North Carolina Student Academy of Science

HANDBOOK

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OBJECTIVES

The primary objectives of the North Carolina Student Academy of Science are:

1. To promote and encourage the study of science and mathematics,
2. To identify and encourage students with an interest and aptitude in science, technology, and mathematics,
3. To assist in the development of students' scientific ability,
4. To facilitate students' use of their knowledge and abilities for the improvement of themselves, their schools, and their communities, and
5. To encourage the adoption of ethical and humanitarian attitudes.

The goal of the Academy is to serve as a learned society with its members and all those associated with its programs working together for the advancement of science in North Carolina.

WHAT THE NCSAS CAN DO FOR YOU

In working toward its goals and objectives, the North Carolina Student Academy of Science provides students with many challenges and opportunities. It provides opportunities for meeting other students from across the state with similar interests and ambitions. It serves as a resource information center for students and teachers. The District and State meetings of the NCSAS provide an opportunity for students to further their interests by hearing lectures and presentations by professional scientists, by visiting campuses and laboratories of North Carolina's colleges and universities, by attending and/or presenting reports on their own research and service projects, and by getting feedback and advice on their research from professional researchers.

MEMBERSHIP

Middle School and High School students become members of NCSAS automatically beginning on the day when they present the results of their research at either a District or a State Competition and lasting for one year after that.

ORGANIZATION AND OPERATION

There are nine districts across the state, as described below.

First District:
Beaufort, Bertie, Camden, Chowan, Currituck, Dare, Gates, Hertford, Hyde, Martin, Pasquotank, Perquimans, Pitt, Tyrrell, Washington

Second District:
Brunswick, Carteret, Craven, Duplin, Greene, Jones, Lenior, New Hanover, Onslow, Pamlico, Pender, Sampson, Wayne

Third District:
Durham, Edgecombe, Franklin, Granville, Halifax, Johnston, Nash, Northampton, Vance, Wake, Warren, Wilson

Fourth District:
Bladen, Columbus, Cumberland, Harnett, Hoke, Lee, Montgomery, Moore, Richmond, Robeson, Scotland

Fifth District:
Alamance, Caswell, Chatham, Davidson, Forsyth, Guilford, Orange, Person, Randolph, Rockingham, Stokes

Sixth District:
Anson, Cabarrus, Cleveland, Gaston, Lincoln, Mecklenburg, Stanly, Union

Seventh District:
Alexander, Alleghany, Ashe, Avery, Burke, Caldwell, Catawba, Davie, Iredell, Rowan, Surry, Watauga, Wilkes, Yadkin

Eighth District:
Buncombe, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania, Yancey

Ninth District
North Carolina School of Science and Mathematics

District Level

Each district is serviced by two Co-directors, one from secondary education and one from higher education. These leaders work in cooperation with the Executive Director. District meetings are held once or twice each year to facilitate (a) interaction among students, teachers, and scientists; (b) tours and observations of college facilities; and (c) selection of papers and projects to represent the district competitions.

State Level

At the state level, the Student Academy is served by the Executive Director, Co-directors representing the nine districts, At-Large Directors, and the student state officers representing the statewide membership, all of whom comprise the Board of Directors.

The highlight of Student Academy activities occurs at the annual state meeting. The annual state meeting includes the presentation of research papers, club project reports, award presentations,

guest speakers, and an annual business meeting at which state officers for the coming year are elected.

All student members and their sponsors are invited to attend and encouraged to participate in the activities of the Student Academy during its annual meetings. While in attendance at the meeting, the sponsors are responsible for the safety and conduct of the students under their care. All students attending the state meeting including individual members, must be supervised by a teacher, or parent or guardian. The North Carolina Student Academy of Science cannot assume liability for students or other persons attending NCSAS meetings.

STUDENT OFFICERS

Student officers of the NCSAS at the state level are the High School President, High School President-elect, and Middle School President. Officers are elected at the state meeting. Each year the High School President-elect is automatically elevated to the office of President, and a new High School President-elect and Middle School President are elected.

DUTIES

Student officers represent the state-wide membership as appropriate to the office, assist in developing and implementing policies and programs, and work in cooperation with the District Co-directors and the Executive Director to further NCSAS goals. They serve on the NCSAS Board of Directors and participate in Board meetings. The state officers also comprise the committee judging any club projects that are submitted at the state meeting.

In addition to these duties, the High School President presides at the state business meeting and performs all other duties normally associated with the office.

