

Mathematics for Gifted Children

An experimental program.

Elinor B. Flagg

THE experimental work described in this paper began in a small way. It started during the school year 1955-56 when several parents and some teachers expressed a desire for offering gifted children work which would present an intellectual challenge beyond that of the regular classroom.

The small beginning consisted of seven children and three instructors. The children were fifth and sixth graders from the elementary school on the campus of Illinois State Normal University; each of the instructors was a specialist in his own field. Three subject matter areas were represented: social studies, science, and mathematics. Reason for selection of these areas was none other than willingness and availability on the part of the instructors.

Each instructor met the group for two 50-minute periods each week, with fifth and sixth grade children meeting together as one class. The children missed work in their homerooms to attend meetings of the special classes, but they were required to keep up with assignments and activities of their regular rooms.

Selection of Participants

Selection for the special group was proposed first by classroom teachers. Their judgment was supported by the results of tests, by achievement records, and by consideration of attitudes and the personal development of the child. Next, each child was given an individual Stanford-Binet test by the University Testing Service. Cutting score was set at 133. Final judgment was made by classroom teachers, coordinators for Special Education, principals, and instructors of the special classes. Parent approval was required, and also a desire on the child's part to participate in the program.

Children were permitted to withdraw from the program; a few have done so. Some withdrawals were for health reasons, and some because other activities seemed more important. One pupil who withdrew later reentered the program. Also, there have been a few mid-year additions; these have come from children newly enrolled in the campus school, and from results of retesting a borderline case.

The original plan had been to use only fifth and sixth grade children. Acting on this premise, sixth graders were dropped at the opening of the next school year. Fifth graders continued as sixth graders, and a new fifth grade group was added; total now was 15. Standards for selection of the new group were the same as those described for the original group; the two grades continued to meet as one class for the special program.

Encouraged by acceptance of the program by classroom teachers and by parents, a decision was made during the

Elinor B. Flagg is Assistant Professor of Mathematics, Illinois State Normal University, Normal, Illinois.

second year to continue the special classes through the eighth grade. It was also decided that after this year, new children would be added to the program only when they became seventh graders. Teaching staff was not available for having special classes for grades five through eight.

Throughout the next two years this same group continued, the children advancing in grade level each year. Six weekly meetings continued at times that took children away from their regular classrooms.

Acceleration Not Planned

In the fall of 1958, special classes began having five of their six meetings at eight o'clock in the morning, before their regular classes convened. There had been some frustration over missing six periods of classroom activity, especially if that "miss" included a swimming period. The eight o'clock proposal was discussed with parents and teachers, and it seemed to be worth trying. For one class each week, the children continued to miss one period from their homerooms.

One year later, children who were eighth graders at that time, began meeting as a separate group. A new class from the seventh grade was added to the program; this class, too, met as a separate group. This change was made because experience indicated that it might produce better results in all three areas. This plan is still in effect. Released time from other duties made teaching staff available for the double shift of special classes.

No limit has ever been placed on size of the special group. The first group included seven children; other groups have included varying numbers up to 15, with an average of about 10.

In the beginning, there was no thought of acceleration for children who entered special classes. It had been planned only to give these children opportunity for intellectual development beyond that usually possible in regular classrooms. The three instructors selected teaching material which did not infringe on the subject matter of the graded classroom.

However, as each group approached the end of the eighth grade, it became evident that the pupils' accomplishment in mathematics was such that they might possibly qualify for exemption from some of the mathematics usually included in the first high school mathematics course. (The science instructor came to a similar conclusion concerning the children's learnings in science.)

At this point, the mathematics department of the University High School was asked to assist in making judgments. They administered standard algebra tests to each group near the end of the eighth grade year. Although most of the children ranked high on these tests, almost all of them have taken the second semester of algebra in the University High School during the summer session following completion of the eighth grade. In the fall, they have enrolled in geometry in the same school. Their record, to date, has been one of outstanding scholarship.

There were some misgivings, on the part of parents, children and teachers, concerning having these children enter a sophomore-level course while they themselves were still freshmen. Perhaps a few sophomores resented having freshmen take "their" course. Whatever these feelings were, they did not become a major issue.

The general objective set up for selection of subject matter in all three areas was that it would offer a challenge. To

implement this general objective, the following special objectives were set up for mathematics classes: (a) to increase interest in mathematics and in the understanding of our number system; (b) to develop appreciation of various numeration systems, of present-day algorithms as compared with those of the past, and of historical development.

