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Scope of Report: The creation and maintenance of interest in the subject is one of the major problems confronting high school mathematics teachers. It is the purpose of this report to explain how a mathematics club may be used to increase student interest and also act as an aid in improving the teacher-student relationship. The purpose of high school mathematics clubs, their history, organization, and activities are described. Suggested topics for programs and sources of mathematical material to be used are also given.

Findings and Conclusions: The sponsorship of a high school mathematics club is a worthwhile activity which any mathematics teacher should be willing to undertake. By introducing non-textbook type material of a mathematical nature in an out-of-class setting, tremendous student response and enthusiasm may be achieved. Any high school with a nucleus of vitally interested students and an enthusiastic mathematics teacher should have a mathematics club, even though the school may have a relatively small enrollment. A mathematics club, while not a panacea for all ills pertaining to high school mathematics, certainly represents a step in the right direction.

ADVISER'S APPROVAL James H. Zant

THE USE OF MATHEMATICS CLUBS IN HIGH SCHOOLS

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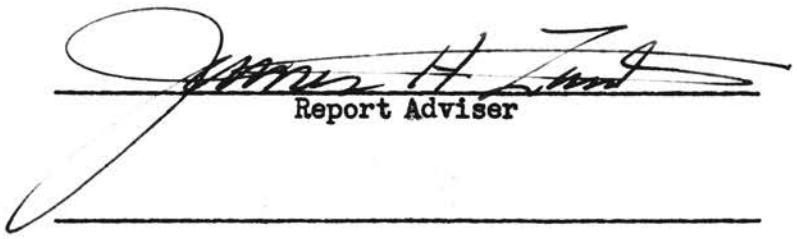

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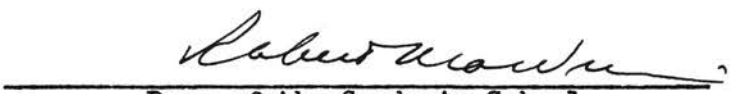

Dean of the Graduate School

PREFACE

During my six years as a high school mathematics teacher, one of my major problems has been that of increasing student interest in the subject. One method by which this objective may be at least partially accomplished is the use of a high school mathematics club.

It is the purpose of this study to describe how a high school mathematics club may be used effectively. Prospective sponsors of such clubs may find suggestions concerning programs and other activities to be of interest.

Indebtedness is acknowledged to Dr. James H. Zant, Director of the National Science Foundation Academic Year Institute at Oklahoma State University, Stillwater, Oklahoma, for his valuable guidance and infinite patience.

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CHAPTER I

WHY HAVE A HIGH SCHOOL MATHEMATICS CLUB?

One of the major problems confronting America today is the maintenance of an adequate supply of technically trained personnel. Inasmuch as mathematics furnishes the foundations for virtually all scientific and technical training, it is necessary that capable young people have their mathematical interests stimulated while they are still in high school. One of the best methods for stimulating and maintaining interest in mathematics is the high school mathematics club if it is organized and managed properly.

The purpose of mathematics clubs in high schools and colleges is the same as that of the Pythagorean Brotherhood of ancient times, of which they are the remote descendants. This purpose was probably both social and mathematical. No doubt its object was to foster an interest in mathematics and serve as a means of revealing the truths of this, the greatest of all sciences, to the world.[1]

In order for a secondary-school teacher of mathematics to do an effective job of teaching he must create and maintain interest in the subject. Inasmuch as mathematics is usually associated with the logical and practical aspects of life, its recreational possibilities are seldom explored. Yet a mathematical puzzle has an allure to the average

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[1]Samuel I. Jones, Mathematical Clubs and Recreations (Nashville, Tennessee, 1940), p. 3.

individual. The origin of some of the puzzle problems that are in circulation today is lost in antiquity. The popularity of the puzzle sections in youth magazines attests to the eagerness with which boys and girls of high school age respond to an intellectual challenge. However, there is little opportunity to bring such recreational material into the work of a mathematics class from day to day. Whenever such an opportunity presents itself, advantage of it should be taken. Since the average adolescent high school student is fond of belonging to organizations and clubs, a mathematics club affords an excellent means of creating added interest in mathematics through emphasis on the recreational aspects of the subject.[2]

