Judges Handbook

HOOSIER SCIENCE & ENGINEERING FAIR

a program of

SCIENCE EDUCATION FOUNDATION

SEFI

OF INDIANA, INC.

The Science Fair: What it is and your role in it?

The purpose of the science fair is to give young people the opportunity to actually do some science. Along with your role as an evaluator of student projects, you will also have the job of reinforcing that purpose as well as encouraging, motivating, and even sometimes doing a little teaching. Even a participant whose project is of modest quality should feel a sense of accomplishment and be proud of what he or she did. Clearly, you have a critical responsibility in the success of this enterprise.

The Hoosier Science and Engineering Fair (HSEF)

The Hoosier Science and Engineering Fair includes about 200 student participants from grades 4 through 12. They come from throughout Indiana. They are all selected after competing in regional science fairs. In addition, most of the students have previously won at local science fairs. Senior division projects (grades 9-12) will be selected to participate in the Intel International Science and Engineering Fair (Intel ISEF) with all expenses paid by SEFI.

Your relationship with the students/participants

As stated above, the students you meet probably already have won or placed in their school science fairs. They will be proud of their accomplishments and should be able to explain their projects clearly and concisely. This explanation should include what they did as well as their results and conclusions. Their displays should clearly show the intent and outcomes of experimentation, and they should be able to answer questions about their projects at levels appropriate to their ages and grade levels. They should be able to describe the methodology and equipment employed and the thought processes that were used to develop their hypotheses, experimental designs, results, and conclusions.

You should not be surprised to find projects vary widely in quality and sophistication. Some projects, particularly at the high school level, may be comparable to graduate school work – and occasionally beyond. Some displays will be elaborate while others may be relatively simple. The purpose of the display is to clearly communicate the project's purpose, hypothesis, methodology, results, conclusions, and other information relevant to the investigation. A simple, clear, and well-organized display is to be preferred over one that is ornate but falls short of accomplishing this purpose. Although the fact that a display is attractive should be taken in account, scientific content, and the ability to communicate that content is of primary importance.

Confidentiality The judging process must remain confidential. Judges should not disclose any information regarding their findings and conclusions except to those on their judging panel and Science Fair officials.

Conflicts of interest If you find that you are acquainted with a student you have been assigned to judge or you think another kind of conflict of interest (real or perceived by others) may be present, inform Science Fair officials as soon as possible so that you can been assigned to another judging panel.

Rules and regulations It is not your role to enforce Science Fair rules or other regulations (local, state, or federal) regarding the projects you are judging. If you think that a project has violated a rule or regulation, do **not** bring up the matter with the student(s). Rather, discuss the matter later with the Science Fair Coordinator or Judging Director for your group. Since all projects were screened before being accepted into the Science Fair, you should assume that projects you judge are in compliance with all relevant rules and regulations. Therefore any allegations of rules violations should not be part of the judging process and should not be discussed when deciding on awards.

Treating students with respect In most cases, Science Fair projects represent a significant enterprise on the part of the student participants. Although a project may have flaws, you should treat it as the serious project it is meant to be. In doing so, listen carefully to the student's description and explanations, ask questions in order to reveal his/her understanding of the project and its conclusions as well as the relevant science, and while evaluating the project fairly and candidly, provide praise for the accomplishments demonstrated along with your appraisal.

Educational value of interviews As stated above, the completion of a Science Fair project should result in significant learning. Although the primary purpose of the questions asked during judging will to evaluate the project and its results, the student should emerge from the process with further insights, understanding, and even ideas about additional investigations. In other words, the best questions will cause the student to think more deeply about the project and become aware of issues not previously considered. Questions which may cause the student to further pursue the subject are encouraged.

Judges often want to help the student with information about the subject of the project, particularly if the judge finds that certain points require clarification or correction. This is commendable, but if information is provided by one judge, the student may use that information in his/her interview with the following judges. This could result in a distortion of subsequent ratings. If you wish to correct misconceptions or errors, it is best to do this by asking questions (e.g., "Have you considered the effect of air pressure on the speed of a baseball?") and/or suggesting to the student that he/she reexamine the areas in question.

