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Judging Handbook

We thank the Calgary Youth Science Fair for letting us adapt this manual for our use.

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THE OTTAWA REGIONAL SCIENCE FAIR

The Ottawa Regional Science Fair (ORSF) is a registered charity and non-profit organization that is dedicated to holding an annual science fair competition for elementary and secondary students in Ottawa and the surrounding area and was founded in 1960. The fair is entirely run by a volunteer committee of about 15 to 20 people each year. The annual budget of about $50,000, covered by our generous sponsors and a registration fee paid by each participant.

Our website orsf.ca in English and esro.ca in French.

WHAT IS THE ROLE OF JUDGES AT THE ORSF?

The judging experience for our science fair students is an integral part of the learning process and your role as a judge is very important. Interviewing the students, evaluating their projects and giving them appropriate verbal and written feedback introduces them gradually to the next step in the scientific process – peer review.

It is essential that students leave our fair with a positive feeling about themselves, their projects and about science. It is your responsibility to make sure that this happens. Therefore, make your comments in a positive way.

HOW ARE PROJECTS SELECTED TO ENTER THE ORSF?

We accept up to 10 students per school in each of our three age categories, junior (grade 7 and 8), intermediate (grade 9 and 10) and senior (grade 11 and 12). Students may participate in a school fair where a selection is made about who continues on to the ORSF, or they may register directly for our fair. We rely on participating schools to ensure their own selection criteria are applied to who comes to the ORSF. A maximum of two students per project is allowed.

Students must have followed our prescribed safety procedures during their experimentation and must also pass an on-site safety check before they are allowed to bring their projects and supporting materials into the ORSF.

THE SCIENTIFIC METHOD

Projects should demonstrate a thorough understanding of the scientific method. The scientific method attempts to remove bias when testing a hypothesis or theory. The scientific method comprises the following steps:

- a reasonable hypothesis is defined after a student has completed background reading

- relevant research (often including experiments) is conducted to evaluate the hypothesis
- a conclusion relating directly to the hypothesis is reached.
- A discussion and explanation of the results (unexpected or expected), including ideas on how the project might be expanded and how results might be applied in the future, is essential.

The following sections give an overview of what a very thorough and complete project should include. Note that this level of detail is what we want to encourage students to aspire to as they grow in their science fair journey. Often elements may be missing or be incomplete and you can encourage them to think how adding these pieces would enhance the quality of their projects in the future.

EXPERIMENTAL PROJECTS

Problem/Purpose: The problem is a concise statement of what is to be investigated. The student should not be testing variables that are not part of the problem.

Hypothesis: This is what the student predicts will be the result of the experiment. The statement is a 'best guess' as to what is going to happen and why based on existing knowledge and any background research.

Background Information: This is the research that the student has conducted on the project prior to conducting the experiment. The information should be in the logbook and/or their poster and includes research notes and a list of references from credible sources.

Variables: There are several types of variables that should be described and explained in the project.

- ***Fixed or controlled variables*** are values and quantities that are kept constant and do not change throughout the entire experiment.
- ***Manipulated (independent)*** variable(s) are changed in the experiment by the student to produce possible changes in the responding variables. Only one variable should be manipulated per experiment.
- ***Responding (dependent)*** variable is what changes when another variable is manipulated. This is what the students are measuring during their experiment.

Example: *The plants grew taller after the amount of available light was increased. The light level is the manipulated (independent) variable, the height of the plants is the responding (dependent) variable and the room temperature, type of soil, seeds and the quantity of water are examples of fixed variables.*

Variables should be listed on the board and the student should be able to identify the fixed, manipulated, and responding variables of the experiment.

Procedure/Method: This should be stated clearly and in sufficient detail that the experiment can be duplicated exactly using the directions given. There should be at least three trials. There should be a control sample that is not manipulated.

Example: *In testing to see which of 4 detergents washed best, the student took 15 pieces of the same kind of cloth and stained them identically. One piece was used as a control sample and washed in water. Three pieces were then washed in detergent A, and then another 3 in detergent B and so forth. This constitutes one trial with a sample size of 3. The experiment is repeated twice more to give a total of 3 trials.*

Materials: They must be listed separately on the backboard or be included in the procedure.

Data/Observations: These are the observations and raw data collected at the time of the experiment and recorded either manually or digitally. They should be clearly displayed on the backboard in tables or charts. The charts/graphs should be clearly labeled and include the proper units of measurement.

Interpretation: The student(s) should be able to explain how the raw data relates to the problem/purpose. This may include calculations, charts, graphs, or an explanation of the raw data. What were their variables? Why are their results important? Are there practical applications for their research? How can the experiment be expanded or taken further?