A mathematics club should have definite objectives around which to plan its activities. According to Jones, the manifold purposes of a high school mathematics club are as follows:

1. To promote interest in the study of mathematics.
2. To bring together kindred spirits, bound by an appreciation of the beauties and significance of mathematics.
3. To give pupils glimpses of the future, which serve as incentives to continue the study.
4. To afford opportunity for discussing the many interesting features of the various mathematical subjects.
5. To furnish an outlet for their social instincts.
6. To illuminate the by-paths of mathematics, to study certain interesting matters connected with mathematics which do not find a place in the usual classroom.
7. To develop an appreciation for the truth and beauty in mathematics and our dependence upon it in practical life.
8. To inspire the members — the future teachers — with the nobler phases of the subject enabling them in turn to inspire the coming generations.[3]

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[2]Claude H. Brown, The Teaching of Secondary Mathematics (New York, 1953), p. 319.

[3]Jones, p. 3.

Kinney and Purdy have stated the following as a newer list of some of the important functions that have been served by high school mathematics clubs:

1. To promote interest in mathematics and a broader understanding of its nature.
2. To develop appreciation of its power and beauty.
3. To provide further opportunity for becoming acquainted with its uses in life.
4. To discover and develop special interests and talents.
5. To provide a broad range of activities for participation by all members.
6. To bring together pupils of kindred interests in a social setting.
7. To improve teacher understanding of pupil interests and characteristics.[4]

These aims, like those for classroom recreational activities, are part of the general aims for teaching mathematics. The mathematics club should supplement the work of the mathematics class. The club should plan to provide activities not possible in the classroom, although they may well grow out of classroom projects.[5]

A well-managed mathematics club can be expected to give to its members a realization of the fact that mathematics is as interesting as any other branch of human achievement. Men and women who devote their lives to a study of mathematics do so because they find it fascinating beyond all else to which they might devote their intellectual powers. If young persons are to devote themselves more than temporarily and casually to the study of mathematics, they must catch at least a small part of the realization of the fascination of the subject. Frequently class conditions are not suitable for this realiza-

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[4]Lucien Blair Kinney and C. Richard Purdy, Teaching Mathematics in the Secondary School (New York, 1952), p. 364.

[5]Ibid.

tion. The mathematics club may be utilized as the means of bringing together under favorable conditions students who are capable of realizing something of the beauty and power of the subject. Through the club associations and programs, this realization may be acquired and maintained as a permanent possession.[6]

Another benefit of a mathematics club is the extension of knowledge beyond the possibilities of class instruction. Rarely does a teacher feel justified in digressing from the sequential development of the essentials of the subject to enter into a discussion of a bit of history or an extension or sidelight that might give new life to the subject. The mathematics club can treat such topics fully and the teacher can feel sure that the presentation will be well received by all members.

Interest in mathematics and extended knowledge of the subject could come as individual achievements by a student reading and studying alone. However, human beings in general and young people in particular are social creatures and achievements are more normal and satisfying when attained by shared activities. This sharing of activities is one of the great merits of the mathematics club. If there is any basis for the criticism that persons who are deeply interested in mathematics are non-social, the mathematics club can certainly help to socialize them at the same time it increases their interest in mathematics.[7]

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[6]Walter H. Carnahan, Mathematics Clubs in High Schools (Washington, D. C., 1958), p. 5.

[7]Ibid., p. 6.

It is the general concensus of opinion of the teachers who have directed mathematics clubs that the objectives mentioned in this chapter are readily realized and that the transfer of interest and initiative that carries over into the classroom more than repay for their time and effort.[8]

Sponsorship of a mathematics club involves a large amount of work, time, and energy. However, it is a worthwhile activity for any teacher who wishes to help young people to discover and enjoy the "Wonderful World of Mathematics."

