What is Eskom Expo for Young Scientists all about?

Eskom Expo for Young Scientists (Expo) is South Africa's primary and only existing science fair for school learners, where they have an opportunity to exhibit their own scientific investigations and engineering projects.

Eskom Expo brings together learners, teachers, professional organisations and educational bodies and governments from all over the world.
Eskom Expo for Young Scientists is proud to have 35 affiliated regions in South Africa in which learners participate.

By participating in Eskom Expo, learners will increase their awareness of the wonders of science and engineering, add to their knowledge and explore entrepreneurial possibilities, while broadening their scientific horizons.

Learners can enter their own individual projects, or a maximum of two learners can work together on a paired project. Learners may enter only one project at a particular Eskom Expo region per year. There are 24 different categories (listed on page 8) in which a project can be accommodated.

Please ask your teacher to enter your school in the nearest region, or contact the provincial coordinator or regional science fair director (RSFD) for assistance.

Role of the teacher

The role of the teacher is that of a mentor. Eskom Expo for Young Scientists depends on teachers to distribute information about Expo to learners and to display notices about Regional Expos. Simply through their encouragement and support, enthusiastic teachers can inspire their learners to great achievements.

A teacher can guide learners through the stages of a scientific project and ensure their scientific approach.

Summary of the scientific method and engineering process:

STEP 1 Choose a topic or question.

STEP 2 Learners must submit their research plan to their teacher for approval before starting the project. Ethics needs to be considered at this point.

STEP 3 Do background research on the chosen topic to find out what has already been done on that particular topic. What does one need to know to answer the question?

STEP 4 What can the answer possibly be? Form a hypothesis/state the engineering goals.

STEP 5 Test the hypothesis/test the prototype/evaluate the prototype and redesign if necessary.

STEP 6 Draw conclusions based on the results of the testing.

Teachers should use the project as part of class work. When assessing the projects at school level, teachers must assist the learners in upgrading their projects so that they can successfully participate in a Regional Expo.

Individual projects are encouraged, but no more than 2 learners are allowed to work together on a project.

Teachers need to enter the learner's projects into a Regional Expo.

Categories

NUMBER	CATEGORY	GRADES
1	Agricultural Sciences	Grades 6 -12
2	Animal & Veterinary Science, including Marine Animals and Animal Ecology	Grades 6 -12
3	Chemistry and Biochemistry	Grades 6 -12
4	Computer Science and Information Technology	Grades 6 - 12
5	Earth Science– including Geography, Geology, Oceanography and Housing and Settlement Studies	Grades 6 -12
6	Energy: Non-renewable - fossil fuels and use of electricity	Grades 6 -12
7	Energy: Renewable -solar, wind, wave, hydro	Grades 6 -12
8	Energy: Renewable - biofuels, geothermal, bio digesters	Grades 6 -12
9	Energy efficiency and conservation: efficient use of energy and ways of using less energy	Grades 6 -12
10	Engineering: Electronics and Electrical	Grades 10 - 12
11	Engineering: Chemical, Metallurgical, Civil and Mining	Grades 10 - 12
12	Engineering: Mechanical, Aeronautical and Industrial	Grades 10 - 12
13	Environmental Management: study of human interaction with the environment (e.g. waste management, deforestation, land management and bioremediation)	Grades 6 -12
14	Environmental Science: changes to the environment (e.g. pollution, climate change, carbon emissions)	Grades 6 -12
15	Food Science, Food Technology and Healthy Eating (Diet)	Grades 6 -12
16	Health Care and Sports Science	Grades 6 -12
17	Innovation and Technology	Grades 6 -12
18	Mathematics and Statistics	Grades 6 -12
19	Medical Sciences: Human Biology (anatomy, genetics, physiology)	Grades 6 -12
20	Microbiology and Diseases, Disease-causing organisms, Medicine	Grades 6 -12
21	Physics, Astronomy and Space Science	Grades 6 -12
22	Plant Sciences including Marine Plants and Plant Ecology	Grades 6 -12
23	Social and Psychological Sciences	Grades 6 -12
24	Sustainable Development , Recycling and Recycled materials	Grades 6 -12

What is an Eskom Expo Project?

Types of Projects

All Expo projects need evidence that a learner(s) carried out the project and must include current year results of their own investigation. No results can be copied from another source.

Investigation

An investigation is a project where the problem, or answer to a question, is solved. When undertaking an investigation, a method is followed that allows for the testing of an idea, or finding a solution to a problem, which determines a clear conclusion to the problem or question asked.

Projects for Expo must have original work done by participants, e.g.

- Survey of more than 100 questionnaires for grades 6 – 9 and 200 survey questionnaires for grades 10 - 12
- Experimental work with repeated testing and a large sample size

Pure Science

Pure science focuses on learning more about the world we live in by improving our knowledge at a fundamental and basic level. Little or no regard is given to applying this knowledge to practical applications. Pure scientists conduct experiments or studies to test scientific hypotheses and develop theories. An important aspect of this experimentation involves identifying variables and, where possible, controlling them.

