Eskom

EXPO

FOR YOUNG SCIENTISTS

Est. 1980

PROJECT GUIDE BOOK

Table of Contents

SECTION A: ABOUT ESKOM EXPO 6

What is Eskom Expo for Young Scientists? 6

Who can participate in Expo? 6

What are the benefits of doing an Expo Project? 6

How do I enter an Expo project? 7

Role of the Teacher 7

SECTION B: ABOUT ESKOM EXPO PROJECTS 8

What is an Eskom Expo Research Project? 8

Expo project ideas 8

Where can I find project ideas? 8

How can I develop my project idea? 8

Types of projects 9

Scientific Investigations/ Experimental 9

Engineering/ Computer Science 9

Social Sciences 9

Mathematics/ Theoretical 9

Categories 9

Category List 11

Ethics 12

Plagiarism 13

SECTION C: PRESENTING AN EXPO PROJECT 13

Written 13

Journal: 13

Research Plan: 13

Report File: 14

Abstract: 14

Visual 14

Poster 14

Project Display Board: 15

Prototypes (if applicable): 16

What happens at the Expo science fair? 16

Project Approval 16

Judging/ Project Assessment 16

Interview 17
Judges are looking for the following from learners during the interview: 17
Scoring 17
Safety 18
Patents 18
SECTION D: APPENDICES 19
APPENDIX A: CODE OF CONDUCT FOR LEARNERS AND ADULTS 19
APPENDIX B: PLANNING A SURVEY 21
APPENDIX C: CATEGORY DESCRIPTIONS 24
APPENDIX D: PLAGIARISM FORM 32
APPENDIX E: RESEARCH PLAN 33
Scientific Investigations/ Experimental 34
Engineering/ Computer Science 36
Social Sciences 38
Mathematics/ Theoretical 40
APPENDIX F: PROJECT REPORT GUIDELINES 42
Scientific Investigations/ Experimental 44
Engineering/ Computer Science 48
Social Sciences 53
Mathematics/ Theoretical 57
APPENDIX G: ABSTRACT 61
APPENDIX H: BINDING AGREEMENT 62
APPENDIX I: PROJECT APPROVAL FORM 64
APPENDIX J: REFERENCING GUIDE 66
Why reference 66
When to reference 66
How to reference 66
Useful Links 72
GLOSSARY 73

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.

An association incorporated under Section 21 of the Company's Act, 1973
Registration number 1992/006939/08
Non-profit Organisation NPO number 008 350
Public Benefit Organisation PBO number 930004487

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Beijing Youth Science Creation Competition (BYSCC)
Kenya Science and Engineering Fair (KSEF)
Oğuzhan Özkaya Educational Institutions – Karademir Science Engineering Energy Project Fair (OKSE^{2}F)

SECTION A: ABOUT ESKOM EXPO

What is Eskom Expo for Young Scientists?

Eskom Expo for Young Scientists (Expo) is the only national initiative in South Africa where learners are provided a platform to showcase their research projects. Expo is proud to have 35 affiliated regions in all 9 South African provinces in which learners can participate. Learners get to discuss their work with judges, teachers and learners from other schools, with parents and with other interested people.

It is a resilient science foundation that has been built over the years by dedicated and highly skilled individuals, who have ensured that learners move in the direction of Science, Technology, Engineering, Mathematics and Innovation. Expo seeks to engage young people from across South Africa in high-quality scientific research in 13 categories that cover scientific investigations, engineering projects, mathematics, computer science or social science projects. Learners have an opportunity to exhibit at various stages of expo and if successful, may proceed to the next level. The first level is at school, proceeding to a district expo, followed by a regional expo and eventually to the International Science Fair (ISF). Some winners are then selected to represent South Africa at various international science fair across the world.

Who can participate in Expo?

Expo district/ regional competitions are open to all learners in school, including home schooled learners. However, only learners from grades six to twelve are eligible to be selected for ISF. Check with the Regional Science Fair Director (RSFD) of your region about grades that are accommodated in your area.

