Contents

A Guide to the Eskom Expo for Young Scientists

Vision

Inspiring Young Scientists and Researchers

Mission Statement

We develop young scientists who are able to identify a problem, analyse information, find solutions and communicate findings effectively.

Management

An association incorporated under Section 21 of the Company's Act, 1973
Registration no: 19920693908
Non-profitable organisation no 008 350

Board of Directors:

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Eskom Expo for Young Scientists is affiliated to:

National Science and Technology Forum (NSTF)
Society for Science & the Public (SSP)
MILSET
INESPO

Introduction

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 students, where they have an opportunity to exhibit their own scientific investigations and engineering projects.

Eskom Expo brings together students, teachers, professional organisations and educational bodies and governments from all over the world.
Eskom Expo for Young Scientists is proud to have 31 affiliated regions in South Africa in which students participate.

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

Students can enter their own individual projects, or a maximum of two students can work together on a group project. Students may enter one project in one Eskom Expo region per year. There are 25 different categories (listed on page 7) in which a project can be accommodated.

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 students and to display notices about Regional Expos. Simply through their encouragement and support, enthusiastic teachers can inspire their students to great achievements.

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

Summary of the scientific method:

STEP 1 Choose a topic or question.

STEP 2 Students 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 your topic to find out what has been done already. What do you need to know to answer the question?

STEP 4 What do you think the answer will be? Form your hypothesis/state your engineering goals.

STEP 5 Test your hypothesis/test your prototype/evaluate your 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 students in upgrading their projects so that they can participate in a Regional Expo.

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

Teachers need to enter their students' projects into a Regional Expo.

Categories

No	CATEGORY	Grades
1	Agricultural Sciences	Grade 6-12
2	Animal/Veterinary Science, including Marine Animals and Animal Ecology	Grade 6-12
3	Chemistry and Biochemistry	Grade 6-12
4	Earth Science, Housing and Settlement Studies – Geography and Geology, including Oceanography)	Grade 10-12
5	Energy: Non-renewable (fossil fuels and use of electricity)	Grade 6-12
6	Energy: Alternative and renewable (solar, wind, wave)	Grade 6-12
7	Energy: Alternative and renewable (biofuels, geothermal)	Grade 6-12
8	Energy efficiency and conservation (efficient use of energy and ways of using less energy)	Grade 6-12
9	Engineering: Electronics and Electrical	Grade 10-12
10	Engineering: Chemical, Civil, Metallurgical and Mining	Grade 10-12
11	Engineering: Mechanical, Aeronautical and Industrial	Grade 10-12
12	Environmental Management: study of human interaction with the environment (e.g. waste management, deforestation, land management and bioremediation)	Grade 6-12
13	Environmental Science: changes to the environment (e.g. pollution, climate change, carbon emissions)	Grade 6-12
14	Food Science, Food Technology and Healthy Eating (Diet)	Grade 6-12
15	Health Care and Sports Science	Grade 6-12
16	Information Technology	Grade 10-12
17	Innovation and Technology	Grade 6-12
18	Mathematics and Statistics	Grade 6-12
19	Medical Sciences: Human Biology (anatomy, genetics, physiology)	Grade 6-12
20	Microbiology and Medical Sciences: Diseases and disease-causing organisms and Medicine	Grade 6-12
21	Physics, Astronomy and Space Science	Grade 6-12
22	Plant Sciences including Marine Plants and Plant Ecology	Grade 6-12
23	Social and Psychological Sciences	Grade 6-12
24	Sustainability, Recycling and Recycled materials	Grade 6-12

Types of projects

Investigation

An investigation is a project in which you try to solve a problem or answer a question that you have identified. When you do an investigation, you follow a method that allows you to test an idea or solve a problem and come to a clear conclusion. Projects for Expo must have original work done by participants, e.g.

- Survey of more than 100 questionnaires
- Experimental work with a lot of testing

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 I make this better?”
- Develop or establish design criteria (could be more than one)
- Do background research and review literature to see what has already been done or what products already exists 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 of your design. Consider reliability, repair and servicing.
- Retest and redesign as necessary. Product testing.
- 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.

Theoretical projects

These projects may involve a thought experiment, developing of new theories and explanations, concept formation or designing a mathematical model.

Steps to doing a good project

STEP 1: Choosing a topic

The topic for your project should be something that interests you and that you want to learn more about. You may think of a good topic straight away just by looking at the list of Expo categories on Page 7, or you may need to look for ideas for your topic. You can get ideas for projects from:

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

Your idea for a project should be an original one. This means that it should be your own 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 you Expo project.** The procedure to follow is well-known from school textbooks and you can easily look up the answer.