Applied Science

Applied science makes use of laws, physical relationships and other knowledge developed in pure sciences and applies this knowledge to human needs. Engineering is very closely related to applied science. Companies make use of applied science in their research and development division to improve their products. Innovative ideas and inventions will sometimes be found in this type of project. Applied science forms the foundation for technology and applied technology.

Technology and Applied Technology

Technology and applied technology is the application of pure and applied science knowledge to meet a specific user need, most often in an industrial or commercial setting. Brilliant innovation and invention is less important, rather a systematic method for user need identification as well as technology or knowledge application to meet the need.

A good project would demonstrate the development of a useful technology using a system design, build and test process.

Engineering Projects

An engineering project should state the engineering goals, development process and the evaluation of improvements. Engineering projects could include the following:

- Define a need or "How can it be made better?"
- Develop or establish design criteria.
- Do background research and review literature to see what has already been done or what products already exist to fill a similar need.
- Prepare preliminary designs and a list of materials needed. Consider costs, manufacturing and user requirements.
- Build and test a prototype for the design. Consider reliability, repair and servicing.
- Retest and redesign as necessary.
- Build a model of the final prototype.
- Present results.

Computer Science Projects

These often involve creating and writing new algorithms to solve a problem or improve on an existing algorithm. Simulations, models or "virtual reality".

Mathematics Projects

These involve proofs, solving equations, etc. Mathematics is the language of science and is used to explain existing phenomena or prove new concepts and ideas.

Steps to doing a good project

The topic for the project should be something that interests the learner and would then inspire the learner to learn more about it. Ideas for a good topic may come to mind straight away just by looking at the list of Expo categories on Page 7. Ideas for projects can also be obtained from:

- Newspaper and magazine articles
- The Internet
- Television programmes
- Practical problems from your community

The idea for a project should be an original one. This means that it should be an original idea and not somebody else's. Do not repeat an experiment from the school syllabus or choose a problem to which people already know the answer. For example, **"Determining the specific heat capacity of iron" is not an original topic for an Expo project.** The procedure to follow is well-known and the answer can easily be looked up in any school textbook.

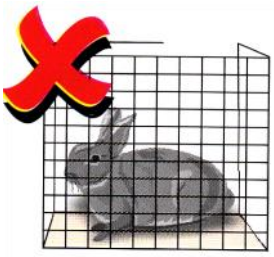
The best Expo projects are not always complicated, but are imaginative and well carried out.

A good project is often:

- A clever solution to a problem; or
- A new idea for a piece of apparatus; or
- A study or survey that no-one has done before.

Be original, but **DO NOT** choose a project that:

- could be dangerous to yourself or others;
- needs any experiments on insects, animals or humans; or
- involves collecting plants or animals that are protected by Nature Conservation laws.
-



If there is any doubt as to whether the chosen topic will make a suitable Expo project, a teacher should be asked for advice.

STEP 2: Do a research plan

Every learner should type a research plan which should be submitted to the teacher/mentor/qualified scientist at the beginning of the project for approval**. This research plan shows how the learner intends to do the project and so it is written in the future tense.** The length of the research plan should be between 2-4 typed A4 pages.

Research plans for ALL projects must include the following:

A. Question or problem being addressed
B. Hypothesis or Engineering Goal (Engineering projects only)
C. Description, in detail, of the method to follow (scientific method projects) or the procedures to follow (engineering projects) that will answer the questions asked or solve the problem posed.
D. The following are important and key items that should be included when formulating **ANY AND ALL** research plans:
    - Procedures (method)
    - Scientific Method Projects: Variables: independent, dependent and at least controlled/fixed or
      Engineering Projects design of first prototype
    - Data analysis: how to analyse the data
E. Bibliography: List the three (3) most important references (e.g. science journal articles, books, Internet sites) that were used to get information about the topic. This information must be referred to in the introduction (Part A above).

    Check this website to ensure that all sources are referenced correctly: http://www.exposcience.co.za/index.php/referencing-bibliography.html

STEP 3: Gather background information

Use books and Internet sites for the research. A summary of the background information must be included in the introduction (this is called a literature review). Remember to record all the references.

Survey results form part of the background research **only**. Engineering projects could include a model resembling the first prototype.

STEP 4: Collect data (ALL data/prototype design and testing must be from the current year in which the project is to be entering into Expo)

- Test the hypothesis/engineering goals.
- Make sure that sufficient testing is done to make the results reliable.
- Interview people interested in the topic.
- Keep handwritten notes in a journal (e.g. file, diary or scrap book). A journal is the most important piece of work. Accurate and detailed notes make a logical and winning project. Good notes show consistency and thoroughness to the judges. Record all data in the journal and then transfer it to tables when writing up the project. Make sure that every entry is dated.

STEP 5: Results

- Record data in tables
- Record numerical results/data in tables
- Generate graphs from the tables. Check that all the graphs are correctly completed.
- Add photos with applicable, scientific captions
- File a blank copy of any questionnaire/survey in the journal

STEP 6: Discuss results

- Interpret the data and make comparisons
- Look at trends and patterns
- Note limitations and errors in the discussion

STEP 7: Conclusion(s)

SCIENTIFIC METHOD PROJECTS	ENGINEERING PROJECTS
• State whether the results support or do not support the given hypothesis. • Conclusion(s) must be based on the results and must be linked to the given hypothesis.	• Were the engineering goals met by the final prototype and testing.