To take part in Eskom Expo you need to be a self-motivated and curious learner.

What are the benefits in doing an Expo Project?

- Expo stimulates learners to pursue their passion in the STEM related fields of study and also prepares them for careers by engaging in inquiry-based research in the informative years of their education.
- Learners acquire 21st century skills which are used throughout their lifetime:
    - Critical thinking and Problem solving
    - Communication
    - Creativity
    - Collaboration
- Expo makes science relevant by allowing learners to conduct research based on their own interest, which also helps them identify a career path at an early age.

Since Expo is an official programme of the Department of Basic Education, the training material and activities are accredited by the South African Council for Educators. Teachers who engage with and facilitate expo activities in a school can earn type 3, type 2 and type 1 SACE continuous professional teacher development (CPTD) points.

SECTION B: ABOUT ESKOM EXPO PROJECTS

What is an Eskom Expo Research Project?

An Expo research project involves learners independently undertaking a thorough scientific investigation of a topic and presenting this investigation in written and spoken form.

Expo project ideas.

Think about your project idea before you select a topic. Try not to focus on a topic first as this narrows your research. You should start by finding something that interests you, it could be a problem that needs a creative solution or something you know could be improved on. Try to focus on that single issue because that could be your project idea. At this stage it's just the start of your project, you are going to narrow that idea down to something that can be developed into an Expo project.

Where can I find project ideas?

- In your home
- At school e.g. in Science clubs, school grounds
- In your community
- Internet, social media, TV
- Issues at local or global level

How can I develop my project idea?

- Talk to your friends and to other people like your family, teachers, professionals
- Read books, magazines or newspapers, online articles
- Do background research, by finding a gap (what has not been done or what needs further research)

You need to ask yourself these questions: why am I doing this project, how will I do this project and when must it be done, who else has done a similar project?

» Tip: To find out what research has been done in your project idea, you may go to Google Scholar and type your project idea in the search area.

Types of projects

Once you have a project idea and you have identified the problem or phenomenon you are going to address, you must start your planning: There are 4 basic types of Expo projects that can be entered, though some projects may be inter-disciplinary.

Scientific Investigations/ Experimental – these are projects that follow a method that answers a research question and tests a hypothesis, usually through observations and experimentation. It involves collecting and analysing data to reach a conclusion.

Engineering/ Computer Science – these types of projects follow a design process according to the criteria, to build, test-redesign and retest a prototype/ product/solution e.g. a device or a computer code.

Social Sciences – these projects follow a systematic approach that involves answering questions or testing a hypothesis of the functioning of human society by observations and analysing of human behaviour, social relationships, social issues, and other phenomena. Its method involves collecting qualitative and/or quantitative data. Surveys are often used to collect data. Details on planning a survey can be found in Appendix B.

Mathematics/ Theoretical – these projects explore quantity, structure, space and change. Starting with an observation, problem or question, make conjectures/ hypotheses, prove your claim using new or existing methods, make valid deductions and test your ideas theoretically. Your reasoning and arguments must be logical.
All Expo projects must contain evidence that the learner(s) completed the project and must include current year results of their own investigation.

Categories

Once you have figured out the type of project you will be doing, start thinking about the category in which it will fall under. A research project can go in various directions, however, the emphasis/focus/experimentation of your research – not the application of your results; will determine the category in which the project will be entered. There are 13 different categories in which an Expo project can be entered.
E.g. when your project is about water hyacinth (*Eichhornia crassipes*) – to place your project in a category, ask yourself what you are trying to find out about the plant. If you are looking at the:

- effectiveness of all established biocontrol agents on water hyacinth plant growth - Category: Environmental Studies
- use of water hyacinth in waste water treatments, focusing on the chemicals - Category: Chemistry & Biochemistry

- water hyacinth as a potential biofuel crop - Category: Agricultural Sciences
- phenology and growth of water hyacinth in two different locations - Category : Plant Sciences
- allelopathic effects of water hyacinth - Category: Biomedical and Medical Sciences (Microbiology)
- socio-economic utilization of water hyacinth and how it has impacted the local communities - Category: Social Sciences;

Check out the Expo category list below and the descriptions in Appendix C. Ask your teacher or mentor for help with choosing a category if you are unsure.

