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HOW STATE ACADEMIES OF SCIENCE MAY ENCOURAGE SCIENTIFIC ENDEAVOR AMONG HIGH-SCHOOL STUDENTS[1]

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I SHALL present four aspects of the problem of encouraging scientific endeavor among high-school students: a glimpse of the trends of the high-school curriculum as they bear upon proposals for cooperation by the state academies of science; an outline of the efforts of the Illinois State Academy of Science to encourage scientific endeavor among high-school students; a statement, as requested, of personal experience related to science clubs, and suggestions as to possible benefits if other state academies of science develop similar projects in their high schools.

Concerning the curriculum, it is apparent that old subject-content, standards, methods and results are not entirely satisfactory. Here, as elsewhere, philosophic and scientific studies are producing change. One who has been called "the greatest educational leader of our time, and perhaps all time,"[2] says in stating his theory[3] that the life of the school is to be

[1] This paper has been condensed from the paper read before the representatives of the State Academies of Science meeting with the American Association for the Advancement of Science, Des Moines, Iowa, December 27, 1929. The representatives voted to request the chairman of the American Association committee on the place of science in education to cooperate in revision and in arranging for the publication and distribution of the paper. Copies of this paper may be secured from the office of the permanent secretary of the American Association for the Advancement of Science, Smithsonian Institution, Washington, D. C., or from the chairman of the association committee on the place of science in education, 433 West 123rd Street, New York City.

[2] R. A. Kent, "Leadership," *Phi Delta Kappan*, XII, 2: 40, August, 1929.

[3] John Dewey, "School and Society," p. 11, University of Chicago Press, 1899.

active, not passive; that the children are to work, not merely to listen, that the curriculum is to be organized around the chief impulses, which are the social instinct of the children, the constructive impulse, the expressive instinct and the impulse toward inquiry or finding out things. So far as the average high school has learned to make use of these impulses, it has been through the so-called extracurricular activities.[4] McKown says: "Extra-curricular activities must be built upon the broad principle that the school is a laboratory for citizenship, and whenever possible the situation in the school should resemble the situation which the future citizen will face." Such activities should be recognized and made a regular part of school life and work.

The science club offers a master key to scientific endeavor among high-school students. The state academies can foster science clubs in high schools by offering the mutual advantages of affiliation between the clubs and the academies. From such affiliations each member of the junior organizations, through such association, may be led to sense the power that science is wielding. There are not less than four million students of high-school age available to organization and leadership. These four million and those to follow will need to know, more than the pupils before them needed to know, all that science can impart to them and open to them for their own opportunities.

The magnitude of the science club movement throughout the country was shown by Dr. H. A. Webb,[5] who compiled data on 146 science clubs in 28 states and found a total enrolment of 5,608 students. In the State of Illinois there are approximately 700 four-year high schools which are officially accredited or have applied for accrediting. Of these there are 290 which are on the approved list of the North Central Association of Colleges and Secondary Schools. The total enrolment of these 700 Illinois schools is approximately 270,000; the average enrolment is approximately 387. In those 700 schools, not less than 67,500 students are enrolled in science courses. In the average Illinois high school a minimum of 96 students is enrolled in science courses. Now, if each school should have one science club, 700 high schools would have 700 potential science clubs. Or, since the 290 four-year high schools bearing the approval of the North Central Association of Colleges and Secondary Schools represent the best that Illinois has in the matter of standards, the Illinois State Academy might reasonably anticipate affiliation of from 290 to 700 science clubs. The Illinois State Academy of Science began fostering and affiliating high-school science clubs in 1919. It has affiliated clubs from 18 different schools. If the number of years during which each club has maintained affiliation be added together, there are 51 year-units of high-school club affiliation with the Illinois State Academy of Science. It is believed that a similar program operating through all state academies of science would be possible. Organization, detailed information and wise stimulation were found to be essential prerequisites on the part of the academy. Character, initiative and other leadership qualities are essential requirements of the local sponsors. Cooperation is the chief essential to be contributed by the local school administrations.

The work of the science club should be a regular and important part of school life, and not an extra piece of work put in at the end of the day or week as an activity unrelated to school work.

The Illinois academy has affiliated scientific societies other than high-school clubs. These society affiliations may have definite relationships to the high-school clubs. They may have addresses or other programs of general interest. Invitations from the societies to the high-school clubs in the community or section of the city represent a salient method of stimulating interest in clubs of secondary schools. Also the affiliation of these societies represents one thing the academies may do toward adult education, which it seems must sometime involve the whole of our educational system. The tabulated data on these societies show that society organizations in terms of maintained affiliations are the more stable. This stabilizing and constant good influence is wholly desirable as far as the high-school science clubs are concerned.