Experimental Error: Students should be able to give potential sources of error either verbally or summarized on the backboard. They should recognize sources of error and be able to explain how these errors would have affected their project.

Conclusion and summary remarks: These remarks should make reference to the problem/purpose and hypothesis. Was their hypothesis correct?

Logbook: Participants should have a record of their research, either as a handwritten logbook or in digital form, available to review at the fair. It should contain all background research (books read, contacts made, etc.), steps taken, experiment setup, data, observations and research the student recorded during the experiment. As well, all drafts of experiment write up should be available. Even rough copies of the raw data should be included in the log book.

Scientific Accuracy: When judging experimental projects, you are not judging for scientific accuracy, but rather whether the students have employed the scientific method correctly and whether or not their observations and conclusions are consistent with the data collected. Students should not be penalized for not being aware of all scientific theories which may apply to their experiment.

Backboard Presentation: Project backboards should be tidy and legible with the experiment presented in its entirety, in a clear, logical manner. No discrimination should be made between projects done on the computer or written by hand. You may acknowledge a backboard that was done in a particularly creative or visually appealing way.

NON- EXPERIMENTAL PROJECTS (STUDY OR INNOVATION)

These projects involve a considerable amount of research and may include literature surveys, construction models, computer programming projects, engineering design and case studies. The following should be included in the project:

Research Topic: The student should have this clearly stated and it should be evident throughout the project.

Research: The student should obtain information from various sources. The student should have talked or written to experts in the field they are researching and read books and articles related to the subject.

From this research they should be able to:

- Summarize their research on a backboard and give a logical explanation of the findings
- Provide an explanation for conflicting information. If two sources of information say two different things, the students should provide reasons why they chose one over the other, or why both could be correct.
- Provide a research report on their subject. This should be detailed and the students should be able to answer questions on the material in the report.
- Show a logbook that has a record of all their research notes. This should include contact information and a bibliography of references consulted.
- Draw logical conclusions based on the information supplied in the presentation.

Occasionally the students will build a model based on research. They should be able to explain the model and how it works. An exceptional project will include limitations of the model's use.

A good project will also make reference to:

- Applications of the research. Why are people studying this subject?
- Areas of future research related to the subject.

Logbook: The logbook should contain all the information that the student gathered in order to complete their project.

SUMMARY: TYPES OF PROJECTS

Experimental projects:
These projects involve an investigation undertaken to test a scientific hypothesis using experimentation. The student must recognize variables affecting their research. Manipulated variables are clearly identified and changed one at a time for each experiment. Within each experiment, controlled variables are used to test the outcome of the manipulated variables on the responding variables.
Repetition and (or) sample size is used to verify results obtained in the course of research. Sources of experimental error are identified and allowances have been made for them. The progress of the research is noted in the logbook.

Innovation projects:
These projects focus upon the development and evaluation of innovative devices, models or techniques in technology, engineering or computers (hardware or software). The student should demonstrate an understanding of the properties of the materials/methods used and the reasons for choosing them. An understanding of the effectiveness of the design is essential. The innovation should be tested and modified if shortcomings are noted.

Study Projects:
These projects involve the collection and analysis of data to reveal evidence of a fact or a situation of scientific interest. It could include a study of cause and effect relationships or theoretical investigations of scientific data. These projects include literature surveys, construction models or case studies.

In presenting projects of this type the information should be of considerable depth, quantity and variety. The scope of the topic (whether far-reaching or of very narrow focus) should be understood by the student. The gathered data needs to be critically analyzed and interpreted by the student and the progress of their research should be chronicled in their logbook.

ON THE DAYS OF THE FAIR

Friday at 11 AM Orientation

Please arrive at the time given to you by email before the fair if at all possible. Please arrive on time. We will start with an orientation for all judges. You will also have a chance to meet the team you are a part of. Each team will judge the same projects and will debrief together at the end to ensure that you agree on the marks given to each project. A light lunch will be served.

12 PM – Preview without students

You will have one hour to visit the presentation hall without students present. This gives you a chance to quickly compare the projects on your list as well as getting a sense for the overall quality of projects at the fair so you have a bit of a baseline when you start judging.

1 PM to 4 PM - Judging

During this time period you will visit each project that you need to judge. It is up to you to give yourself enough time for each project and to find a time when they are not busy talking to another judge. It may be helpful for your team to decide on an order that you will each visit the projects in. It is important that you interview and evaluate each of the projects INDIVIDUALLY and not as a team.

4 PM to 4:30 PM - Judging Team Meeting

When you have finished evaluating all of your projects, meet your team in the judges' room/area. The final mark of each project does not have to be a mathematical average, but all judges should be in agreement if at all possible. Once you are happy with your marks please turn them in to us right away.