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[8]Jones, pp. 3-4.

CHAPTER II

THE HISTORY AND DEVELOPMENT OF HIGH SCHOOL MATHEMATICS CLUBS

One of the first mathematics clubs in a secondary school was organized in 1903 in the Shattuck School, a private school for boys at Faribault, Minnesota. C. W. Newhall, in an article in School Science and Mathematics, June, 1911, describes the organization of this club.[1]

While Shattuck was a private school, which may make the matter of organization somewhat simpler, the course in mathematics was no higher than that in any good public high school, and the boys were the same age.

The object of the club was to study certain interesting matters connected with mathematics which do not properly find a place in the usual classroom work. Such questions as the history of mathematics, its famous problems, unusual applications, mathematical puzzles, fallacies, and tricks were considered proper subjects for study, anything in fact that was capable of a mathematical solution or explanation and that promised to be entertaining. The club met in the classroom at night once a week. Each meeting was devoted to some general subject, and reports were prepared on three or four special topics by as many members. So far as was known at the time, this was the first attempt to conduct a club of this sort in a secondary school. That the experiment was a success, the increasing enthusiasm for the club during the eight years

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[1]Jones, p. 4.

from 1903 to 1911 abundantly proved.[2]

In 1913 a Euclidean Club was organized at Scott High School, Toledo, Ohio, by Miss Marie Gugle, who was then a teacher in the school. The boys of grades ten to twelve, whose ratings in mathematics were excellent or good, were admitted to membership. Its programs usually had three features: a biographical sketch of some great mathematician and a story of his contributions; a mathematical game, trick, fallacy, or a unique solution, and an account of some scientific discovery or invention related to mathematics.[3]

Although the high school mathematics clubs are remote descendants of the Pythagorean Brotherhood of ancient times, such clubs have only existed in American high schools for approximately a half-century. At first mathematics clubs were confined to private schools or to public schools in large cities. Since 1930, however, the mathematics club movement has spread throughout the entire nation so that now virtually any high school may have a successful club if it has one devoted teacher and a nucleus of a few vitally interested students.

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[2]Charles W. Newhall, "A Secondary School Mathematics Club," School Science and Mathematics, XI (1911), p. 500.

[3]Jones, p. 4.

CHAPTER III

ORGANIZATION OF A HIGH SCHOOL MATHEMATICS CLUB

Soon after the beginning of a new school year, a teacher is likely to be asked to help with some extracurricular activity. Often he will be permitted to choose the activity he will sponsor. Inasmuch as many schools still do not have a mathematics club, this represents a real opportunity for a teacher to develop in capable students a keen interest in mathematics. Since the idea of a mathematics club is new to most people, administrators and students must be persuaded that membership in this club will be valuable.[1]

Where does interest in such a club originate? One might think that interest in the organization of a mathematics club would always originate with the teachers of the subject. However, experience does not justify this conclusion. The interest that leads to the organization of a club is often that of students. For example, Miss Miriam Hunds of Ypsilanti, Michigan, reported that three of seven mathematics clubs which she studied were started as the result of student interest in such an organization.[2] However, it is probable that in cases in which students take the first active steps some teacher or teachers

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[1]Annie John Williams, "Organizing A Mathematics Club," The Mathematics Teacher, XLIX (1956), p. 149.

[2]Carnahan, p. 7.

have planted the seeds that are responsible for growth of the necessary interest.[3]

However carefully the teacher may "plant" the idea, better results will be obtained if the initiative for organizing the club comes from the students themselves as much as possible. They should feel from the beginning the responsibility for making the club a success. At the beginning the sponsor needs to contribute careful leadership and direction, but the tendency to over-contribute should be avoided. Increasingly the role of the teacher should diminish until eventually he assumes merely an advisory capacity.[4]

According to Dr. Norman Anning of the University of Michigan, the faculty adviser should be like the spare tire, inconspicuous but ready when needed. "The simile is a poor one," he states, "because the tire ought to be full of wind; the teacher in this situation ought to be silent or at least be heard as little as possible."[5]

The actual form of the organization will depend on the time available for meetings and other local conditions which must be taken into consideration. The club may meet at a free period in the day or it may be privileged to meet occasionally during part of a regular recitation period. The program may be primarily social and recreational in nature or it may be a medium for exploring the applications of mathematics

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[3] Ibid.