Difficulties regarding high-school affiliations are due, in part, to the following causes:

In the development of the so-called non-academic subjects, including athletics, the classroom instructors lost much of their earlier influence in extracurricular activities. Discussion societies and dramatic clubs, which formerly represented the most activating type of extracurricular work, came to be of little consequence as a means of motivating the student in the average high school. This situation arose partly because the average instructor of academic subjects was not well prepared to match the influence of his personality and work against so many powerful factors outside the classroom. Then, there came to the high school hordes of children who did not possess a background of scholastic interest. It is a salutary thing that science, in continuously extending privileges to man's ability, is among the first in the academic field to use concerted action toward appreciation and in-

[4] Harry C. McKown, "Extracurricular Activities," p. 9, Macmillan, 1927.

[5] H. A. Webb, "Some First-hand Information concerning Science Clubs," *School Science and Mathematics*, 29: 273–76, March, 1929.

formation through such agencies as science clubs and societies.

Secondly, the science instructor must meet outside influence by offering genuine and lasting values to all those whom he expects to motivate. The instructor must be a salesman[6] of the highest order. With proper incentives and dependable working tools he will produce the desired results. These incentives and tools should be derived from at least three sources: the teachers' training course, teachers' conference meetings and state and national organizations. Interest on the part of science instructors is increasing. Requests for information of various kinds relative to club work have come from many states and from Canada. It is desired that the state academies work through these teachers' training courses and teachers' conferences. Such plans require time and tact for their development. The quality of the personnel of committees is essential to success of even carefully developed plans. Not only these state committees but also the local club sponsors are vitally important in the success of the movement.

At the Jacksonville meeting, J. L. Pricer,[7] then state secretary, concluded his report as follows:

> Education in science is so vital to the general welfare of every phase of science that it seems to me that every member of the academy should have some interest in the problems of science education in the secondary schools. Therefore, I believe that the academy should have a permanent committee of three on science education in the secondary schools. It should be the function of this committee to make annual reports to the academy on the status of secondary school science, and on occasion to call on the academy for cooperation and help in the solution of certain problems.

In 1922, the president was empowered to appoint a committee of five, to be called the committee on high-school science and clubs. This committee took the place of two former committees, the committee on secondary science and the committee on high-school clubs. This committee has separate chairmen for high-school science and for high-school science clubs. These chairmen work together with the whole committee on the various problems they have to consider. It is my opinion that the compact committee of those responsible for cooperation with high schools represents a very efficient arrangement. In 1926[8] the committee decided to confine its activities to presenting a series of programs in the high-school section of the annual academy program, for the purpose of encouraging the formation of science clubs. With the demonstration of more tangible values no clubs were lost during the next two years and there have been gains each year, until at the present time there are more clubs than at any time in the history of the movement. The Danville Science Club has held affiliation continuously for nine years. Last spring, for the annual meeting at Macomb, several car-loads of high-school delegates, bearing their scientific exhibits, traveled across the length and breadth of the state to enjoy the dynamic program arranged for them. This included a stirring lecture on the opportunities in science to-day by Professor B. S. Hopkins. There were films and reports on the activities of the various clubs, as well as judging of exhibits. The most stimulating feature of the business meeting was the adoption of a standardized pin and guard to be worn by the student members of all affiliated clubs in the state.[9] That evening, preceding the popular lecture, a chemistry play[10] by college students was presented through the courtesy of the Western Illinois State Teachers College. The privilege of taking six representative high-school delegates on that 450-mile trip to such an inspiring program represents an opportunity in leadership and service which is an outstanding thing in my teaching experience.[11] Out of the success of that trip has arisen the community project of providing for transportation for high-school delegates to the annual meeting of the academy.

To aid sponsors and clubs in organization as a step toward affiliation, the Illinois academy has authorized the preparation and distribution of literature. An eight-page printed pamphlet[12] has been useful. It contained a model constitution, sample programs, information on the significance of science and on the importance of affiliation with the academy. It also included addresses given by the committee members. One of the publications recommends automatic perpetuation of the club through the election of officers at the end of a year rather than at the beginning of the next year. If, then, there is the somewhat common change in sponsorship or administration the science club has a greater chance of surviving. Another practical suggestion is the development of a model constitution for the junior academy of science,

[6] A. L. Turnbull, "The First Great Salesman of Science," *Popular Science*, 109: 25, September, 1926.

