementary and secondary schools.
8. Teachers trained in new technique.

BIBLIOGRAPHY

1. BERRY, C. S. Report of the Superintendent of Public Instruction of Michigan. 1914-15, pp. 57-75.
2. BERRY, C. S. A Study of the Retardation, Acceleration, Elimination and Repetition in the Public Elementary Schools of 225 Town and Cities of Michigan.
3. BRESLICH, E. R. Forward Movements in Secondary Education. *Sch. Rev.* 1916, Apr.
4. CLERK, F. E. The Arlington Plan of Grouping Pupils. *Sch. Rev.* 1917, Jan.
5. CLEVELAND, E. Report of Director of the Special Advanced Class. Education in Detroit. 1916, p. 94.
6. DOLBEAR, K. E. Precocious Children. *Ped. Sem.*, 1912, Dec.

7. EVANS, G. W. Mathematics for the Junior High School. *Math. Teach.*, 1916, Dec.
8. FLEXNER, A. A Modern School. 1916. Pub. by the General Education Board.
9. GEGENHEIMER, F. C. The Mathematics Club in Marion, Ohio. *Sch. Sci. and Math.*, 1916, Dec.
10. KARPINSKI, L. C. Teaching of Elementary Mathematics. *Sch. and Soc.*, 1917, Jan. 20.
COBB, H. E. Current Educational Movements and General Mathematics. *Sch., Sci. and Math.*, 1916, May.
11. MILLER, G. A. The Teaching of Mathematics Teachers. *Sch., Sci. and Math.*, 1915, Jan.
12. MORRISON, J. C. Supervisor's Use of Standard Tests of Efficiency. *Elem. Sch. Jour.*, 1917, Jan.
13. MYERS, G. W. Educational Movements and General Mathematics. *Sch., Sci. and Math.*, 1916, Feb.
14. RUGG AND CLARK. Standardized Tests and the Improvement of Teaching in First Year Algebra. *Sch. Rev.*, 1917, Feb., Mar.
15. SCHORLING, R. The Place of Mathematics in the Secondary Schools of To-morrow. *Sch., Sci. and Math.*, 1916, Oct.
16. SCHORLING, R. A Mathematics Contest. Its Relation to the General Problem of Individual Differences. *Sch., Sci. and Math.*, 1915, Dec.
17. SHOESMITH, B. I. Mathematics Clubs in Secondary Schools. *Sch., Sci. and Math.*, 1916, Feb.
18. SNEDDEN, D. The High School of To-morrow. *Sch. Rev.*, 1917, Jan.
19. SYKES, M. The Mathematical Survey of the Chicago School System. *Sch., Sci. and Math.*, 1915, Feb.
20. WRIGHT, H. C. Mathematics Equipment and its Uses. *Sch., Sci. and Math.*, 1915, June.