Note: At District or Regional level, the judges may recommend that your project be moved to a new category, which is most appropriate.

Category List

See Appendix C for category descriptions.

1. AGRICULTURAL SCIENCES(AGR)
- Animal Production
- Aquaculture
- Crop Sciences

2. ANIMAL SCIENCES(ANI)
- Animal Behaviour
- Animal Genetics
- Animal Physiology
- Aquatic Animals
- Entomology
- Wildlife Management
- Zoology

3. BIOMEDICAL AND MEDICAL SCIENCES(BIO)
- Diseases and Illnesses
- Food Science and Technology
- Health Care
- Human Genetics
- Human Physiology
- Medical Science
- Microbiology
- Pharmacology
- Sports Sciences
- Veterinary Sciences

4. CHEMISTRY AND BIOCHEMISTRY(CHB)
- Analytical Chemistry
- Biochemistry
- Inorganic Chemistry
- Organic Chemistry
- Polymer Chemistry

5. COMPUTER SCIENCES AND SOFTWARE DEVELOPMENT(COM)
- Data Management
- Data Sciences
- Networking
- Software Systems

6. EARTH SCIENCES(EAR)
- Atmospheric Sciences
- Climate Sciences
- Geography
- Geology
- Limnology
- Oceanography
- Soil Sciences
- Water Sciences

7. ENERGY(ENP)
- Energy Productivity
- Non-Renewable Energy
- Renewable Energy

8. ENGINEERING(ENG)
- Biomedical Engineering
- Chemical Engineering/Process Engineering
- Civil & Industrial
- Electrical, Electronics and Embedded Systems
- Mechanical & Aeronautical
- Mining & Metallurgical

9. ENVIRONMENTAL STUDIES(EVS)
- Biological Control
- Bioremediation
- Ecology
- Environmental Management
- Sustainability
- Sustainable Development

10. MATHEMATICS(MAT)
- Algebra
- Game Theory
- Geometry
- Number Theory
- Statistics and Probability

11. PHYSICS, ASTRONOMY & SPACE SCIENCES(PHY)
- Astronomy and Space Sciences
- Material Sciences
- Matter and Materials
- Mechanics
- Mechatronics and Robotics
- Optics
- Theoretical Physics

12. PLANT SCIENCES(PLA)
- Aquatic Plants
- Botany
- Plant Genetics
- Plant Pathology
- Plant Physiology

13. SOCIAL SCIENCES(SOC)
- Anthropology
- Education Studies
- Human Behaviour
- Human Settlements
- Psychology

Plagiarism

Eskom Expo promotes ethical research behaviour regarding all aspects of the research conducted . Using another person's words or ideas and presenting them as your own is known as **plagiarism**. Plagiarised projects will be disqualified at all Eskom Expo events.
Examples of plagiarism:

- To steal or borrow another person's work including data without their permission. **DO NOT** submit the same project your friend, sibling or relative exhibited at a science fair before.
- To pay another person to do your project for you or write it up. Acknowledge persons for the contributions they made to your project. Their contribution should not be the major part of the science project.
- To copy directly from a source without referencing the original source and without permission from the author(s). Make sure you use in-text referencing and have a reference list (see appendix J).

It is compulsory for every participant to have a signed copy of the Plagiarism Form in their file, which can be found in Appendix D.

SECTION C: PRESENTING AN EXPO PROJECT

At Eskom Expo, projects are presented in written and visual form.The presentation must include the following:

Written

The following are presented in written form, at an Eskom Expo fair:

Journal:
From the ***first day*** of your project, you should keep a journal where you record the date and what you did on each day. The journal can be hand written in an exercise book including data, observations, etc. This is a record of ***ALL*** the work of the project – no matter how untidy it is! This journal must be presented as part of the assessment. File all emails and rough data/results. File notes from interviews. Record all your conversations with people, including relevant text messages and emails. File all designs, photos, and plans.