The Judge-Student Relationship

The following was taken from the Judging Handbook, California State Science Fair, 2002 and adapted by Robert Allison of the Kern County Science Foundation and Judy Day of the NC State Science Fair

Not infrequently, a judge is especially impressed with a student or project and would like to offer help or advice, or even a job. If you wish to do this, contact the Judging Director or Science Fair Coordinator. If direct contact between a student and judge after the Science Fair would result in further benefit to the student, such contact will be facilitated by SEFI, but only with the approval of the parent or guardian. Judges may not ask students for their phone numbers or initiate or propose any future contact.

Inappropriate comments by a judge to any participant are unacceptable. Such behavior is sufficient grounds for barring that judge from future science fairs. Judges must adhere to the highest standards of professionalism in all cases.

It is important to remember that students participating in the Fair are elementary, middle, and high school age. They are not adults. The relationship of student to judge is that of a minor to any adult in a position of authority.

It is the responsibility of all judges to ensure that all interactions between themselves and the students are in the best interests of the students.

The Judging Process

Preparing for judging

During the fair, things will go pretty fast. It is, therefore, important that you are prepared when you arrive. It is suggested that you do the following in the days before the Fair.

- Read this manual and become familiar with the judging guidelines and worksheet.
- Read the abstracts of the projects in the grade level you will be judging
  (Note: a login link will be emailed to you with instructions for reviewing abstracts).
- Prepare preliminary interview questions.

Pre-Judging Activities

- Orientation Meeting – Upon your arrival, and after you have time to partake of coffee and doughnuts (or other refreshments), there will be a meeting to review procedures and provide the latest information.
- Judging panel meeting – Immediately following the orientation meeting, your judging panel will meet. The chair will go over any special issues and procedures involved in the categories you will judge and will assign any project interview schedule changes. The most important purpose of this meeting will be to formulate questions to be asked of all students. Although some variety in questioning is fine, the judges must agree on a primary set of questions in order to establish a common basis for ranking the projects. We will be using a 10 minute interview period with 3-5 minutes to finalize and get to the next interview.

Judging Procedures

- Begin by introducing yourself and putting the student at ease.
- Ask the student to explain the project. He/she likely will have prepared a brief (not more than a minute or so) presentation.
- Following the initial presentation, ask questions designed to clarify aspects of the project and to determine how the student got the idea for the investigation and her/his level of understanding of both the project itself and its underlying science.
- After interviewing a project, scores are to be entered into our online scoring system. Please do not hold all your scores until the end of the day. Scores not submitted in a timely manner may not be considered by the group during caucusing.

  If you enter a score incorrectly or need to change it, see the Judging Chair to have your score edited.
- As indicated above, you should ask questions to determine the student's understanding of the scientific principles that form the basis for the project. These questions should be appropriate to the student's age and grade level, but do not hesitate to probe the student's depth of knowledge. Often you will be surprised at the scientific sophistication demonstrated even by elementary and middle school students.
- Sometimes students will have received help with their projects. This is acceptable as long as the help is limited, and that project really was conceived, developed, and carried out by the student. If the student demonstrates good understanding of the project as well as its scientific basis and conclusions, it is likely that he/she did not receive unwarranted assistance. If the project required equipment, understanding of scientific concepts, or knowledge of procedures which are unlikely to be available to someone at that grade or age, it is appropriate to ask how he/she acquired the equipment or came to understand those concepts or procedures.
- Judging should be done by one member of the panel at a time rather than by the whole group at once. This is more likely to put the student at ease during the interview and affords a greater level of individual interaction with panel members.
- It is imperative that you follow the assigned schedule and use the full interview time allotted for each project. Do not skip around through your schedule.
- After the morning round of judging is completed, the panel will meet during lunch to begin the caucusing project. Panel members will then complete the interview process, making certain, as mentioned above, that all potential winners are interviewed by as many judges as possible.
- Following the completion of interviews, the panel will meet again to determine the first, second, and third place. This process **must** be completed, and results turned in to Science Fair officials no later than the designated time. This is essential in order to prepare for the awards ceremony.