The President-elect learns the duties of the President, serves in his/her absence, and performs such other duties as assigned by the President.

The Middle School President assists the High School President in running the annual business meeting.

QUALIFICATIONS AND ELECTIONS

All candidates for elections must meet certain qualifications at the time of election:

A. Candidates must be members in good standing of NCSAS.

B. Candidates for High School President-elect must come from grades 8 through 10.

C. Candidates for Middle School President must come from grades 6 through 7.

NOMINATIONS

Nominations for the state offices may be made from the floor at the designated business meeting.

STATE ELECTIONS

Prior to the State Meeting the Executive Director will ask all students wishing to run for office to submit their names, desired office, contact information and a brief statement of their qualifications and plans for the office to the Executive Director. They will be introduced at the

State Meeting. and the statements will be provided to those in attendance. Each school in attendance will have one vote for each office. A secret ballot will be held, with run-offs as necessary to determine a winner for each office by majority vote.
Newly elected officers assume office at the next meeting of the Board of Directors after the State Meeting.

VACANCIES IN OFFICE

High School President's office - the High School President-elect assumes the duties of President.

In all other vacancies, the Executive Director appoints a student to fill the vacant office for the remainder of the term.

GUIDING PRINCIPLES FOR CONDUCTING ORIGINAL SCIENTIFIC RESEARCH

I. Select a Topic. What things interest you? For what kinds of problems would you like to find answers? Keep in mind that a good project will take a lot of your time! Choose something you will enjoy, something with which you will not soon become bored. Now that you have a topic in mind, get on the internet and go to the library. Search the literature to discover what others know about your topic. Try to find related experiments. Read everything you can find on your topic. As you read: narrow, refine, and change your research topic to encompass a problem that is limited enough for you to complete in the time available. If you discover the answer to the question you were thinking of testing, your test would be a demonstration, not an experiment. Don't panic and think that you must start over with a different topic. Analyze their problem, method of testing, and data. If your design is different, or if your method of controlling variables is different, then it is an experiment. If you take a different approach you just may get different results. Conducting the experiment is the only way to know for sure.

II. State Your Problem. After you have searched the literature and limited your field of study, the next step is to formally state your problem and objectives. What is it that you want to learn from this experiment and why? State your hypothesis; do not think of your hypothesis as an "educated guess", but as a guide for your experimentation.

III. Design the Experiment. Read and analyze your hypothesis. How could you test this hypothesis? Design an experiment or series of experiments to test this hypothesis. In your design, state the experimental variable and the method of controlling other variables. Include in your design the special equipment you will use, a sufficient number of trials to test your hypothesis, what observations you will make, and the methods you will use to analyze your data.

IV. Conduct the Experiment. As you conduct the experiment, record your observations in a log book. If appropriate, take photographs at various stages of the experiment. These pictures can be used as data and for your oral presentation.

V. Analyzing Data and Drawing Conclusions. The aim of all research is to gather data in order to support or reject a hypothesis. When presenting data, use graphs, charts and tables wherever practical. Remember that one experiment does NOT prove anything. Your conclusion should be "The data reject the hypothesis that .....", "The data support the hypothesis that .....", or "The data are inclusive." It is just as important to reject a hypothesis as it is to support a hypothesis. Be careful to record all information as objectively as possible. This is no place for science fiction!

VI. Presentation. You now have a product, but it will not sell if you don't market it correctly. Remember the project is not judged on its merit alone. It is your responsibility to clearly convey to the judges in only ten minutes your problem, your method of testing, conclusions, and the significance of the research. Use projected visual aids to present the vital information in an appealing manner. It is your research; be prepared to answer questions about all aspects of the project. If a judge asks a question related to your project but one about which

you have no knowledge, say you don't know. If you have an opinion, you can say "I am not sure, but based on what I have read, I think ...." The key to a good presentation is to be prepared, relax, talk to your audience and show your enthusiasm.

HOW TO GET HELP

Most people, including scientists, frequently find it necessary to call on others within their field or in related disciplines for advice and information. This is especially true for students who are just beginning to work on research projects. The following suggestions are offered to help students in their efforts to get information from scientists.

1. When a question arises while reading about a topic or working on a project, first do some digging on your own. Try to find the answer in the library. Librarians are always willing to help students find information. Search on the Internet. If you do not find an answer, at least you now have enough knowledge to ask an intelligent question.