Research Plan:
At Eskom Expo for Young Scientists, it is compulsory to write a Research Plan, before you start your project. Once you have figured out what you want to do for your Expo project, you must start writing a research plan. The Research Plan shows how you intend conducting your research. Hence, it is written in the future

tense i.e. before you actually do your project. It also needs to be written in the 3rd person (do not use: I, We, us, My etc.). When planning your project, consider "what", "why", "how", "when" and "where" you will do your research. What resources will you need? What literature do you have to read before starting the research? What time frames are needed to complete the research? Is this research doable? Think about ethical issues you may encounter and how you will address these. Your Research Plan will guide your research process and may change as you progress with your research. In case, note the changes in your journal and why you made those changes. Do not change your research plan (see Appendix E for a detailed research plan template).

Report File:
A report file consists of a printed project report. The purpose of a project report is to communicate your ideas and results in full detail, in a way that is understandable to judges and your peers. For an Eskom Expo project report, use the passive voice (e.g. The data was collected…) in the third person i.e. do not use ***"I, We, Us, Me".*** Convey your ideas objectively, based on what you've read. Your writing needs to be clear, concise and to the point. Don't use emotive words/ slang. Simple language is preferable to jargon, if they convey the same meaning. Your report must have the following compulsory headings: **Introduction, Method, Results, Discussion, Limitations and Errors, Recommendations for Future Research, Conclusion, Acknowledgements, References,** and/or **Appendix**) have an initial capital letter, are in bold and are aligned along the left margin (left-justified). The report is completed after your research is done, so it is in the past tense (See Appendix F for guidelines).

Abstract:
An abstract is a summary of your project report that you write after you have completed your research and written your project report. Your abstract must be clearly written in the past tense and concise, does not include references/tables/ graphs/images and must be less than 250 words. See Appendix G for guidelines on how to write an abstract.

Visual
The following are presented in visual form, at an Eskom Expo fair:

Poster:
A poster is a display of a summary of the project report. The poster must be printed on A4 pages (landscape or portrait) and stuck onto a project dispay board in logical order (see Figure 1). Information on the pages must be easy to read from a distance, use text that is large enough to be read at arm's length. Choose colours that make your poster easy to read. Make the poster interesting and attention-grabbing e.g. through pictures. DO NOT put detailed information, this will be in the report file.

Project Display boards will be provided at Regional Expos and in some District expos- check with the RSFD for the size and dimensions. The ISF project display board dimensions are as follows; Height: 1m Total width: 2.5m (Left side: 50cm; Middle: 1.5m; Right side: 50cm). Display width is 1.5m –see example below (Figure 1)