STEP 8: Evaluate the whole project

- Review, Revise and Redo

STEP 9: Write a report using the following headings:

SCIENTIFIC METHOD PROJECTS	ENGINEERING PROJECTS
• Title (must be simple, descriptive and scientific) • Introduction • Background research including literature review • Problem • Aim • Hypothesis • Variables and Method • Results – record data in tables and graphs • Analysis and discussion of results • Conclusion(s) • References • Acknowledgements • Photos and images – must be referenced	• Title (must be simple, descriptive and scientific) • Purpose • Background research including literature review • Engineering Goal • Procedure including at least 2 prototypes, designs and tests. • Detail of final prototype design, testing and photos • Evaluate efficiency of final prototype • Costing • Conclusion(s) • References • Acknowledgments

STEP 10: Showing the Project

The presentation must include the following:

1. Poster – this must be a summary of the report and the order of the pages on the poster must follow the order of the report.
2. The poster must be printed on A4 pages (landscape or portrait). This is compulsory for Regional Expos **and** the International Science fair (ISF).
3. The poster must be arranged in a logical order starting on the top of the left hand board and ending at the bottom of the right hand board. See below for more information on the order of the A4 pages on the poster board.
4. Report file
5. Journal
6. Models must fit onto the table within the poster board provided. The model may not obstruct the poster board. Any part of the poster board that is obstructed by anything on the table (including a stack of files, computers, model, bottles, etc.) will not be judged, unless it is easily visible to the judges. Furthermore, nothing may protrude over the edge of the table, be on the floor, or obstruct the Eskom Expo branding and title on the display board in any way. Safety rules would also still apply.
7. Survey questionnaires (if applicable)

Poster boards will be provided at Regional Expos - check with the Regional Science Fair Director for the size and dimensions.

The poster is a very important part of the exhibit. It should be easy to read and understand and it should explain what the learner did, how it was done and what was found out. Make the presentation interesting and attention-grabbing. The intention is to get visitors to stop and read what the project is all about. The summarised information must be out in a logical order. The detailed information will be in the report file.

Compulsory logical order for the poster

SCIENTIFIC METHOD PROJECTS	ENGINEERING PROJECTS
• Title • Name and grade below the title • Introduction • Background information • Problem • Aim • Hypothesis • Variables • Method • Detailed results including key tables and graphs • Analysis • Discussion of results • Errors and Limitations • Conclusion(s) • Future Research (if applicable) • Acknowledgments • Photos and diagrams with acknowledgements	• Title • Name and grade below the title • Purpose • Background information • Engineering Goal • Procedure: Prototype 1 - design and photo Prototype 2 - design and photo Final prototype – design, testing and photo • Efficiency of final prototype • Costing • Errors and limitations • Conclusion(s) • Future Research (if applicable) • Acknowledgments

Report File

SCIENTIFIC METHOD PROJECTS	ENGINEERING PROJECTS
• File must be neatly laid out – begin with a contents page, use labelled dividers, file in a logical order. • At front of file – plagiarism pledge, research plan, abstract, code of conduct, survey permission letter (s) and supervising scientist's letter. • Introduction including literature review and background research – why the project was selected, including evidence of background research and the value of the project. • Problem statement or focus question. • Aim – to find out/to determine etc. • Hypothesis – statement that is to be tested, which includes independent and dependent variables. • Method – how the project was carried out, including the fixed variables. Written in the third person - **no pronouns**. • Results (what happened and all tables and graphs). • Analysis of results (results/findings/graphs explained in words, more extensive in this report than on poster).	• File must be neatly laid out – begin with a contents page, use labelled dividers, file in a logical order. • At front of file – plagiarism pledge, research plan, abstract, code of conduct, survey permission letter (s) and supervising scientist's letter. • Introduction including literature review and background research – why the project was selected, including evidence of background research and the value of the project. • Problem – Focus question or problem statement. • Engineering Goal – which needs has been identified. • Procedure – detail of prototype, design and testing. • Discussion efficiency of the final prototype. • References – which books and webpages consulted. These must be referenced correctly; the first reference must be one where the project idea came from.

Report File (Cont.)

SCIENTIFIC METHOD PROJECTS	ENGINEERING PROJECTS
• Discussion including errors and modifications (patterns and trends are noted and explained, anomalies/unusual results are discussed, limitations noted and clarified). • Conclusion(s) – refer directly to hypothesis. Incorporates key results and supports the hypothesis. • References – which books and webpages consulted. These must be referenced correctly. The first reference must be the one where the project idea came from. Acknowledgments – people spoken to, all those who assisted with the project in any way. State what help was given	• Acknowledgments – people spoken to, all those who assisted with the project in any way. State what help was given.

Journal for ALL Expo projects

- This is a record of **ALL** the work of the project – no matter how untidy it is!
- Everything should be dated.
- File all emails and rough data/results.
- File notes from interviews.
- File all designs, photos and plans.
- File copies of articles read, either alphabetically or in order of importance.
- File all survey questionnaires.