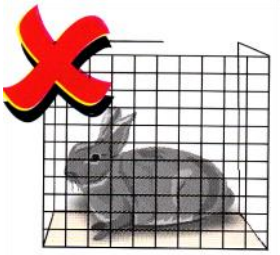
The best Expo projects are not always complicated, but they are imaginative and well carried out.

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 live animals or humans; or
- involves collecting plants or animals that are protected by Nature Conservation laws.



Ask your teacher for advice if you are not sure whether your topic will make a suitable scientific Expo project.

STEP 2: Do a research plan

Every student should type a research plan which should be submitted to the teacher/mentor/qualified scientist at the beginning of the project for approval. **This plan shows how you intend to do your project** 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 you asked or solve the problem. The following are important and key items that should be included when formulating ANY AND ALL research plans:
    - Procedures (method)
    - Variables: independent, dependent and controlled/fixed
    - Data analysis: how long you will analyse the data
D. Bibliography: List the three (3) most important references (e.g. science journal articles, books, Internet sites) that you used to get information about your topic and that you will refer to in your introduction/ part A above.

    Check this website to ensure that you reference your sources correctly:
    http://www.exposcience.co.za/index.php/referencing-bibliography.html

STEP 3: Gather background information

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

STEP 4: Collect data

- Test your hypothesis/engineering goals.
- Make sure you do sufficient testing to make your results reliable.
- Interview people interested in your topic.
- Do surveys or send out questionnaires – a minimum of 100 people, or make a working model to illustrate the solving of your problem.
- Keep handwritten notes in a **project data book** (e.g. file, diary or scrap book). A project data book is your 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 your project data book and then transfer to tables when writing your project. Make sure you date every entry.

STEP 5: Results

- Record data in tables
- Record numerical results/data in tables
- Generate graphs from your tables. Check that your graphs are correctly completed
- Add photos with captions
- File a blank copy of your questionnaire/survey in your project data book

STEP 6: Discuss results

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

STEP 7: Conclusion(s)

- Scientific Method
- State whether your results support or do not support your hypothesis
- Your conclusion(s) must be based on your findings and must be linked to your hypothesis/aim/engineering goals.

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

STEP 8: Evaluate the whole project

- Review, Revise and Redo

STEP 9: Write a report using the following headings

- Choose a title of the project - Title must be simple descriptive and scientific.
- State the problem/aim and hypothesis/engineering goals.
- Introduction, including information collected and description of the project literature review.
- Procedures (Method) – numbered, logical, concise, third person, includes description of variables.
- Results - record of data in tables and graphs.
- Analysis/discussion and interpretation of results (include errors and modifications).
- Conclusion(s).
- Bibliography/References – list of books, journal articles and/or Internet sites where you acquired important information.
- Remember to reference all images and photos.
- Make sure your report clearly shows whether you did a scientific method or an engineering project.
- Acknowledgements – the list of people who helped you and the help each one gave. For example someone might have lent you a piece of equipment, taken photographs for the poster or given some advice.
- Plagiarism form.
- Research Plan.
- Abstract – compulsory for Regional Expo and Eskom Expo International Science Fair
- For engineering projects: discuss efficiency of prototype and redesign and re-test if necessary.

STEP 10: Showing your Work

Your presentation must include the following:

- Presentation for your display board must be printed on A4 pages (landscape or portrait). This is compulsory for regional expos and the International Science Fair (ISF).
- Presentation must be arranged logically* and must be eye-catching.
- Project data book / journal
- Report file
- Surveys, questionnaires (if applicable)
- Working model on table (if applicable)
- **Display boards will be provided - check with the Regional Science Fair Director for the size and dimensions**

Compulsory logical order for display board at Regional and International Science Fair

- Introduction and background information
- Aim
- Hypothesis
- Procedure or Method including variables
- Title (Font size 150)
- Name and grade underneath the title
- Results – graphs and analysis
- Discussion and interpretation of results
- Conclusion(s)
- Acknowledgements
- Photos (if applicable)

Your poster is a very important part of your exhibit. Your display should be easy to read and understand. It should explain what you did, how you did it and what you found out. Make your presentation eye-catching and interesting. You want visitors at the Eskom Expo to stop and read about what you did. Summarised information must be laid out in a logical order. Anyone who wants more information can read your report file.

Report File/Project Data Book

Report File

- File must be neatly laid out – contents page with headings below, dividers, logical order.
- At front of file – plagiarism pledge, research plan and abstract.
- Introduction including problem, literature review and background research – why you did the project, including evidence of background research and the value of the project.
- Aim – to find out/to determine etc.
- Hypothesis/Engineering Goals – statement that you are going to test which includes independent and dependent variables.
- Procedure (Method) – how the project was carried out, including the fixed variables. Written in the third person.
- Results (what happened – tables and graphs).
- Analysis of results (results/findings/graphs explained in words, more extensive in this report than on poster).
- Discussion, error and modifications (patterns and trends are noted and explained, anomalies/unusual results are discussed, limitations noted and clarified).
- Conclusion(s) – refer directly to aim/hypothesis or engineering goals. Incorporates results and states whether the findings support the engineering goals or hypothesis.
- References – which books and webpages you consulted and these must be referenced correctly, the first reference must be one where you got your project idea from.
- Acknowledgments – people you talked to, who helped you and state what help they gave you.