Perhaps, to a degree, these objectives might be used for a regular classroom. Accomplishments of gifted children, however, can go beyond those of average children. For example, many average children, upon being taught that counting numbers can be used as exponents, are satisfied to learn the definition of *exponent*, and to get answers to problems. Gifted children are likely to inquire whether fractions, and negative numbers, can also be used as exponents. In general, gifted children can be led to extend their mathematical horizons beyond those ordinarily reached through use of graded text material.

Topics Used in Mathematics

Content was selected in keeping with objectives listed above, and also in such a way that there would be no duplication of regular classroom work. From the list given below, selections were made for various groups at various times according to abilities of the children involved. (Yes, there *are* differences in ability even within a selected gifted group.) The order presented here does not necessarily imply teaching sequence.

Content has included selections from the following topics: (a) historical topics; algorithms formerly used, development of our numerals, other numeration systems; (b) exponents; meaning, use in analyzing place value and in scientific notation; (c) bases other than the ten;

analysis of place value, operations; (d) sets and sentences; equalities and inequalities; (e) number systems; natural numbers, integers (positive and negative), rational numbers; laws governing operations; (f) number line representations and graphing; (g) prime numbers and factors; (h) tests for divisibility and why they "work."

Choice of topics is continually being modified as the impact of "modern" mathematics is being felt in the regular classroom. The first groups coming into the special program had not been "exposed" to any of the above topics; today, children entering the special classes are likely to have some knowledge of bases other than ten, some background in exponents, and some work with sets, sentences, equalities, and inequalities. If work in the special classes was to continue to be challenging, obviously, some revision of content had to be made. The trend at the moment is in the direction of analytical study of number systems; the natural number system, the system of integers (both positive and negative), and the rational number system are stressed. Study is made of the structure of these systems and of the laws governing operations within the system.

As a consequence of this change in content, each year subject matter has come to include more of the mathematics of the high school courses than during the preceding year.

Beginning in September 1960, an evaluation of the social climate of the experimental classes was undertaken by a member of the Psychology department of the University. Three groups of people were interviewed: (a) children who had been in the experiment, and also their peer groups. (b) parents of children in special classes, and (c) teachers of regular and of special classes.

Results showed that the program was a popular one, and that it was helpful. Children and parents approved the program almost without exception; most staff members approved, but their reaction was less favorable than that of children and parents. A majority of all three groups considered the program helpful, but some reservations were expressed by some staff members.

The children reported that there were times when they felt some pressure because of the additional time and work required by participation in the program. They said there were times when they felt that they had done less than their best work.

Interviews indicated that the program might be improved by increasing its flexibility; that is, by permitting a child to attend one, or two, or all three classes, depending on his own situation. A second suggestion for improvement was that of more complete sectioning. Children who attend the special classes also attend classes in their homerooms in these same areas; a majority of those interviewed believed that students taking a special class should get all work of that subject in the special class. A majority looked favorably on departmentalization of at least one more area, perhaps mathematics. (Science is already one of the subjects that is taught by a teacher other than the homeroom teacher.)

From comments by persons interviewed, it appeared that the program might profit by a more clear-cut statement of purpose. These people were not certain whether the purpose of the program was that of acceleration, or of enrichment, or both, or whether some other goal had been in the minds of those who planned the special program.

Some curricular adjustments have had to be made for participants in the special

classes when they reached high school. Interviews indicated that the program might be improved by arranging better articulation between the elementary school and the high school.

A majority of interviewees from all three groups agreed that the homeroom teacher alone could not meet all the needs of all children. This might be interpreted to suggest that there is a real place for a program for gifted children.

Evidence pointed toward the conclusion that, in determining what happens to children, the teacher is more important than the organizational structure. This should not be interpreted to mean that some organizational structures do not have advantages over others.

In drawing general conclusions from the interviews, it should be noted, first, that many constructive criticisms have been made. Although the program is popular and helpful, it appears that more flexibility, better definition of purpose, and better articulation with other subject matter areas and other grade levels might be desirable.

The work with gifted children which has been described is only one experiment; many others exist in various schools throughout the country. This one came into being in a small, faltering way, and "felt" its way along. It is now in its seventh year and, even though the program appears to be on a firm basis, changes are continually being made. Content will always be subject to change, governed by backgrounds and abilities of the children who come into the group. Organization of classes is also subject to change. Two features of this program that have not changed through the years are the method of selection of participants, and the standards for enrollment in the program.

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