2. When asking questions or requesting information, be very specific about what you need. Identify yourself by name and where you are a student, and include your grade level. This will provide an idea of the level and depth of information that is appropriate. Inform the listener that you are conducting scientific research. State clearly the problem or problems you are investigating.

3. Plan ahead and contact your consultants early. At least three or four weeks should be allowed for a response. If you write early, you can write again for clarification or more details.

4. A brief letter of thanks is always appreciated and appropriate. If your correspondence involves multiple letters, give your consultant periodic updates on your progress, including how the advice or information has been useful.

5. Small grants of up to $150.00 are available from the NCSAS Board of Directors to help students pursue their research. The grant proposal form is on the NCSAS website. Proposals must be received by the Executive Director, NCSAS, no later than January 1st in order to be considered.

GUIDING PRINCIPLES IN THE USE OF ANIMALS

The basic purposes of experiments involving animals are to achieve an understanding of life processes and to further man's knowledge. Such experiments must be conducted with a respect for life and an appreciation of humane treatment that must be afforded all animals. To assure humane treatment of animals, a qualified adult supervisor with training in the proper care of laboratory animals must assume responsibility for the conditions of any experiment involving

vertebrates. Experiments involving the use of anesthetic drugs, pathogens, ionizing radiation, carcinogens, or surgical procedures must be performed under the immediate supervision of a biomedical scientist experienced in the field of investigation. Documentation to show compliance must be completed before the project is conducted.

If you are not working under the supervision of a trained scientist, do not experiment with vertebrate animals or humans unless there is NO physical or psychological risk involved. Guidelines are available from the NC Science Teachers Association (www.ncsta.org).

The NCSAS Board believes that all student scientists have a responsibility to grant all animals and human research subjects every humane consideration and assurance for their comfort, well-being, and care. It is mandatory, therefore, that qualified adult supervision and student compliance with local, state, and federal guidelines for animal care and research are an integral prerequisite for any project considered for the NCSAS Competition.

WRITING THE PAPER

This is your summary of the months you have spent conducting research. A suggested paper format follows:

A. Title – A clear, concise, appropriate description of your project.

B. Abstract – a paragraph (a maximum of 250 words) describing your main questions, hypotheses, methods, results and conclusions.

C. Introduction – A brief description of the aims and purpose of the research. It should include a statement of the hypothesis or hypotheses.

D. Experimental Methods – A detailed description of the methods, experiments, and controls (including difficulties and remedies) used in the research. This section should be detailed enough that a knowledgeable researcher could duplicate your experiment.

E. Results and Conclusions – Summary of your experimental results and conclusions. Strive for quantitative observations. This material should be presented in tables or graphically wherever practical. Photographs and drawings may also be used. This section may also include an evaluation of the success of the experiment and suggestions for future research. A good piece of original research often raises more questions than it answers. Note: a complete record of every instrument reading and happening observed should not be included here but can be attached to the paper as an appendix.

F. Bibliography – List of all books, journal articles, URLs, other publications, and communications from which significant material was drawn for the research.

G. Acknowledgments – Give credit for assistance received from scientists, instructors, parents, etc. You may also give credit to literature listed in the bibliography from which essential material was obtained.

It is permissible to use first person when writing your paper. Carefully proofread your paper. If your paper contains numerous errors, the reader may assume that your experiment was conducted with the same carelessness.

COMPETITION AND JUDGING

The North Carolina Student Academy of Science sponsors two types of projects: club projects that the club does as a group, which aid the club, school, or community, and individual research projects. Individual research projects are carried out by individual students or a team of 2-3 students who conduct research in some appropriate area of science, technology or mathematics and then prepare research reports. Active science clubs and their members can conduct club service projects related to science. Research reports from these projects are presented in competition at the district and state meetings each spring. All forms for registering, entering a project, animal use, etc. are available at the Student Academy website www.ncsas.org.

INDIVIDUAL RESEARCH PROJECTS

No later than two weeks before the District competition each student must submit a completed entry form on the Student Academy website (www.ncsas.org) and send a copy of her/his paper by email, fax or postal mail to one of the District Co-directors for that District. If a student is unable to participate when the District competition is held, the student may contact one of the District Co-Directors to explain the issues or concern that prevent participation, and the Co-Director will make a decision about whether to certify the paper for competition at the State level.

In Districts where there is a District competition, the District Co-Directors must certify each paper that goes on to the State Competition.