Project Display Board

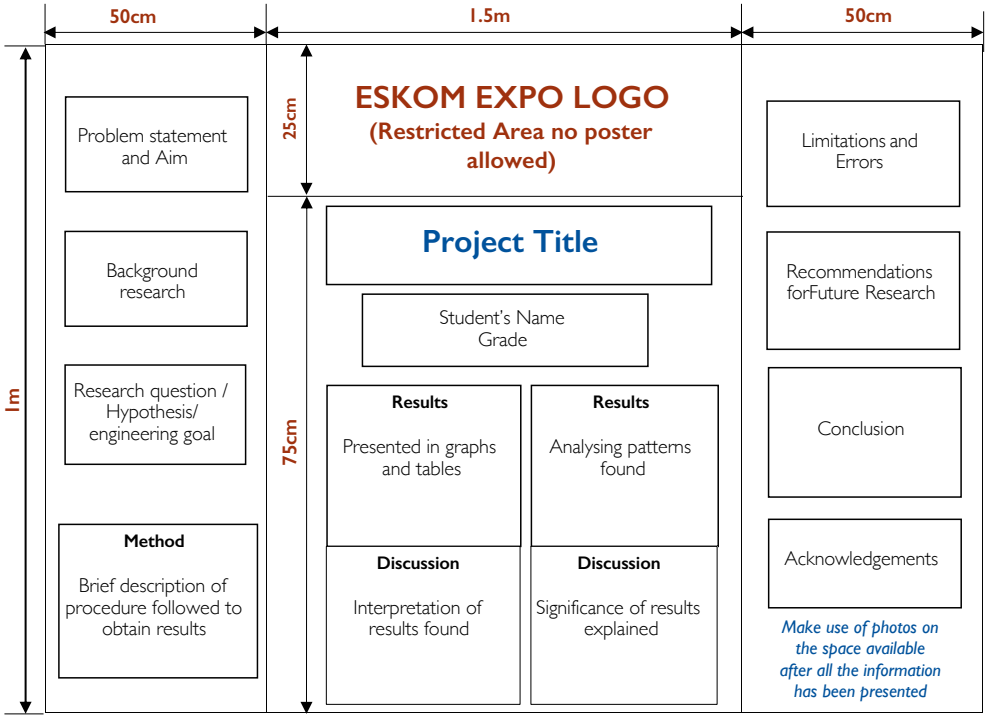


Figure 1: Project display board dimensions for the Eskom Expo International Science Fair, showing the order in which you must display your project report information.

Prototypes (if applicable):
Must fit onto the table within the project display space provided. The model may not obstruct the project display board. Any part of the 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 project display board in any way. Safety rules would also still apply. If prototypes are too large, a video showing how it works is sufficient.

What happens at the Expo science fair?

You will be allocated a space and a Project Display Board to set up your project. Use only rubber-like re-usable adhesive e.g. prestik to stick your A4 pages on to the project display board. No marking/writing is allowed on the project display board. You will be given a Project ID number based on the category your project is placed in. When you arrive at the science fair, your project must first be approved, this is known as the project approval process.

Project Approval

All projects need to be approved prior to judging. This means that it is checked for compliancy with the rules of the Eskom Expo science fair. The Project Approval team will first check for ethical violations (see Ethics Rules) – Anything that is not allowed to be exhibited will be confiscated.

At ISF, the following documents are also inspected at Project approval:

- Journal
- Plagiarism Form signed by learner
- Research Plan signed by teacher
- Report File with Project Report
- Abstract
- Binding Agreement signed by learner
- Permission Letters for surveys / scientist supervision (if applicable)

See Appendix I for the Project Approval form

Judging/ Project Assessment

Your project will be judged/ assessed by several specialists after it has been approved. At this stage, your forms will be checked, and a first ethics check will be done.

No teachers or parents are allowed in the hall during judging.

The following criteria are guidelines that will be used during judging::

- Introduction
- Method
- Results and Discussion
- Limitations, Further research, conclusion
- Originality and Creativity
- Communication (report, poster and interview)

Interview

The learners are given the following advice in preparation for the interview:

- Firstly, introduce yourself by name.
- Know your project very well
- Don't prepare an oral presentation and recite it to the judges. To prepare, rather get your friends and family to ask you questions about your research project.
- Listen to the judge's questions.
- Be enthusiasticwith your answers and refer to important aspects of your poster.
- Make sure the answers are to the point.
- Speak clearly with confidence and use appropriate language.
- If you have a prototype, don't only focus on the prototype, but rather the science behind it.

Things to Remember:

- Your cell phones must always be switched off – unless it is part of the display.
- Be aware of time constraints, the interview is only about 10 minutes long.

Judges are looking for the following from learners during the interview:

- Ability to provide a logical summary of your project, highlighting the most important information
- Ability to communicate research project effectively
- Extent of research and understanding of the research field
- Appropriate use of technical/ scientific terminology
- Extent of ownership i.e. whether the work was done by the learner

Scoring

Marks are finalised by the judging team and projects are ranked according to the following scale:

- Gold medal: 80-100%
- Silver medal: 70–79%
- Bronze medal: 60-69%
- Highly commended certificate: 50-59% (may be awarded)

At Regional and ISF level, medals and/or certificates are awarded for these projects.