Project Data Book / Journal

- 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.

What is an abstract?

The purpose of an abstract is to serve as a link between the title of a scientific project (research study) which may be a brief paragraph or two (maximum 250 words).

- Write your abstract in the past tense.
- It is a useful summary of the project that provides justification for the research.
- The abstract allows the reader to conclude whether the project write-up is worth reading.
- Your abstract appears at the **beginning** of your report file and a copy must be displayed on your table.

How to write an abstract

The abstract should include the following headings:

Purpose of the Project/Experiment

- 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 (Method):

- A summarisation of the key points and an overview of how the investigation was conducted.
- An abstract gives no details about the materials used unless it greatly influenced the procedure or had to be developed to do the investigation.
- An abstract should only include reference to procedures done by the student during the project. Work done by a mentor (such as surgical procedures) or work done prior to the student involvement must not be included.

Data/Results:

- This section should provide key results that lead directly to the conclusion you have 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.
- The summary paragraph reflecting on process and possibly state some applications and extensions of the investigation.
- An abstract does not include a bibliography, reference or acknowledgements.

Entering a Regional Expo

Please check with your Regional Science Fair Director as to which grades may enter 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 32-36) or visit our website www.exposcience.co.za for more information.
Ensure that entry forms are fully completed; that the information is clearly readable and you have entered your project 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 your own drawing pins, staples, temporary adhesives (eg Prestik), velcro, masking tape or whatever else you need to put up your display.
- Bring your own extension cord if you have a model or apparatus that needs 220 volt electricity to work.
- Do not include any live animals, insects, spiders, fish and plants in your display. Photos and video clips may be shown instead. Do not include any animal or human body parts in your display. (Refer to page 24 and make sure your project is ethical)
- Burning of any substance or use of open flames as part of your exhibit is prohibited.
- Do not leave valuable items on your 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:

PART A: Value of the project (50)

- Originality of the project. The student is able to think and act independently. Refers to reading, originality of approach, use of resources, depths of planning and execution of investigation.
- Scientific method. Command of the scientific method, scope/range of investigation, results, analysis and conclusion.

PART B: Written communication of the project (30)

- Written communication of research (Poster, report file, project data book)

PART C: Oral communication (20)

- Interview

The interview with the judge is aimed at establishing the participant's understanding of the topic, originality and thoroughness of their procedures (methods) and experimentation.

Most of what the participant has done should be on display or be discussed during the interview.

A standard set of judge's criteria is used at Regional Expos and the ISF. Please make sure that you study the judge's criteria before you participate 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

Parents and Teachers

Expo for Young Scientists supplies a forum for students 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 student(s).

More information on judging is available on the Eskom Expo website and on the Judging DVD.

DO NOT USE BRANDED PRODUCTS ON YOUR DISPLAY BOARD – RATHER IDENTIFY USING LETTERS OR NUMBERS. YOUR PROJECT WILL BE DISQUALIFIED IF YOU INCLUDE BRANDING

Selection for the Eskom Expo International Science Fair is only for students 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.

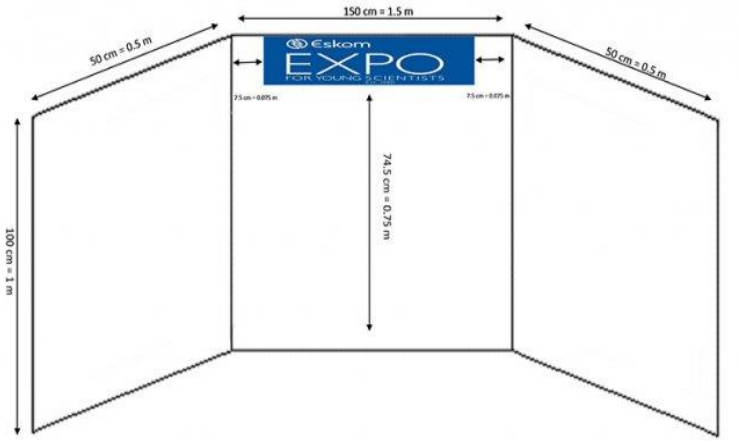
Each exhibit is given space of maximum 1.5m table length and a display board. It is compulsory to use the display boards provided at ISF events.

Size and dimensions of the display board:

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

Logical order

Refer to the drawing below to plan how to make the most of the space you are given. For logical order see page 14.