[4] Kinney and Purdy, pp. 365-366.

[5] Norman Anning, "High School Mathematics Club," The Mathematics Teacher, XXVI (1933), p. 71.

or for more extensive study of topics of interest to the group but not part of the regular course. Whatever form a mathematics club takes, it should be a student activity with the teacher as adviser and consultant only. It is as impossible to enjoy the recreational aspects of mathematics by assignment as it is impossible to "require democracy."[6] Details of club organization will be covered more fully in a later section of the present chapter of this report.

The teacher who has not had experience with a mathematics club but wishes to organize one may hesitate because he is uncertain how he should go about it. The essential steps in organizing a high school mathematics club are simple enough.

1. The prospective sponsor should talk with his principal, discuss the benefits which he thinks the club could confer, and ask the principal for his approval.
2. The matter of a mathematics club should be discussed with other mathematics teachers of the school and their approval and help enlisted.
3. The situation should be discussed with a few good mathematics students, either in class groups or individually, explaining to them briefly what the club could accomplish. The matter should be discussed more than once so that it is clear as to the work to be done and the responsibilities to be carried as well as to the benefits to be expected. The active interest of a number of good students should be obtained before further steps are taken.
4. Other teachers should present the matter in their classes that have eligible students. Have them talk with recommended students individually.
5. An organization meeting should be called, inviting only those who are eligible according to the standards that the sponsor, the principal, and the other mathematics teachers have decided should be set.[7]

At this first meeting the general plan of organization should be outlined. A number of subjects should be suggested that would

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[6] Brown, pp. 319-20.

[7] Carnahan, p. 8.

constitute suitable material for club programs and enough details should be given so that the students will have a clear realization of the possible interest and profit to be expected from participation in the organization. The necessity for making provision for the systematic conduct of club business and program meetings should also be discussed. If the decision has been reached that the students are to write and adopt a constitution and/or by-laws and elect officers, then the next step will be to have the members elect a president pro tem and appoint a committee to provide the instrument for organization.[8] If possible an appropriate name for the club should be agreed upon at the first meeting.

Now begins a period of work by the temporary president and the committee that has been named to write the instrument of organization for the club. The sponsor will, of course, work with the students at every step of their activity. After the constitution or by-laws have been written, a second meeting of the students is called by the temporary president and the chairman of the writing committee reads the proposed constitution. Then will follow the usual discussion and debates. After the instrument has been revised and adopted, an election of officers is held, and the club is under way.[9]

After having completed the general organizational guide, we now turn our attention to several specific items which must be taken into consideration.

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[8]Ibid.

[9]Ibid., pp. 8-9.

One of the most important items to be considered is the selection of an appropriate name for the club. The name of the organization in general is The Mathematics Club of _____High School. Sometimes more imaginative names such as the following are chosen: The Euclideans, The Naperians, The Irrational Club, The Magic Squares, The Mystic Hexagram, The Cartesians, The Pascal Triangles, The Circle of Truth, Magic Circle, Pythagoreans, or something similar.[10, 11]

Recently there has been organized a national mathematics club for high school students, Mu Alpha Theta. It is possible that a group would wish to affiliate with it instead of organizing an independent club. For information write Box 1127, University of Oklahoma, Norman, Oklahoma.

The officers of the club usually consist of a President, Vice-President, Secretary, and Treasurer, with the addition of any others considered to be necessary. The term of office should be specified in the constitution, if there is one, or by the sponsor if this is considered to be his responsibility. Some clubs elect officers for a year while others elect each semester.[12] Local preference should be the determining factor.