It is up to the judging panel to determine the method by which it reaches it decisions about project rankings and awards. It is important, however, that this process is collegial in nature, involving all of the panel members. No one member, not even the panel leader, should be seen as the final authority in making

these decisions. Sometimes ranking decisions will be determined quickly and unanimously. In other instances, considerable discussion will be required. After discussion is completed and a decision reached, all panel members should feel that their opinions were heard and seriously considered even if those opinions did not always prevail. Finally, if consensus cannot be reached after discussion, the fairest way to reach closure is through a vote. Needless to say, all panel members should treat each other with courtesy and respect.

Judging Criteria

It critically important that judging be based primarily on the scientific merit of the projects. This includes the project itself, the student's knowledge of the scientific and/or engineering principles underlying it, and his/her comprehension of the project's basis, experimental design, outcomes, and implications. A good project must consist of an **investigation** and not be merely a collection or demonstration of technology or scientific principles, however impressive. Sometimes displays will be elaborate and polished. This should be given credit only to the extent that its elaborate nature results in more effective communication of the purpose, hypothesis, methods, results, and conclusions reached in the investigation. A polished display is not a substitute for good science.

What makes a good science fair project?

A good Science Fair project involves the student in a journey of discovery, driven by curiosity. It typically starts with an interest in some scientific subject, such as biology or geology. As a result of learning about the subject, the student may propose a *hypothesis* and then do further background research. The student then develops an experimental procedure that will produce data, from which she/he can draw conclusions to prove or disprove the hypothesis. More often than not, new *hypotheses* will result from the experiment, leading to new experiments, which might be done in the future.

A hypothesis typically takes the form of "If I do this, then that should happen." **A good hypothesis is not just a guess about what might happen if something is done, however. It is based on some knowledge of the subject, usually gained from reading and observation.** A quality Science Fair Project directs the student's efforts toward a particular result or expectation; undirected experimentation just to find out what happens is play, not science (although notable discoveries have been made in this manner, they are notable because they were "accidents").

All science fair projects should include the following steps:

- Conduct background reading and study
- Write a hypothesis
- Do further reading and study
- Develop an experimental procedure to investigate the hypothesis
- Obtain or construct the apparatus needed for the procedure
- Operate the apparatus or conduct the procedure to collect experimental data. Record the data as you collect it.
- Repeat the procedure and record new data to make sure that you are getting reliable results.
- Analyze the experimental data
- Arrive at conclusions
- An explanation of the results and conclusions.

It is important to understand that proving the hypothesis is NOT the purpose of a Science Fair project. It is the intent of the Science Fair that students go through the process of asking questions and performing experiments in an attempt to find answers.

Teachers and Parents are advised to encourage students to develop a project that genuinely interests them. Judges will occasionally ask students why they chose to do a particular project, and it usually turns out

that the best work is done by students who are motivated and inspired by their curiosity about what they are investigating. Students who developed a project simply because a teacher or parent expected them to do so often will produce mediocre results.

Specific Judging Criteria

At the Hoosier Science and Engineering Fair, we utilize the scoring guidelines established by the Intel ISEF. Since the criteria are closely related, the elements included in them can overlap. We have constructed a judges workbook with worksheets to track interviews.

Judging Criteria for Intel ISEF

The following evaluation criteria are used for judging at the Intel ISEF. As shown below, science and engineering have different criteria, each with five sections as well as suggested scoring for each section. Each section includes key items to consider for evaluation both before and after the interview. Students are encouraged to design their posters in a clear and informative manner to allow pre-interview evaluation and to enable the interview to become an in-depth discussion. Judges should examine the student notebook and, if present, any special forms such as Form 1C (Regulated Research Institution/Industrial Setting) and Form 7 (Continuation of Projects). Considerable emphasis is placed on two areas: Creativity and Presentation, especially in the Interview section, and are discussed in more detail below.

Creativity: A creative project demonstrates imagination and inventiveness. Such projects often offer different perspectives that open new possibilities or new alternatives. Judges should place emphasis on research outcomes in evaluating creativity.

Presentation/Interview: The interview provides the opportunity to interact with the finalists and evaluate their understanding of the project's basic science, interpretation and limitations of the results and conclusions.

- If the project was done at a research or industrial facility, the judge should determine the degree of independence of the finalist in conducting the project, which is documented on Form 1C.
- If the project was completed at home or in a school laboratory, the judge should determine if the finalist received any mentoring or professional guidance.
- If the project is a multi-year effort, the interview should focus ONLY on the current year's work. Judges should review the project's abstract and Form 7 (Intel ISEF Continuation Projects) to clarify what progress was completed this year.