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

Note:
Not all gold medal winners at the Regional level will be selected to participate at the Eskom Expo International Science Fair. Numbers are limited at ISF so an allocation is given to each region.

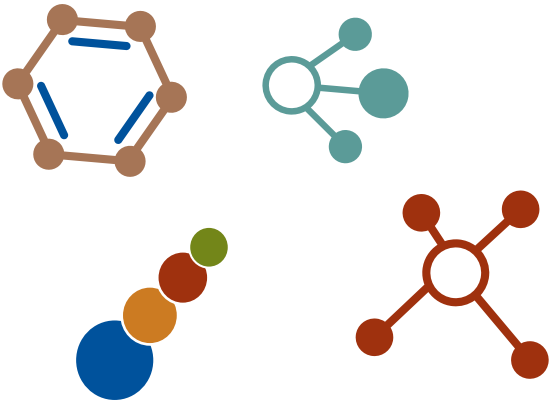
For more information on the regional expos, contact Provincial Coordinators and RSFDs for assistance. Details available on the website: www.exposcience.co.za

Safety

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

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. Before you show your project in an Expo, you should consider registering it for a patent. Go to: http://www.cipc.co.za/index.php/trade-marks-patents-designs-copyright/patents/how-app/



6.9. Unauthorized entry, use, or occupation of EXPO facilities.
6.10. Disorderly conduct of any kind; including intoxication, indecent or obscene behaviour, libel, slander and illegal gambling.
6.11. Illegal purchase, sale, use, possession, or distribution of alcohol; drugs or controlled substances.
6.12. Failure to follow any instructions given by any EXPO official – especially those related to security or safety.
6.13. Unauthorized possession or use of any weapon including firearms, BB-guns, air rifles, explosive devices, fireworks, or any other dangerous, illegal or hazardous object or material.
6.14. Interference with or misuse of fire alarms, blue lights, elevators, or other safety or security equipment or programmes.
6.15. Loitering and/or playing around corridors, stairways.

7. Disciplinary action
7.1. Every RSFD is responsible for discipline and has the full authority and responsibility to correct the behaviour of participants when necessary.
7.2. Any corrective measure or disciplinary measure will correspond with and be appropriate to the offence.
7.3. All participants will abide by the disciplinary system that has been developed to assist and guide participant's behaviour during any EXPO activity.
7.4. Should a matter be deemed severe in nature, the responsible RSFD may refer the matter to the national office for a decision.
7.5. The national office may convene a disciplinary hearing.
7.6. A decision taken at this hearing will be final and will be communicated to the offending party in writing.

8. Disciplinary sanctions
Depending on the nature and severity of the offence, one or more of the following disciplinary sanctions may apply:
8.1. Verbal warning (school informed of misdemeanour and disciplinary measure taken)
8.2. Written warning (copies sent to parents and school)
8.3. Withdrawal of participation for the current or forthcoming expo
8.4. Disallowed participation at the International Science Fair
8.5. Disallowed participation at any international expo
8.6. Disallowed participation at any future science expo
8.7. Withdrawal of any medals received
8.8. Withdrawal of special prizes received

APPENDIX B: PLANNING A SURVEY

The key to obtaining good data through a survey is to develop a good survey questionnaire. Whether you are conducting interviews or mailing out surveys, you will need to know how to design a good survey questionnaire.

What is a survey questionnaire?
Survey questionnaires present a set of questions to a participant who, through their responses will provide data to a researcher (learner conducting survey). Here we discuss some key elements to consider when designing a survey questionnaire, and then highlighting some tips and tricks for creating a good survey questionnaire.