The time and frequency of meetings should also be determined. Meetings are usually held once every two weeks or once a month, with the former seeming to be more popular. Many schools have an administrative regulation concerning the time when any club can meet. In such a case, the mathematics club can only adjust to the regulation. In

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[10]Jones, p. 5.

[11]Kinney and Purdy, p. 366.

[12]Carnahan, p. 9.

the absence of such regulation, it becomes the responsibility of the sponsor and the club members to select a time. The most common time is the homeroom or activities period or immediately after the close of the school day. Some clubs hold evening meetings.[13] Again local preference should be the determining factor.

In no other detail do clubs vary so greatly as in the matter of eligibility for membership. Also, there is great diversity of opinion among authors on the subject. Some, like Kinney and Purdy, feel that if the mathematics club is to make its maximum contribution to the school, membership must be open to all students and to the faculty. "Scholarship restrictions, enrollment in class, anything beyond nominal dues, would be likely to exclude the pupils who can most profit from the activities," is the opinion of these writers.[14] Some clubs limit membership to juniors and seniors; some admit any high school student who fulfills other requirements than classification. Some clubs admit any student who applies and is elected; some specify a certain scholastic standard; some require submission of a written paper on some mathematical topic. In many clubs there is a limit to the number of members at any one time, so that students who are eligible for election to membership may be required to have their names placed on a waiting list. Eligibility requirements should be carefully considered by any prospective sponsor of a mathematics club. The controlling purpose in club organization will help to determine eligibility requirements, if any.[15]

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[13] Ibid.

[14] Kinney and Purdy, p. 366.

[15] Carnahan, p. 9.

Appropriate committees should be appointed. Many clubs have a program committee whose responsibility it is to plan the program of speeches, discussions, and activities other than business and social. Almost all clubs engage in social activities to a greater or lesser degree. Such activities vary widely from club to club. Local conditions should regulate this matter. Usually there will be a social committee appointed by the president for the semester or year or for a designated event.

The final item to be discussed in regard to club organization concerns the adoption of a club constitution. Some clubs have neither constitution nor by-laws and seem to function quite well. Some clubs have either a constitution or by-laws, while some have both. Some constitutions are long, whereas others are very brief. For example, the Mathematics Club of Central High School in Fort Wayne, Indiana, founded by John P. Clark in 1913 and still quite active, has a constitution of only fifty-nine words. The by-laws of this club contain only eight brief items.[16]

The club constitution in general will contain a preamble, the club's name, purpose, membership requirements, sponsor's duties, officers and their duties, method of election of officers, amendments to the constitution, and any other information that may be pertinent, depending upon the local situation.

After the club has been organized it is ready to begin work. Suggestions for club activities and programs will be found in later chapters of this report.

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[16] Carnahan, p. 10.

CHAPTER IV

MATHEMATICS CLUB PROGRAMS

Mathematics club programs vary widely, depending upon the purpose for which the club was formed, the length of time allowed for each meeting, the grade levels, abilities and interests of the members, and the facilities available. The program may consist of anything of mathematical interest from simple puzzles, tricks, and games on up to presentation of topics which require much study and research.

Undoubtedly more familiar to most teachers is the "popular" type of mathematics club wherein all students who so desire are welcomed as members. Because of the heterogeneity of talent which is embraced by such a plan, the group activities are in most cases limited to such things as mathematical recreations, puzzles, plays, and simple applications. Such a club has the advantage of appealing to large numbers, but also has the disadvantage of prohibiting discussions of an advanced nature.

Less familiar is the opposite type of club which limits membership but permits almost complete freedom of activity. Clubs of this type usually have a constitution which limits membership to a small number of carefully selected students. Admission requirements may include both the passing of a comprehensive examination in mathematics and approval of the active members. Even with the relatively homogeneous membership of such clubs, great differences in interest will be evident. The amount of research done by some individuals is remarkable. Equally

encouraging is the attitude of the student body. The question asked candidates for admission to one club of this nature was not, "Were you foolish enough to want to belong to the mathematics club?" but rather, "Were you good enough to make the grade?"[1]

This type of club may not be organized in every high school, but when a teacher finds several youngsters with superior mathematical ability who are apparently not sufficiently challenged in the classroom, that teacher may offer these students a challenge in a mathematics club designed for high school students who may be future mathematicians, scientists, research engineers or other leaders in tomorrow's world.[2]

The superior student is usually the most neglected student in our high schools and this exclusive type of club is organized for his benefit. Any teacher who sponsors such a club will be amply repaid for his efforts if he discovers a future mathematician or if he helps many students to enjoy the study of mathematics more fully.