Please note that both team and individual projects are judged together, and projects should be judged only on the basis of their quality. However, all team members should demonstrate significant contributions to and an understanding of the project.

Judging Criteria for Science Projects

I. Research Question (10 pts)

___ clear and focused purpose
___ identifies contribution to field of study
___ testable using scientific methods

II. Design and Methodology (15 pts)

___ well-designed plan and data collection methods
___ variables and controls defined, appropriate and complete

III. Execution: Data Collection, Analysis and Interpretation(20 pts)

___ systematic data collection and analysis

___ reproducibility of results
___ appropriate application of mathematical and statistical methods
___ sufficient data collected to support interpretation and conclusions

IV. Creativity (20 pts)

___ project demonstrates significant creativity in one or more of the above criteria

V. Presentation (35 pts)

a. Poster 10 pts)

___ logical organization of material
___ clarity of graphics and legends
___ supporting documentation displayed

b. Interview (25 pts)

___ clear, concise, thoughtful responses to questions
___ understanding of basic science relevant to project
___ understanding interpretation and limitations of results and conclusions
___ degree of independence in conducting project
___ recognition of potential impact in science, society and/or economics
___ quality of ideas for further research
___ for team projects, contributions to and understanding of project by all members

Judging Criteria for Engineering Projects

I. Research Problem (10 pts)

___ description of a practical need or problem to be solved
___ definition of criteria for proposed solution
___ explanation of constraints

II. Design and Methodology (15 pts)

___ exploration of alternatives to answer need or problem
___ identification of a solution
___ development of a prototype/model

III. Execution: Construction and Testing(20 pts)

___ prototype demonstrates intended design
___ prototype has been tested in multiple conditions/trials
___ prototype demonstrates engineering skill and completeness

IV. Creativity (20 pts)

___ project demonstrates significant creativity in one or more of the above criteria

V. Presentation (35 pts)

a. Poster (10 pts)

___logical organization of material
___clarity of graphics and legends
___ supporting documentation displayed

b. Interview (25 pts)

___ clear, concise, thoughtful responses to questions
___ understanding of basic science relevant to project
___ understanding interpretation and limitations of results and conclusions

___ degree of independence in conducting project
___ recognition of potential impact in science, society and/or economics
___ quality of ideas for further research
___ for team projects, contributions to and understanding of project by all members

Other judging issues:

• Comparing projects with widely different levels of sophistication

Sometimes students have access to sophisticated laboratories, have advanced scientific equipment available to them, and/or carry out their projects under the guidance of a professional scientist. Comparing such projects with those done in a home environment can be difficult. As a judge, you should not be the position of assuming that a project would have been better or worse with or without the advantages of better equipment or instruction.

The critical issue here is not the level of the tools used. Rather, it is what the student has done with the resources at his/her disposal. If advanced instrumentation is used to further a strong scientific investigation, and that is clearly communicated in the interview, such a project should do well. However, a student who does better science and has superior understanding but used only items found in an ordinary kitchen deserves a better rating. The mere use of sophisticated equipment in a weak project and/or by a student who does not understand the scientific principles involved should receive little or no credit.

Finally, it is important that the student's knowledge should be appropriate to the project and its goals. If advanced instrumentation is used, for example, the student should be conversant with the principles underlying that use, and how results obtained from the equipment relate to conclusions reached.

• Team vs Individual projects

The criteria for judging team projects are the same as for those done by individuals. It is important, however, that each member of the team demonstrates her/his significant contributions to the project and comprehensive understanding of it. This can be accomplished through statements made in the interview by each team member and/or by questions asked by the judge. In conducting the interview, the judge should direct questions to individual team members to make sure that each one has an opportunity to speak. This is especially important if the team has chosen to have one member make the formal presentation about the project or to direct certain questions to the team member with expertise in that area.

Because a team will have more physical and possibly brainpower resources than an individual, it is appropriate that teams be expected to produce higher quality projects than those working alone.

Remember that the best projects should win, whether it is an individual or team effort.