Abstract

What is an abstract

The purpose of an abstract is to serve as a brief summary of the project which is written after the project has been completed. The maximum word count is 250 words. All Expo projects must have an abstract.

- Write the abstract in the **past tense.**
- The abstract allows the reader to conclude whether the project write-up is worth reading.
- The abstract appears at the **beginning** of the report file.

How to write an abstract

The abstract should include the following headings:

Purpose of the Project

- An introductory statement of the reason for investigating the topic of the project.
- A statement of the problem or hypothesis or engineering goals being studied.

Procedure or Method:

- A summary of the key points and an overview of how the investigation was conducted.
- An abstract gives no details about the materials used unless they greatly influenced the procedure or had to be developed to do the investigation.
- An abstract should only include reference to method or procedure done by the learner during the project. Work done by a mentor or work done prior to the learner's involvement must not be included.

Data/Results:

This section should provide key results that lead directly to the conclusion that has been drawn.

- It should not give too many details about the results but must include the most important data generated in the investigations.

Conclusion(s):

- Conclusion(s) from the investigation should be described briefly.
- An abstract does not include references or acknowledgements.

Entering a Regional Expo

Regional Expos are usually held between July and August each year. Interested students and teachers should contact their nearest Regional Science Fair Director (see pages 37 - 41) or visit our website www.exposcience.co.za for more information, especially as to which grades may enter a Regional Expo. Ensure that entry forms are fully completed; that the information is clearly readable and that the project is entered in the correct category.
Any project done must fall under one of the Expo Categories.

NB. Not all gold medal winners at regional level will be selected to participate at the Eskom Expo International Science Fair (ISF)

Points to remember:

- Bring the following to put up the display: drawing pins, staples, temporary adhesives (e.g. Prestik), masking tape. DO NOT USE DOUBLE SIDED TAPE.
- Bring an extension cord if one is needed for the model or any apparatus that needs 220-volt electricity to work.
- Do not include any live animals, insects, spiders, fish and plants in the display. Photos and video clips may be shown instead. Do not include any animal or human body parts at all.
  (Refer to pages 25 - 28 and make sure the project is ethically correct).
- Burning of any substance or use of open flames as part of the display is prohibited.
- Do not leave valuable items on display. The organisers will endeavor to make sure that things are safe at Expo, but will not be responsible for any losses.
- No chewing gum during interviews.
- Switch off cell phone during interviews.

Judging

Judging is based on the following criteria:

SECTION I: Value of the project (50)

- Originality of the project. The learner is able to think and act independently. Refers to reading, originality of approach, use of resources, depths of planning and execution of investigation.
- Value: Refer to thoroughness and depth in application of the scientific method/technological process.
- Scientific Investigation: Command of the scientific method, scope/range of investigation, results, analysis and conclusion. Check for sample size, validity and reliability of results.
  OR Engineering Procedure: look for 2 or more prototypes

SECTION 2: Written communication of project (30)

- Written communication includes poster, report and journal.

SECTION 3: Oral communication (20)

Interview

The interview with the judge is aimed at establishing the learner's understanding of the topic, originality and thoroughness of their method or procedure. It is also to make sure that the learner(s) did the project and to what extent they made use of help offered by mentors (teachers, parents, scientists etc.).

Most of what the learner has done should be on display and be discussed during the interview.

A standard set of judge's criteria is used at Regional Expos and the ISF. Please make sure to study the judge's criteria before participating at Expo.

PLEASE NOTE THAT AT THE ESKOM EXPO FOR YOUNG SCIENTISTS REGIONAL AND INTERNATIONAL SCIENCE FAIRS, THE CHIEF JUDGE'S DECISION IS FINAL AND NEITHER DISCUSSION NOR CORRESPONDENCE WILL BE ENTERED INTO

Interview

Please take note of the following points:

- Introduce yourself by name
- Know your topic
- Be enthusiastic
- Speak clearly with confidence and use appropriate language
- Listen to the judge's questions
- Don't read off notes or recite a prepared speech, answer the questions
- Make sure your answers are to the point
- Be aware of time constraints
- Switch off your cell phone and don't eat or chew gum during the interview.

Parents and Teachers

Expo for Young Scientists supplies a forum for learners to display their scientific knowledge and skills. Parents and teachers can act as mentors to the students, **but must not display their own scientific knowledge and skills.** Judges will disqualify any project that was not done entirely by the learner(s).

More information on judging is available on the Eskom Expo website and on the Judging DVD (participating schools can request for a copy of the DVD from the Regional Science Fair Director).

DO NOT USE BRANDED PRODUCTS ON THE DISPLAY BOARD – RATHER IDENTIFY USING LETTERS OR NUMBERS. THE PROJECT WILL BE DISQUALIFIED IF BRANDING IS INCLUDED

International Science Fair (ISF)

These pages only refer to information which is specific to learners selected to participate at the Eskom Expo International Science Fair (ISF).

Selection for the Eskom Expo International Science Fair is only for learners in grades 6-12. The ISF event is held in the public school vacation between term 3 and term 4 of the public school calendar.

Each exhibit is given space of maximum 1.5m table length and an Expo display board. It is compulsory to use the display boards provided at ISF events.