Awards at ISF

Participants are judged and awarded gold, silver and bronze medals.

Special awards

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 a rural Primary and Secondary School
- International trip to a science fair or science forum

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

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 participants and invited Eskom Expo officials. No exception will be made.

Ethics Statement

Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include plagiarism, forgery, and use of presentation or other research's work as one's own and fabrication of data. Fraudulent projects will fail to qualify for competition at any Eskom Expo events.

1. Plagiarism

What is plagiarism? It can be defined as follows:

To use another person's words or ideas and to pretend that they are your own. The following are considered as plagiarism:

- To steal or borrow another person's work.
- To pay another person to write your assignment.
- 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 in them without giving credit to the original ideas.
- To paraphrase 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 or words in your own words, or use small sections of another person's writings without acknowledging it 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. Any surveys (questionnaires) need another form giving consent or permission by parents or schools. Both forms need to be filed in the project file in the appendix.

Make sure your 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, human subjects, hazardous equipment or materials, recombinant DNA or other biothechnological materials. (By the way, "animals" include pets and livestock and "humans" include family members and students in your class or school). It's heartbreaking to have your project disqualified at any Eskom Expo events because you broke the rules – or maybe even 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 animals, fish, 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 and devices (for example firearms, weapons, ammunition, reloading devices, knives and any sharp instruments).
- Flammable substances.

Ethics infringements continued

- Photographs or other visual presentations depicting humans or vertebrate animals in surgical techniques, dissections, necropsies or other lab procedures, or belittle people in any way, or show animals being harmed in any way.
- Brand names or any branded products.
- Food substances that are not in completely sealed containers (plastic wrap is not acceptable as it can be easily removed).
- 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 you must state if you took the photos or if you used them with permission.

3. Safety

All electrical work must conform to the National Electrical Code and Exhibit Halls 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 / Bibliography

Referencing means that you give credit to the various sources you have used when writing your assignment/report. A reference list should include any documentation that is not your 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:**
   www pages: e.g. Unknown (1995) Sentient micorfilaments: A tempest in a tubule (online). Available: http://somecomputer.printer.edu/pub/harnard/bixley
   Date accessed:

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 your background research and not the whole project. Before you start you need to ask yourself these questions – 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 I could consult before carrying out a survey (literature search)?
- How will I ensure that those who have a stake in the outcome of the survey support it (well-written permission letter)?
- How will I develop the list of people/organisations to be surveyed and how reliable is the contact information (important part of research plan)?
- How should I design my sample (group of people taking the survey) to minimize cost and maximise the accuracy and flexibility of the results?

As you develop the questionnaire you need to know:

- What information is required to meet the needs of my project (part of aim and hypothesis)?
- What is the best way to word questions so that I will get unbiased responses (procedures/method)?
- How will I 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 should I pre-test the survey questionnaire (in the pilot study)?
- When should I use the results of the pre-test?

When dealing with the respondents you need to answer:

- How will the confidentiality of the responses be protected (all questionnaires are filled in anonymously)?
- Who will respondents contact when they have questions (you, the investigator)?
- How long do respondents have to respond (shorter deadlines work better)?
- What will I do if they don't respond (accept this as it's their choice to complete the questionnaire)?
- What is an acceptable response rate? What will I do if my response rate is unacceptably low (for an initial study for Expo a minimum of 100 completed survey questionnaires is needed so if you get too few send out more survey questionnaires)?

Before you analyse and present the information, you need to know:

- How will I assess whether or not the responses are biased and how will I correct my data for bias if it exists (double blind questions)?
- What is the best way to present the data so that my audience grasp the importance of my findings (tables and graphs)?
- How will I 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)?
- What techniques will be used to impute, estimate and weight the responses to give accurate, fully representative results (statistical analysis)?
- What techniques will I use to analyse the data (analysis and 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 event.
Conclusion	Relates the results obtained to the aim/hypothesis and either agrees or disagrees with the aim/hypothesis.
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 wrong 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).
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.
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.
Variables	Factor(s) that affect(s) an experiment.
Controlled/ Fixed variable	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.

Important Information

- Students may enter one project in one Eskom Expo region per year.
- Individual projects are encouraged, but no more than 2 students are allowed to work together on a project.
- Not all gold medal winners at regional level will be selected to participate at the Eskom Expo International Science Fair.
- Do not use branded products in your experiment – rather identify using the alphabet or numbers. Your project will be disqualified if you include branding.
- A standard set of judge's criteria are used at Regional Expos and the International Science Fair. Please make sure that you study the judge's criteria before you participate at Expo.
- 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.
- Please note that participation at International Science Fairs in other countries is strictly for selected individual participants and invited Eskom Expo officials. No exceptions will be made.
- It is compulsory that every participant has a signed copy of the research plan, plagiarism form and abstract in their file.

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.

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