Your scores will determine first, second and third place winners in each age category, as well as the winners of the challenge awards (awards given by type and field of science).

The data will also be used to determine second round judging on Saturday morning for our grand awards.

Please make constructive comments on the judges' forms which we will give to the students on Saturday as their feedback from you.

Saturday, 8:30 AM to 11:30 AM - Judging
Arrive by 8:30 AM for orientation and for an opportunity to see the projects before the students arrive at 9. If you are participating in judging on Saturday you will evaluate projects that have been shortlisted to win one of the grand awards. These include the best-in-age category awards, the scholarship awards, the Canada-Wide Science Fair participants, and the Best-in-fair awards.

THE INTERVIEW

This is the most important part of the Science Fair. The only chance for some students to present their project will be to you and your team members. It is important that you spend as much time as possible with the student. Your time should be divided between the presentation and discussion, with some time to complete the evaluation form.

Presentation: Smile, introduce yourself and invite the student(s) to present the project *("Could you tell me about your project?*"). It is better if you sit and they stand when doing the presentation. Listen to the student and do not look at other things. Please be aware of your body language. Be friendly and open; the students are often nervous so it is important for you to make them feel at ease.

Discussion: When the student has finished the presentation, try to summarize and paraphrase the project. This will allow the student to correct any misconceptions that you have as well as show that you have listened to their project. You can ask questions, and try to use 'I' statements. Make sure you speak to them at a level appropriate for their age and knowledge.

When you have finished asking questions, be sure to thank the student for the presentation. You should also give them some praise about an aspect of the project that impressed you.

Useful Questions to Ask Students:

- How/Why did you choose this topic?
- What are the independent and dependent variables?
- What do your graphs tell you?
- Why did you choose this method (type of graph, rank the results, etc.) to interpret your data?
- Did you have a control group? What does it tell you?
- Can you think of other experiments that you could do dealing with this subject?
- What is the application of this experiment to daily life?
- What are some possible sources of error? (What wasn't controlled as carefully as it may have been?)
- If you did this experiment again what would you change?
- What did or did not work?
- What are some of the most important aspects of your experiment?
- What were your sources of information?
- Who helped you with your project? What support did they provide?
- Tell me (more) about…

THE EVALUATION

Making notes after a student's presentation will help you evaluate the project and write comments later. It is easy to forget the details of a particular project after judging 4 or 5 of them. However, do not complete the evaluation forms in front of the students.

After interviewing a student, fill out the evaluation form. Remain open to changing these marks after viewing further projects. Be consistent in your marking.

- Make sure you follow the rubric! Remember that marking too hard penalizes good projects, while marking too easy gives undeserved awards.
- Be objective and listen carefully. Give all students an equal opportunity. You may encounter the 'same' project topic more than once, but it doesn't mean they are all done equally well.
- Mark the science and the clarity of their communication both orally and through their backboard.

Once you have finished marking all the projects, meet with your team in the judging room/area. Compare notes and marks for the projects and find a mark that the group can agree on. It does not have to be the average of the marks. When you have finished giving marks to all your projects, hand in your sheets to our team.

Feedback for Students

All students who participate in the ORSF have worked very hard and have done their best. Their efforts should be recognized under all circumstances.

Feedback is the only way the students learn how they did on their project since they don't see their marks. Your comments are vital and let the students know how they could add material to or improve their project. IT IS IMPORTANT THAT STUDENTS LEAVE WITH A POSITIVE FEELING ABOUT THEMSELVES AND THE SCIENCE FAIR EXPERIENCE.

You should point out where the student has done well and where they can improve.
Print or write legibly.

Things to keep in mind:

- It is important to provide this feedback so that the student is aware of where improvement needs to be made in future years. Make sure you tailor your remarks to the level of proficiency they have attained. For example, if a bronze medal winner receives no indication of where they can improve, they might wonder why they didn't receive a silver or gold medal.
- You can either make up comments or use some of the suggested words and phrases we have listed in this book for your convenience. We prefer that you make your own as the comments seem more genuine.

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SANDWICH TECHNIQUE

This technique allows you to give comments in a positive and encouraging framework by 'sandwiching' a suggestion between two positive statements.