The main feature of any mathematics club, whether the more exclusive type described above or the more familiar general type, is the program. The transaction of necessary business should occupy from ten to fifteen minutes, leaving from thirty to forty-five minutes for the program itself which is usually given by club members with the occasional exception of an outside speaker, who may be a professor from a nearby college, or someone connected with business or industry in the local community who can describe the uses of mathematics in his particular

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[1]H. Vernon Price, "Mathematics Clubs," The Mathematics Teacher, XXXII (1939), p. 324.

[2]Harold W. Stephens, "A Mathematics Club for Future Mathematicians," School Science and Mathematics, LIV (1954), p. 715.

line of work. A wide variety of topics should be covered in the programs. Most of the subjects to be discussed may be listed under the three following groups:[3]

1. The history of mathematics.
2. Mathematics in industry and art.
3. Mathematical contests, plays, and recreations.

A typical high school mathematics club, "The Archimedeans," of Rosati-Kain High School, St. Louis, Missouri, has a committee of three appointed to take care of the program for each meeting. A variety of activities has been presented. These have included skits, radio broadcasts, explanation of some advanced theory, biographical sketches of mathematicians, quiz programs, history of mathematics, number games, riddles and puzzles.[4]

Many clubs will have members who enjoy making devices which can be used for demonstrations before the club. With proper guidance this may be done without spending a large amount of money. For example, a student might make a model of the curve of swiftest descent, thus bringing about an investigation and discussion of the cycloid.

Other students may become interested in computing machines as an example of the utilization of the binary number system. A field trip to a computing center may be arranged so that the students may see a demonstration of the construction and use of these machines.

Some clubs spend practically all of their time studying the slide rule while others devote a few weeks each year to such study.

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[3]Jones, p. 44.

[4]Sister Anne Agnes, C. S. J., "The Archimedeans," The Mathematics Teacher, XLVII (1954), p. 366.

In order to plan their programs more effectively, every mathematics club should have access to such books as Mathematics and the Imagination by Kasner and Newman or Riddles in Mathematics by Northrup.[5] Such books are filled with mathematical material which may be used at club meetings.

The program committee should see that programs are made as interesting as possible. The aim should be to put fun, variety, competition, and informality into every meeting.[6]

Inasmuch as it will be impossible to describe all of the permissible types of programs for a mathematics club meeting, a list of some of the topics which are suitable will be presented on the following pages.[7]

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[5]Carnahan, pp. 17-18.

[6]Jones, p. 44.

[7]Carnahan, pp. 22-24.

Suggested Topics for Mathematics Club Programs

I. Arithmetic and Number Theory

1. Systems--decimal, binary, duodecimal, etc.
2. Computing devices and calculating machines
   a. Abacus
   b. Napier's rods, Genaille-Lucas rods
   c. Electronic machines
   d. Slide rule
3. Number tricks
4. Numbers--prime, perfect, polygonal, Fibonacci
5. Checking by casting out nines
6. Logarithms
7. Finding a secretly selected number

II. Algebra

1. Algebra of sets (Boolean)
2. Historical methods of solving a quadratic equation
3. Imaginary numbers
4. The slope-intercept form of a linear equation
5. Finding the equation of a tangent to the graph of a quadratic equation at any point on it
6. Equations which have no roots
7. Nomographs