[7] J. L. Pricer, "Secretary's Report," *Transactions of the Illinois State Academy of Science*, XII: 17, 1919.

[8] F. C. Phipps, "Report of Council Meeting," *Transactions of the Illinois State Academy of Science*, XIX: 11, 1926.

[9] L. A. Astell, "A Ritual and Other Devices for High-school Science Clubs," *School Science and Mathematics*, 27: 952–955, December, 1927.

[10] R. D. Billinger, "A Night in Alchemy," *Journal of Chemical Education*, 5: 715–24, June, 1928.

[11] L. A. Astell, "Fostering Science Clubs in the High School," *Journal of Chemical Education*, 6: 496–501, March, 1929.

[12] "A Message to High-school Science Teachers and Students of Illinois from the Committee on High-school Science and Clubs." The chairman of this committee was Dr. J. C. Hessler, of Knox College.

with provisions for state officers to be selected from the high-school students in affiliated clubs. Another suggestion is that detailed program outlines found to be successful because of their dynamic, educational and general values should be compiled and distributed together with program references in current literature.[13] The program data should include the names, sources and ratings of films, slide sets and film-slides used in connection with these programs. The average teacher will appreciate such carefully developed service. He will need to recognize, of course, the sociological importance of imitation as applied to the students' action. In the same manner he will need to take cognizance of the psychologically valuable principle of self-expression. And he must reckon with the pedagogically valuable advantage of student participation in the social events and consciousness of the surroundings. All these things need to be understood by the instructor, but he does not need to be a master in these fields nor does he need to have a personal library of special information in order to get good results.

The idea of fostering the spirit and methods of science through a knowledge of our great men of science has not been developed as fully as desired. Relatively few clubs at the present time have honored scientific achievement in this way. The requirement that candidates pass a written initiatory examination on the life of the chosen scientist whose name has been selected by the club is a valuable aid. The presentation of films or other types of visual aid materials regarding the life and work of the chosen scientist is another deserving method, particularly if accompanied by good talks. This year, on the night of "Light's Golden Jubilee," the Edisonian Science Club of West Chicago held its initiation. The formal part included slides and accompanying remarks concerning the great benefactor. Then, in the hush of anxious moments, the re-created voice of Edison, himself, as it was broadcasted from Fort Dearborn, swept into the auditorium. To have been initiated into this club on the fiftieth anniversary of the incandescent lamp is a memory to be treasured. Who could forget that privilege? What an incentive for emulating Edison's painstaking methods! What an urge for duplicating his production in any small part!

The academy can help further by placing the high-school club section of the academy's annual program at such time as to avoid conflicts with the important and popular features of the general program. The Illinois academy, for example, no longer has the club section meeting on Saturday morning, which is the time for the customary field trip. Another factor in the success of clubs is the lecture service. The constitutions I have used have required that the clubs bring or assist in bringing to the community at least one good scientific lecturer each year. No large amount of work has yet been done by the Illinois Academy of Science in the direction of free lecture service. Thus far the academies have discharged this function through the careful selection of speakers for the annual program. The appointment and endorsement annually of lecturers for high-school clubs at a minimum of expense to the individual club may become desirable. Even though the academy were to develop some means to defray a major portion of the expense, this seems more practical than calling for volunteers to give gratis lecture service. The high-school students would obtain further value from the idea that these lecturers represent the state academy with which their club is affiliated. On the same basis the lecturers should be able more effectively to encourage scientific endeavor in the youthful audiences.

Where the academies are unable to render lecture service to the affiliated clubs the following alternatives are offered. First, the academies can distribute gratuitously, or otherwise, such admirable reprints as Dr. Little's "The Fifth Estate." These reprints should be selected with a view toward utilization as student reports in the club programs. Such material is not commonly found in the average high-school library. Second, the academies can send out reference sheets on scientific lectures, which after all are to be found in considerable numbers[14] under conditions not difficult to meet by the average club. This has never been undertaken by the Illinois academy, but it is recognized as a practical and inexpensive service. The academies can encourage the clubs by distributing or listing references to novel, distinctive and purposeful initiation ceremonies.[15]

It will be noted that none of these suggestions entail extensive machinery on the part of the individual state academies. Nearly all the suggestions are already in practice in Illinois. Teachers perhaps are too often concerned with receiving rather than rendering service, but it seems that the psychology for obtaining useful affiliations is not greatly different from that of obtaining added club memberships, that is, by having the academy demonstrate its service to the affiliated clubs.