Sandwich technique = positive/helpful/encouraging

For example, you might say or write to a student:

> *"I really like the way you chose to present your results in a graph.* (POSITIVE)
> *Perhaps next time you could label the axes so that persons reading your graph will know what it is that you measured in your experiment.* (HELPFUL)
> *Once you used words to explain your graphs to me it was very clear that you used them to show the relationship between A and B. That was well done!* (ENCOURAGING)*"*

Useful Sentences:

- Your objective was clear and your project was well organized and led to an interesting conclusion.
- You chose an interesting topic to demonstrate and used a variety of models to emphasize the points you made.
- Your use of models and diagrams made your project come alive.
- Your topic was interesting and presented in a visually clear manner.
- Your understanding and use of scientific vocabulary certainly added to your project.
- The conclusions you reached were well documented by your research.
- Your experimental design was clear and well thought out. It showed a good understanding of your question.
- Your creativity in developing a method to prove your hypothesis is commendable.
- Your ability to summarize your data in an interesting and meaningful way shows a good understanding of the topic.
- It was interesting to observe how you recognized and controlled the variables in your experiment. Your collection of data was precise and orderly and showed care in your experimentation and observation.
- Your conclusions are valid and are the result of careful experimentation and recording.

Useful Phrases:

- Thank you for…
- Keep up the good work.
- It was a pleasure to learn about…
- I really like the way…

- Congratulations for…

Useful Words: original, excellent, well thought out, unique, exceptional, high quality, creative, clever, impressive, valuable, remarkable, ingenious, amazing, commendable, enthusiastic, eager, scientific, intelligent, interesting, inspiring, superior, resourceful, capable, innovative, well prepared, imaginative, hard work, worthwhile, meticulous, wonderful, admirable, well presented, superb

Words Demanding an Explanation: adequate, fair, average, good, satisfactory

Words to Avoid: mediocre, bad, ordinary, too easy, pitiful, too simple, boring, inferior, miserable, uninspiring, simplistic, obnoxious, unacceptable, questionable, common, unprepared, banal, dull, uninteresting, tedious

ELEMENTARY PROJECTS

Tricky Situation #1: Student tackled a complex project and didn't really understand it.
Possible Approach: Acknowledge that they chose a complex project and commend them for their efforts. Make specific reference to something they have done well. Point out that it would be perfectly acceptable to choose one aspect of the complex subject for a project in the future, possibly to be followed by other aspects of the same complex subject in succeeding years.

Tricky Situation #2: The student admits the parents did all the work. On questioning, the student does not know the material.
Possible Approach: Compliment them on their efforts and on the components of the project they understood. Offer them encouragement to come back next year.

Tricky Situation #3: A very well done project. The student knows all the material and is very enthusiastic. You wonder whether the student did all the work.
Possible Approach: Don't judge too quickly and give the student a chance to show what they know. You may wish to ask a few more questions so that they can demonstrate their understanding. One of the ORSF goals is to encourage children to learn science – how this is done is less important. As long as the child demonstrates a true understanding of the subject, we're happy.

Tricky Situation #4: A poor project with inconsistencies. A look at the logbook seems to indicate that it was done at the last minute.
Possible Approach: Commend them for their efforts. Choose something from the project to praise. Recommend that in the future they start earlier to collect data and analyze results that would give them more information to back up their conclusions. Then, if appropriate, suggest this would be a wonderful project to present in greater depth next year.

SECONDARY PROJECTS

Tricky Situation #1: Students do not really comprehend the complexity or depth of the topic they have chosen.
Possible Approach: Congratulate the students on their effort in attempting such a project. Start from their existing level of comprehension and work together to a higher level. Ask a few 'What would happen if…?' and 'How would we find out?' questions. Using this approach, you will at least be able to discover if the students have a grasp of the scientific principles and method. Suggest that for next year's project they select an aspect of this topic to study.

Tricky Situation #2: The project is very well done and you suspect that the student did not do all (or any) of the work.
Possible Approach: Don't be too sure! Junior and senior high students are capable of astounding work. Try to establish a friendly relationship and ask questions related to the project, but not directly demonstrated in the work. If it is obviously not the student's work, be supportive. It's quite likely the student does not want to be there in the first place.

Tricky Situation #3: Two students worked on the project and only one talks or answers questions.
Possible approach: Make a point of directing questions to the silent partner. If the talker constantly butts in, remind them that you asked the partner the question. Sometimes you discover the project is much better than the talker led you to believe and you can see that both did the work.

Tricky Situation #4: The project is terrific, the student is brilliant, hours of hard work have gone into the preparation, and you don't have the slightest idea what they are talking about!
Possible Approach: Take a deep breath and calm down. Don't hesitate to point out you are not too familiar with the topic. Remember, you are there to determine if the student has used a scientific approach to answering a question, not to judge whether or not they got the facts right.

THANK YOU TO OUR SPONSORS

Each year, the ORSF receives generous support from many corporations, organizations, individuals and professional associations whose donations allow us to successfully host one of Canada's largest regional science fairs.

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