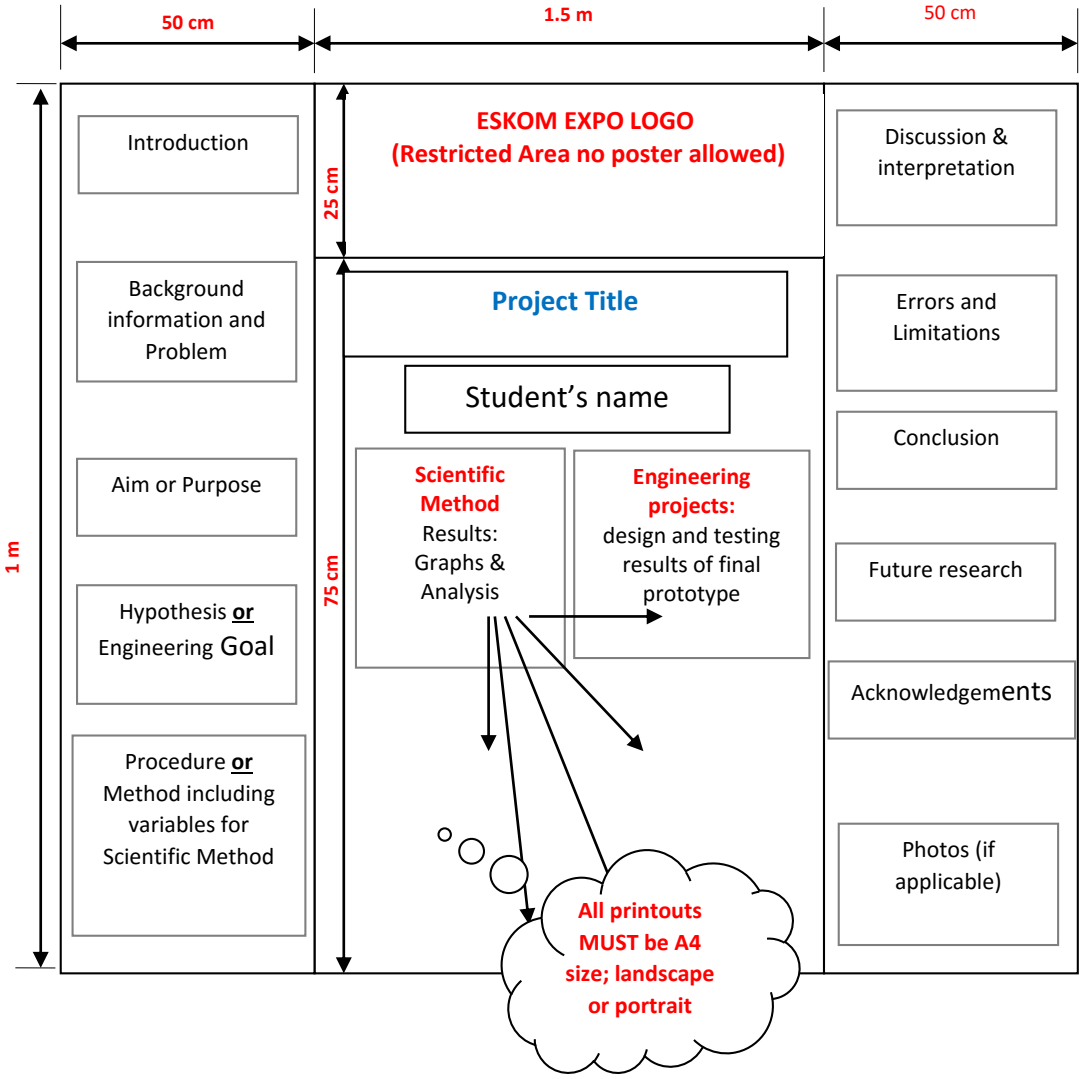
It is compulsory to have the following at ISF:

Poster made up of A4 pages
Scientific Report
Dated journal
Folder of official forms: signed plagiarism form, signed research plan, abstract, signed code of conduct, survey permission letters (if relevant), and supervising scientist letters (if relevant).
NB: A copy of the abstract must be displayed on the table at ISF.

Size and dimensions of the display board at ISF:

- Height: 1m
- Left side: 50cm
- Middle: 1.5m
- Right side: 50cm

Eskom Expo ISF Poster Layout



Awards at ISF

Projects are judged and finalists could be awarded medals.

Special awards

There are many prestigious special awards presented by interested organisations at the ISF prize-giving ceremony.

Special awards are given by a separate set of judges using independent criteria which are not the same as the Eskom Expo criteria.

There are numerous awards made by special interest groups such as:

- Best development project
- Best energy project
- Best female project
- Best energy efficiency project (energy cost-saving covered in all categories)
- A science lab for both a rural primary and secondary school
- International trip to a science fair or science forum

Visit the link below for the Hall of Fame, which lists previous winners.
http://www.exposcience.co.za/index.php/hall-of-fame/special-awards.html

Some finalists from ISF are selected to participate in international science fairs in other countries.

Please note that participation at international science fairs is strictly for selected individual learners and invited Eskom Expo officials. No exception will be made.