III. Geometry

1. Ceva's theorem
2. Menelaus' theorem
3. Euler's line
4. The nine-point circle
5. Topology--Koenigsburg Bridge problem
6. Three famous problems of antiquity
7. Linkages
8. Curve stitching
9. Paper folding
10. The Platonic Solids
11. The Golden Section
12. Cycloid or curve of swiftest descent
13. Non-Euclidean Geometry
14. Indirect measurement--field work
    a. Using angle mirror, hypsometer, clinometer, plane table transit, and sextant

IV. History of mathematics

V. Biographies of great mathematicians

VI. Applications, amusements, games, puzzles

1. Quincunx
2. Paradoxes and fallacies
3. Chance and probability
4. World calendar--history of calendar and calendar reform
5. Infinity
6. Number sense problems--sample problems from college entrance examinations and aptitude tests
7. Mathematical spelldowns
8. Optical illusions
9. Mathematical crossword and cross-number puzzles
10. Magic squares
11. Tower of Hanoi
12. Chinese rings
13. Unicursal puzzles

VII. Topics from related fields--science, navigation, music, art, economics

VIII. Vocational opportunities in mathematics

CHAPTER V

OTHER ACTIVITIES OF THE MATHEMATICS CLUB

Although the program will be the main feature, most mathematics clubs will wish to engage in a variety of other activities. If club members, sponsors, and other mathematics teachers are alert for possibilities, they will find many activities in which the club can participate to the benefit of all concerned. A few of these activities will be suggested in the present chapter of this report.

Interest in mathematics may be created on a school-wide or even a community-wide basis by means of occasional brief articles in school publications. Unlimited material may be obtained for such articles and their preparation need not involve a great burden on anyone. Challenging problems may be used or any other topic of a mathematical nature. The list of topics suggested for club programs provides other possibilities. The club sponsor, of course, should carefully read and edit every article prepared for publication. One school puts out a mathematics club pamphlet each year for the purpose of acquainting the student body with the activities of the club and thereby stimulates interest in mathematics and encourages membership in the club.[1]

The classroom bulletin board has been used by many teachers of mathematics as an effective means of cultivating interest. The National Council of Teachers of Mathematics has published an excellent bulletin

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[1] Math Student, Brooklyn Technical High School, Brooklyn, New York.

on this subject which may enable teachers to derive the maximum benefit from this device.[2] However, there is always the problem of finding time to assemble, exhibit, change, and file bulletin board materials. The mathematics club may relieve the teacher of a lot of this tedious work. Members will usually take pride in collecting and exhibiting materials that make the bulletin board the center of interest. If the old materials are regularly removed and new materials added students will learn to watch for the changes and their mathematical interest will be maintained at a high level.

Mathematics has great possibilities for interesting classroom exhibit material. Models, linkages, graphs, stitched curves, drawings, geometric constructions, mobiles, natural forms, folded paper, and many others can be found or easily made. Since no teacher has the time to find or make many of these items, the mathematics club can come to the rescue by providing the materials, arranging the exhibits, removing, changing, and storing them. This work, of course, must be supervised, but the details may be left to the club members.

Hall exhibits to appeal to the entire student body may also be provided by the mathematics club. If the sponsor is asked if his club can fill the display cabinet in the main hall, the answer ought to be, "We surely can." Every club should start a collection of models that have been made and demonstrated by its members. No club is so small or so poor that it cannot enjoy the possession of at least a modest amount of exhibit material. By this is meant no "heterogeneous omnium gatherum" but material which has been used in the club and in which

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[2]Donovan Johnson, How to Use Your Bulletin Board, (Washington, D. C., 1957).

individual members have taken an active interest. The most valuable models are those which the members think out and construct with their own hands.[3]

It may be possible for selected members of the mathematics club to be trained to speak before mathematics classes and thus expand interest in the subject. Almost any teacher will welcome such talks. The use of multi-sensory aids or student participation in simple activities will increase the effectiveness of such talks.

An assembly program may be used to familiarize the student body with the work of the mathematics club. Brief talks by five or six club members on some interesting topic of a mathematical nature should hold the attention of the audience.