Objectives
The key to developing a good survey questionnaire is to keep it short while ensuring that you capture all of the information that you need. Before you even begin to design your survey questionnaire, you should develop a set of objectives for your research and list out the information that you are trying to capture. This list of objectives and research goals will serve as your plan for the survey questionnaire.

Now that you know what you are looking for, you can begin to structure the questions that will help you capture the information. Once you have developed your survey questionnaire, go back to your objectives to determine if each of the questions is providing you with information that you need. Any question that is not providing necessary information should be removed. Test your questionnaire by asking someone who is not a participant in your study to complete. This is called a pilot study.

Types of Questions:
There are two different types of questions that can be used to collect information. The first is called a structured or fixed response question and the second is called non-structured or open question. It is important to understand when and how to use these questions when designing your survey.

Structured (fixed response)
Structured questions offer the respondent a closed set of responses from which to choose. Structured questions make data collection and analysis much simpler and they take less time to answer. Structured questions are best suited in the following situations: (1) when you have a thorough understanding of the responses so that you can appropriately develop the answer choices (2) when you are ***not*** trying to capture new ideas or thoughts from the respondent.

Examples of Structured Questions

Do you have a driver's license? ( ) Yes ( ) No	Which subject do you enjoy the most at school? ( ) Mathematics ( ) Science ( ) English ( ) Afrikaans ( ) History ( ) Geography ( ) Art / Music ( ) Other	How many hours a day do you spend doing homework? ( ) 0 to 1 hour ( ) 2 to 3 hours ( ) 4 to 5 hours ( ) more than 5 hours

When writing the selection of responses for a structured question, you must ensure certain that the list covers all possible alternatives that the respondent might select AND that *each of the answers is unique* (ie they do not overlap). So for example, in the homework question above, we have included every option on the number of hours (from 0 to infinity). Also, you will notice that we were careful not to overlap the hours when defining the ranges by stating them as <0 to 1 hour> and <2 to 3 hours> rather than saying <0 to 1 hour> and <1 to 2 hours>.

Non-structured (open-ended)
Non-structured questions, or open-ended questions, are questions where there is no list of answer choices from which to choose. Respondents are simply asked to write their response to a question. Here is an example:
Example of a Non-Structured Question.
What do you like best about the school holidays?

Tips for creating a good survey questionnaire

- Clearly state your intentions with the research.

Many people are hesitant to answer questions about themselves and state their opinions. If you are developing your survey for a science fair project, people will probably be more willing to help if you clearly state your intentions. At the top of your survey, write a brief statement explaining why you are collecting the information and reassure each respondent that the information is entirely confidential and anonymous. If you need to know specifics about a person, respect their privacy by identifying them as subject1, subject2, etc...

- Include instructions with your survey questionnaire

What may seem obvious to you is probably not very obvious to someone else. To ensure that you collect valid survey results, make sure you include instructions on how to answer the survey questionnaire. There should be a short introductory set of instructions at the top of the survey questionnaire, and additional instructions for specific questions as needed.
Your overall instructions may be something like:

Food Science and Technology	is the study of the nature of foods, the causes of their deterioration, and the principles underlying food processing as well as the selection, preservation, processing, packaging and distribution of food. This includes nutrition and dietary needs.
Health Care	is the provision of services, the processes for the prevention of illnesses and injuries as well as the promotion and awareness of wellbeing.
Human Genetics	is the study of genes, genetic variation, and heredity in humans and how they are can cause certain diseases? An understanding of genetic diseases may influence treatment.
Human Physiology	is the study of physical and biochemical functioning of the human body and different organ systems. It includes understanding of cell physiology, immunology and organ systems.
Medical Science	is the science concerned with the diagnosis, treatment, and prevention of diseases and illnesses. This includes translational medicine, which is the discovery of new diagnostic tools and treatments, using a multi-disciplinary bench-to-bedside approach.
Microbiology	is the study of the structure, function, uses and modes of existence and the associated diseases of microscopic organisms such as eukaryotes (fungi and protists) and prokaryotes (bacteria and algae) and viruses. This includes the use of microorganisms for medical applications such as treatments. This sub-category focuses on: ***Bacteriology*** is the study of the biology of bacteria as well as the associated diseases. It includes the study of the biochemistry, physiology, molecular biology, ecology, evolution and clinical aspects of diseases caused by bacteria. ***Virology*** is the study of the biology of viruses as well as the associated diseases. It includes the study of the biochemistry, physiology, molecular biology, ecology, evolution and the clinical aspects of diseases caused by viruses. ***Mycology*** is the study of fungi as well as the associated diseases. It includes the study of the biochemistry, physiology, molecular biology, ecology, evolution and clinical aspects of fungal diseases.
Pharmacology	is the science of drugs, concerned with the uses, effects and modes of actions of drugs, on living tissues and systems and their effects on health and wellbeing, as well as the treatment of illnesses.