If selected to participate at the Eskom Expo International Science Fair, test the prototype and redesign, rebuild and retest the new prototype or test the hypothesis again and make sure that more data is collected to support the hypothesis.

Project Approval

All projects need to be approved for judging; this means that it is checked for compliancy to the rules of Eskom Expo and it does not violate any ethics.

Ethics Statement

Scientific fraud and misconduct are not condoned at any level of research or at any Expo. Scientific fraud and misconduct include:

- plagiarism,
- forgery,
- the use or presentation of other researchers' work as one's own, fabrication of data events.

1. Plagiarism

Plagiarism can be defined as follows:
To use another person's words or ideas and present them as your own. The following are considered as plagiarism:

- To steal or borrow another person's work including data without their permission.
- To pay another person to write your assignment or do your project for you.
- To copy directly from a source without referencing the original source **and** without permission from the author(s).
- To use another person's ideas and build them into your presentation without giving credit to the original ideas.
- To use another person's photographs/drawings and build them into your presentation without giving credit to the original photographs/drawings.
- To copy another person's work word-for-word.
- To present false data (fabricated, altered or borrowed without permission).

The worst form of plagiarism is to do it intentionally.
Plagiarism can also occur unintentionally: when you rewrite another person's ideas into your own words, or use small sections of another person's writings without acknowledging them as a source.

Fraudulent projects will be disqualified at all Eskom Expo events.
It is compulsory that every participant has a signed copy of the plagiarism letter in their file.

2. Ethics

Ethics is concerned with what is right or wrong, good or bad, fair or unfair, responsible or irresponsible. Research on micro-organisms, human or animal subjects, including surveys, needs a letter signed by a supervising scientist or teacher giving approval for the project to be done. ALL survey questionnaires need a signed letter or email giving consent or permission by the interviewee (if over 18) and if under 18 parents or schools need to give signed permission or an email.
Both letters need to be filed in the project file in the appendix or at ISF in the official file of forms.
Make sure the project is safe and ethical

Before you start a project, it's important to know the rules – especially if you're thinking of using ANY animals, micro-organisms, human subjects, hazardous equipment or materials, recombinant DNA or other biotechnological materials. (By the way, "animals" include pets and livestock and "humans" include family members and students in your class or school). It's heart-breaking to have your project disqualified at an Eskom Expo event because you broke the rules – or maybe even the law eg underage drinking is against the law. Any research or experiments on potentially hazardous biological agents, animal or human subjects must be done under the supervision of a qualified scientist/laboratory. **A signed letter or form from the qualified scientist and/or laboratory will be required before participating at any Eskom Expo events.**

Ethics infringements

Students are encouraged to check for ethical infringements before exhibiting projects at any Eskom Expo events. Please note that the following are not allowed at any Eskom Expo event:

- Living organisms including bacteria, fungi, animals, insects and plants.
- Agar plates and other growth mediums for microbiology studies.
- Human or animal parts including tissues and body fluids (for example blood, urine, hooves, skins etc.).
- Dangerous chemicals: Poisons, drugs, medications, controlled substances, hazardous substances.
- Dangerous devices (for example firearms, weapons, ammunition, reloading devices, knives and any sharp instruments).
- Flammable substances eg methylated spiritis.
- Photographs or other visual presentations depicting humans or vertebrate animals in surgical techniques, dissections, necropsies or other lab procedures, or which belittle people in any way, or show animals being harmed in any way.
- Brand names or any branded products.
- Non-perishable food substances that are not in completely sealed containers (plastic wrap is not acceptable as it can be easily removed). Perishable foods may not be part of any Expo display.
- Water except if in sealed apparatus.
- No water is allowed in any experimental apparatus.
- Any apparatus deemed unsafe by the Eskom Expo organisers.

NB: Photographs will be sufficient for judging but it must state who took the photos, and, has permission been given to display them?

3. Safety

All electrical work must conform to the National Electrical Code and Exhibit Hall Regulations. Fire regulations will be strictly enforced. The on-site electrician may be requested to review any electrical work on any project. The safety guidelines here are general ones and other rules may apply to specific configurations.

4. Patents

Some participants display projects that show innovative thinking and provide new products. Expo encourages the development of entrepreneurial products which may lead to the marketing of these products.

Participants are advised to obtain legal advice about patent applications before entering their work at any Eskom Expo. Once a design or product has been on public display, it cannot be patented. However, if any exhibit is displayed for judges only, no patent rights should be lost.

Refer to the following website for more information on how to patent your project: http://patentsearch.cipc.co.za

Referencing

Referencing means that credit is given to the various sources used when writing an assignment/report. A reference list should include any documentation that is not one's own. All sources should be arranged **alphabetically** according to the surname of the first author.

The references should be written in the following order:

Author's surname and initials, year of publication, title (underlined or italics), edition, place of publication, publisher. This is the Harvard style of referencing. Other referencing styles are also acceptable.