How does the principle of encouraging scientific endeavor among the high-school students through the

[13] "Program, Edisonian Science Club, West Chicago Community High School, West Chicago, Ill.," *School Science and Mathematics*, 29: 1929.

[14] The School Assembly Association, 1309 Kimball Building, Chicago, Illinois, and the Bureau of Commercial Economics, Department of Public Instruction, Washington, D. C., are examples.

[15] W. M. Lamar, "The Fraternity Initiation," A one-act burlesque, *Journal of Chemical Education*, 6: 2254–59, December, 1929; L. A. Astell, "Initiation Ceremony of the Edisonian Science Club," *School Science and Mathematics*, 28: 771–4, October, 1928.

state academies find application? First, there will be an application to a single student; then to the club as a whole as shown by a comparative outline of annual reports; then the work of certain progressive clubs will be presented; then the concluding remarks.

Some time ago, a boy was discovered making, voluntarily, day-by-day clipping record of Commander Byrd's work in the Antarctic. What school hasn't a boy who has been doing that! In conversation with the boy it was found that he had studied the North Pole achievement as completely as the libraries at his command permitted. These libraries were above the average on account of the environment and suburban location. The boy had made a study of the personal life of Commander Byrd. The teacher's opportunity for encouraging scientific endeavor was plainly shown. The idea of a "Pole to Pole" theme program came into being. Two reels of Commander Byrd's North Pole flight were located.[16] What audience would not thrill at the thought that before their eyes were reflected the very pictures that Byrd had taken during the flight, as the now-lamented Bennett piloted the plane known as the *Josephine Ford* above the barren and untracked wastes to a new victory for mankind? What history! What science! Another reel on Byrd's South Pole preparations was booked from a difference source.[17] The club boy was scheduled to give the half-hour feature-talk as part of the program. A local business man, who had lived in Alaska, was secured to add "native color." Only music and short readings were needed to add the final touch to a program worthy of the attention of any adult audience. What a privilege for the local club members and for the invited delegates from other high-school science clubs! What a feeling of assurance must have arisen in the minds of the club members' parents who were invited to attend this program! What more satisfactory way of encouraging scientific endeavor among high-school students and in the community!

Whatever the form of organization and the nature of the scientific work of the individual club, the end product should be an encouragement of scientific interest and endeavor which the student will not discontinue when he leaves the high school. This is true already, we believe, where delegates have gone to worth-while state academy programs; where these student delegates have their own junior academy organization with their own officers functioning under the senior academy and where the state academies are rendering definite assistance in the matter of organizing and operating the local high-school clubs.

If the efficient management of this detailed service on the part of each state academy appears to be too burdensome, or if there should be too much duplication by the different state academies, there might be a national director who would perform his duties in cooperation with the state chairmen of high-school science clubs. The permanent secretary of the American Association may have had something of this thought in mind a year ago to-day when he spoke of the economic aspects and increased efficiency of circularizing the science workers in each state through the Washington office. If such a director should secure detailed reports from the different state meetings he would possess the basic information necessary for service to each state academy. Useful reprints and other data could be sent to the state chairmen. Such a director's position should place him in command of suitable lecture service to be broadcasted through the courtesy of scientific organizations and companies for the benefit of the individual club organizations. The prestige of that position could be used to assist the affiliation of local high-school clubs and other local science organizations with the larger scientific bodies.

To summarize briefly. The state academies may encourage scientific endeavor among high-school students by establishing the necessary organization, by supplying detailed information and by developing momentum for science clubs as activities concerned with the fundamental academic subjects. The academies may promote this work through such specific actions as: (1) making the necessary constitutional changes of adult societies as well as high-school science clubs; (2) assisting in the development of a constitution for the junior academy; (3) by working through teacher-training courses in science, wherever offered; (4) by obtaining and utilizing to a maximum advantage the periods of time in scientific sections of district, state and national conferences and associations of teachers; (5) by preparing and distributing literature to the local clubs and schools; (6) by fostering the spirit and methods of science through an intimate knowledge of the men of science, and by the use of their names in identification of clubs; (7) by constructing the annual program of the state academy for the maximum benefit to the high-school delegates; (8) by supplying lecture service or reprints and other items of direct use in the local programs; (9) by encouraging the use of such devices as purposeful initiations, cards of credentials and standardized club pins, and (10) possibly sometime by the employment of a national director.

[16] Pathé Exchange, Inc., 35 West 45th St., New York City.

[17] Motion Picture Bureau, Y. M. C. A., 120 West 41st St., New York City, and 4829 South Kedzie St., Chicago, Illinois.