In the State and District Competitions, papers will be screened and placed into one of the following categories:

I. Behavioral Science

II. Biological Science

III. Biotechnology

IV. Chemistry

V. Computer Science

VI. Earth / Space Science

VII. Environmental Science

VIII. Mathematics

IX. Physical Science/Physics

X. Technology/Engineering

Papers meeting Advanced criteria (see below) are judged separately from other papers in that Category.

The District Co-directors make the final decision on the category for each paper submitted for district competition. A similar decision will be made at the state level by the Executive Director.

Each student presents his/her paper orally, and the projects are evaluated by a panel of judges. Ten minutes are allowed for the presentation and five minutes for questioning. Only the judges may ask questions. Presenters are encouraged to bring their slides on a thumb drive. Pcs and projectors are also provided.

If a research project was done jointly by 2-3 students, all members of the team may present the paper and answer questions. Only students who participate in presenting the project can be considered for awards. The same time allowance described above for a single presenter for presentation and questions applies also to joint papers.

Projects are judged at different levels. The junior level includes students in grades 6-8. The senior level includes grades 9-12. Advanced projects, those that meet any of the following criteria, are judged separately:

A. The student spent or received gifts worth more than $200 for the project in addition to materials provided by the school (audio-visual supplies are excluded).

B. The student researcher worked under the direct supervision of an employee of a hospital, college or university, commercial laboratory or industry, or a professional research organization.

C. The student used a data base of which a substantial portion was obtained from instrumentation or other procedures that the student researcher did not personally operate or perform.

D. The project is a continuation of a study for which results have previously been reported by other students.

Students compete with other students at their own level and within a specific category. The following criteria are used in judging individual and team research projects at the district and state levels:

1. Experimental design

Including: creativity, completeness, and logical consistency (i.e. did it really test your hypothesis).

2. Research paper
Including: organization, clear presentation of data, proper use and citing of references, and proper English usage.

3. Presentation
Including: organization, clarity, use of visual aids, and direct response to questions.

At the district level, judges determine winners in each category according to the accomplishment shown by the projects. A maximum of three winners from each category at each level may be chosen to represent the district at the State Meeting. Two additional entries may be recommended by the District Co-director.

The rules for presentation and judging at the State meeting are similar to those for the District meeting.

CLUB SERVICE PROJECT COMPETITION

Competition includes science-related work performed by clubs which aids the club, schools, or community. This competition is intended to promote community involvement among students interested in science. Club projects are important as they promote visible improvements, develop favorable local publicity and support, and provide encouragement and involvement of students.

In this area of competition, oral project reports are presented to and judged by the students themselves. No later than two weeks before the district competition each participating club must submit a completed entry form on the Student Academy website (www.ncsas.org). If a club is unable to participate when the District competition is held, a club representative may contact one of the District Co-Directors to explain the issues or concern that prevent participation, and the Co-Director will make a decision about whether to certify the project for competition at the State level.

In Districts where there is a District competition, the District Co-Directors must certify each project that goes on to the State Competition. In Districts where there is no District competition scheduled, a club representative may contact one of the District Co-Directors to explain the issues or concern that prevent participation, and the Co-Director will make a decision about whether to certify the project for competition at the State level.

The following format is recommended for the written report to be submitted at the time of registration:

1. Title
2. Objectives--reasons for projects, goals, who benefits

3. Method
4. Progress
5. Acknowledgments

The following guidelines are used for judging and should be addressed in the report:

Originality of Project
Degree of club involvement in project
Degree of community involvement
How beneficial was the project
Lasting or continuing impact of project
Were the objectives of the project met
Organization of presentation
Response to questioning
Use of visual aids

Each group project is allowed 10 minutes to present the club's project to the committee. This presentation may include charts and other audio-visual aids; however, clubs must provide any equipment other than computer and projector needed in the presentation.

After all of the projects have been presented at the district meeting, the judging committee chooses the winning project by vote. The project receiving the most votes represents the district in state competition. However, in special circumstances where there is more than one outstanding project, the district committee may recommend two projects for competition at the state level.

At the state level, the judging committee consists of the state officers with the state president presiding. Any student officer whose club is in competition is disqualified from the judging committee. If a majority of the district officers and state officers are eliminated, presidents of non-competing clubs may be added to the judging committee at the State level by the Executive Director. Each group project is permitted 10 minutes for presentation, and the judging committee is permitted 5 minutes to ask questions at the end of the presentation. No questions are permitted from the floor.