1. **Books:**
   e.g. Kritzinger, A.A.C and Fourie, C.M.W 1996 *Basic Principles of Financial Management*, Cape Town, Juta

2. **Journals:**
   Journals should be written in the following order: author's surname and initials, year of publication of the journal, title of article, title of journal, volume, pages.
   e.g. Manning, T. 1996 "*Three steps to the future*", Human Resources Management, 12(8), 8-9

3. **Chapters in books:**
   e.g. Smith, R.J. Comparative themes in higher education, in "*Trends in High Education*" edited by J.N. Green. London: Benton

4. **Newspaper articles:**
   The reference should be written in the following order: year, newspaper, date and month, page.
   e.g. 1908. *Business Day.* 25 June: 7

5. **Internet referencing:**
   Munmun De Choudhury et all (2016) *Characterizing Dietary Choices, Nutrition, and Language in Food Deserts via Social Media*
   Available at:
   http://www.munmund.net/pubs/cscw16_fooddeserts.pdf
   Date accessed: 06 March 2016

6. **Theses and Dissertations**
   e.g. Smith, R.H. 1998 *Critical Theory and University Transformation.* DPhil thesis, Rhodes University, Grahamstown

7. **Info on Referencing and Photos**
   For more information on Harvard Style referencing and referencing of visual material (images/photos) please visit the following websites:

   http://rmit.libuides.com/content.php?pid=220068&sid=1827557

   http://www2.lib.uct.ac.za/infolit/bibharvard.htm

Planning a Survey

Surveys may only be part of the background research and **not** the whole project. Before starting, the following questions need to be asked – relevant Expo information is added in brackets:

- What are the objectives of the survey (*is it to find out opinions as part of background research or is it to obtain scientific data which would be part of the results of the investigation?)*
- Are there other sources of data that could be consulted before carrying out a survey (*literature search)?*
- How can it be ensured that those who have a stake in the outcome of the survey support it (*well-written permission letter)?*
- How can a list of people/organisations to be surveyed be developed and how reliable will the contact information be (*important part of research plan*)?
- How can a sample (group of people taking the survey) be designed to minimize cost and maximize the accuracy and flexibility of the results?

What to know when designing a questionnaire:

- What information is required to meet the needs of the project (*part of aim and hypothesis)?*
- What is the best way to word questions so as to get an unbiased response (*procedures/method*)?
- How to design the survey questionnaire to ensure the questions are clearly understood and answered properly *(procedures/method)?*
- What is the most reliable and cost-effective method of delivering the survey (procedures/method)?
- How to pre-test the survey questionnaire *(in the pilot study*)?
- When to use the results of the pre-test?

Answer these questions when dealing with the respondents:

- How will the confidentiality of the responses be protected *(all questionnaires are filled in anonymously)?*
- Who will respondents contact when they have questions *(the investigator)?*
- How long do respondents have to respond (shorter deadlines work better)?
- What to do if the respondents don't respond *(accept this as it's the respondent's choice to complete the questionnaire)?*
- What is an acceptable response rate? What to do if the response rate is unacceptably low (*for an initial study for Expo a minimum of 100 completed survey questionnaires for primary schools and 200 for high schools is needed. Should there are too few then send out more survey questionnaires)?*

What to know before analysing and presenting the information:

- Whether or not the responses are biased and how data will be corrected for bias if it *exists (double blind questions)?*
- The best way to present the data so that the audience can grasp the importance of the findings (*tables and graphs of all data)*
- The best way to demonstrate that the results are statistically valid, accurate and reliable (*all fixed variables must be controlled and there needs to be a sufficiently large sample size for the study to be reliable)*
- Which techniques will be used to analyse the data to give accurate, fully results *(statistical analysis)?*
- How to link analysis and the discussion?

Questions sourced from: http://www.bcstats.gov.bc.ca/Home.aspx

Glossary

Abstract	A summary of the project that provides justification for the research.
Acknowledgements	A detailed list of people who helped and what they did.
Aim	The why behind doing an experiment. Usually stated as 'To show…', 'To demonstrate…'.
Analysis of results	Results/findings/graphs explained in words, more extensive in report than on poster.
Branded products	These show the name of an item e.g. BMW and these names should not be visible in any Eskom Expo report or poster.
Conclusion	Relates to the hypothesis and either agrees or disagrees with the hypothesis and must include key results.
Discussion of results	Patterns and trends are noted and explained, anomalies/unusual results are discussed, limitations noted and clarified.
Engineering goals	These are the design processes that an engineer does when he/she identifies a problem or need and then creates or develops a solution.
Errors and modifications	What went wron7777g that you can change next time and what could you have done if you had more time or resources?
Hypothesis	A proposal intended to explain certain facts or observations – this is a statement based on the aim.
Introduction	The reason for you doing the project and it includes evidence from the most important source as well as the value of your project i.e. who will benefit from this knowledge. In addition you should refer to ethical issues if relevant.
Mentor	A person who assists you as you develop your project and gives you professional help (e.g. scientist or a teacher)
Method/ Procedure	A step-wise description, written in the third person, of how the project is being done. It includes the apparatus used (where relevant).
Observation	Something interesting (a phenomenon) that you have noticed e.g. Elephants prefer to eat leaves off trees.
Problem/Question	This is what you want to know about the phenomenon e.g. why do elephants prefer to eat tree leaves?
Prototype	A device made from a design and tested when doing an engineering project.
References	ALL the books, magazines and Internet sites that you consulted while doing the project and referenced in the correct way.