Some states have fairs or assemblies in which mathematics students from all high schools may participate. The local mathematics club may assist in preparing for these events. It may be possible in order to advertise a fair for students to be given time to demonstrate on radio or television a mathematical phase of the exhibit.[4]

Many schools allow provision for plays to be given at assembly programs. There are a number of plays relating to mathematics that the club may present as part of its activities. The Mathematics Teacher contains such plays frequently and also occasionally lists plays which have appeared in back numbers of the magazine. Carnahan in his bulletin, Mathematics Clubs in High Schools, also lists several appropriate plays.[5]

Field work may well be a regular part of the program of a mathe-

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[3]Anning, p. 73. [4]Carnahan, p. 15. [5]Carnahan, pp. 25-26.

matics club. A Staten Island, New York, teacher taught surveying to the members of the mathematics club which she sponsored, many of whom were also in her trigonometry class. The boys made most of the instruments themselves or received them as discards from local engineering firms.[6]

Field trips to factories, banks, research centers, and other places where mathematics is used may be arranged. Special preparation for such a trip may be necessary if it is to be made during the school day. The club members may derive more benefit from the trip if a representative of the institution to be visited speaks to the club before the trip and tells the members some of the things they should look for while on the trip.[7]

Most mathematics clubs will engage in some type of social activities, which should be varied and inexpensive. Very interesting events can be arranged, such as initiations, Faculty-Parents nights, "get togethers", or exchange parties with other clubs. Parties might be arranged for various festive occasions, such as Christmas, Halloween, and St. Patrick's Day. The same type of general entertainment should never be repeated. Something different is more interesting and educational. In order to eliminate those who would join the club for entertainment only the social activities could be limited by school ruling to one party and picnic per semester. One club with such a policy has the Christmas Party during the first semester and a picnic for members and guests at the end of the school year. As a money making project,

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[6]Esther Sweedler, "The Mathematics Club at Curtis High School," The Mathematics Teacher, XXIX (1936), p. 394.

[7]Carnahan, p. 16.

this club sponsors a mixer in the school gym after one of the basketball games.[8]

In the serving of refreshments at the social functions, the subject of study for the cook should be "Mathematics in Serving." The mathematical idea can be beautifully carried out in preparing many dainty dishes by using the various lines, angles, curves, and figures found in plane geometry and the various solids found in solid geometry, such as cones, cubes, cylinders, spheres, and pyramids.[9]

Such a banquet has been described by Mary Kathryn Rosendahl. All of the angles of "Geometryville" are depicted as having attended a banquet. Humorous descriptions of the angles are given. "All the angles were seated about a huge table covered with many kinds of food. There were delicious triangles surrounded by line-segments, tempting squares of plane surface, many circles filled with arcs and even bisectors and perpendiculars. Everyone was laughing and having a good time."[10]

The last sentence of the above quotation describes what should be occurring among the members of any effective mathematics club.

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[8]Inez Kelly, "Garfield Mathematics Club," The Mathematics Teacher, XLV (1952), p. 37.

[9]Jones, p. 49.

[10]Mary Kathryn Rosendahl, "The Banquet of Angles," The Mathematics Teacher, XXVI (1933), p. 186.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The previous chapters of this report have attempted to describe the purpose, organization, programs, and other activities of high school mathematics clubs. In order to be effective, the club must be composed of vitally interested members led by an enthusiastic sponsor. Nothing can kill interest in a club quicker than a sponsor who is himself disinterested.

With the proper sponsorship it is the belief of the author that a high school mathematics club may be of great value in removing some of the stigma which has been attached to mathematics by people who consider it to be dull and uninteresting.

The result of interest created in a small group of students may spread like the waves of a pond into which a stone has been thrown. Who knows but what an Edison or Einstein may be discovered through a mathematics club?

While it is certainly true that sponsorship of a mathematics club consumes a lot of time and energy, it is an activity that is worthwhile for every teacher of mathematics. If only one student becomes more interested in mathematics as a result of the club, then this time and energy will not have been wasted.

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