Reliability of results	Reliability refers to the results. The sample size must be large enough to support the hypothesis. In order to increase reliability there should be evidence of repeated testing and increasing the size of the sample group.
Research Plan	How you intend to do your project so it is written in the future tense.
Results	What can be discovered from doing the investigation or project? They should be quantitative – in other words, can be measured and recorded in a table. Graphs should be able to be drawn.
Scientific method	The way of proving whether something is true or false by carrying out experiments. The steps of the scientific method are: aim, hypothesis, method, results, interpretations, and conclusion.
Validity of a scientific investigation	Validity refers to variables. A scientific method project/experiment is valid if there is only one independent variable and other variables are fixed. It does not matter if there is more than one dependent variable.
Variables:	Factor that affect an experiment.
• Controlled/ Fixed	Factor(s) that cannot change throughout an experiment.
• Independent/Manipulated	Factor that is being investigated in an experiment.
• Dependent/ Responding	The results obtained after doing the investigation. They are dependent on the independent variable and change as the independent variable changes.

FOR FURTHER INFORMATION ON SURVEYS, PERMISSION LETTERS, QUESTIONNAIRES AND OTHER INFORMATION PLEASE GO TO THE EXPO WEBSITE WWW.EXPOSCIENCE.CO.ZA AND CLICK ON DOCUMENT LIBRARY.

Important Information

1. Learners can enter **one** project in only **one** of the Eskom Expo regions per year.

2. Individual projects are encouraged; pairs are also allowed to work together on a project for regional competitions. There is a limit to the number of group projects at ISF.

3. Data must be from the same year as the Expo/ISF.

4. Not all gold medal winners at regional level will be selected to participate at the Eskom Expo International Science Fair.

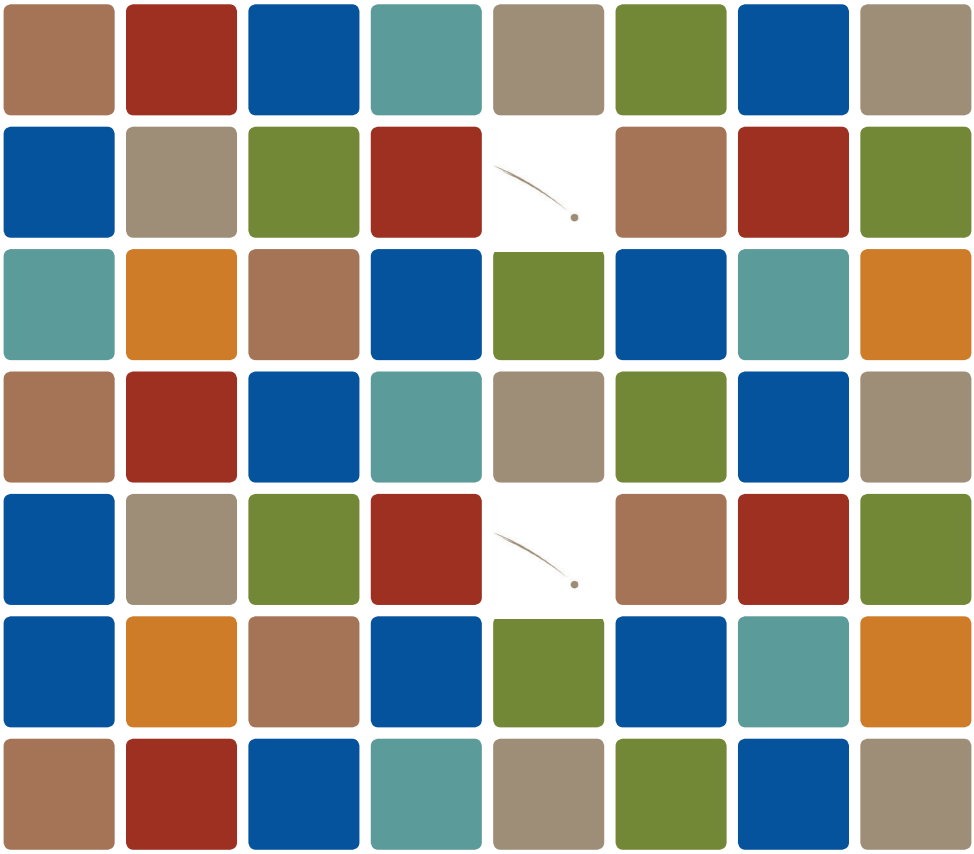
5. Do not use branded products in the experiment – rather identify using the alphabet or numbers. The project will be disqualified if branding is include.

6. A standard set of judge's criteria are used at Regional Expos and the International Science Fair. Please make sure to study the judge's criteria before participating at Expo.

7. Please note that at regional and at the International Science Fair, the chief judge's decision is final and neither discussion nor correspondence will be entered into.

8. Please note that participation at International Science Fairs in other countries is strictly for selected individual learners and invited Eskom Expo officials. No exceptions will be made.

9. It is compulsory that every learner has a signed copy of the research plan, code of conduct, plagiarism form and abstract in the relevant files.



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