Sports Sciences	is a multi-disciplinary field concerned with the understanding and enhancement of human performance in exercise and sport. It includes the knowledge, methods and applications of the sub-disciplines of human movement studies (i.e. exercise physiology, biomechanics, motor control and motor development, exercise and sport psychology), as well as how they interact.
Veterinary Sciences	is concerned with animal pathology and healthcare, specifically with the prevention, diagnosis and treatment of diseases in animals (domesticated and wild).
4. CHEMISTRY AND BIOCHEMISTRY (CHB)	
Chemistry is the branch of science concerned with the composition, structure and properties of substances and the transformations they undergo. Biochemistry is the branch of science that explores the chemical processes within, and related to, living organisms.	
Analytical Chemistry	is the study of the composition, separation, identification and quantification of chemical components of materials.
Biochemistry	is a laboratory based science, which brings together biology and chemistry. It explores the chemical processes within and related to living organisms at a molecular level.
Inorganic Chemistry	is the study of the structure, synthesis, properties and reactions of all chemical elements and compounds, which includes metals and minerals, other than organic compounds.
Organic Chemistry	is the study of the structure, properties, composition, reactions, and synthesis of organic compounds, which by definition contain carbon.
Polymer Chemistry	is the study of the synthesis, characterisation and properties of monomers, polymer molecules or macromolecules whether natural or synthetic.
5. COMPUTER SCIENCES AND SOFTWARE DEVELOPMENT (COM)	
Computer Science is the study of computational systems and information technology, specifically the theory, design, development, and application of these systems. This includes artificial intelligence, computer systems and networks, security, database systems, human-computer interaction, vision and graphics, numerical analysis, software systems and languages, bioinformatics and the theory of computing.	
Data Management	focuses on collecting, validating, storing, protecting, and processing data usually using databases.
Data Sciences	is the field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from data in various forms, including data mining. This requires data management (collection, validating, storing, protecting, and processing data) and data analysis.

Networking	is the use of computers and infrastructure to create networks and the study of how these networks' communicate. This includes the practice of transporting and exchanging data between nodes over a shared medium in an information system comprising of hardware and protocols (wired and wireless technology).
Software Systems	primarily focus on the interface between the hardware and users, the development of unique applications and the different programming languages used. Examples include programming applications for mobile devices, social media platforms, office suites, gaming applications, and educational software .
6. EARTH SCIENCES (EAR)	
Natural sciences related to planet earth.	
Atmospheric Sciences	is the study of the dynamics and chemistry of the layers of gas that surround the Earth, for example, study of ozone depletion, greenhouse gases.
Climate Sciences	is the scientific study of climate, scientifically defined as weather conditions averaged over a period of time.
Geography	is the study of science that deals with the description, distribution, and interaction of the diverse physical, biological, and cultural features of the earth's surface.
Geology	involves studying the materials that make up the earth, such as rocks and the features and structures found on earth as well as the processes that act upon them.
Limnology	is the study of the physical, chemical and biological properties of fresh water.
Oceanography	is the study of the physical, chemical and biological properties of the ocean. For example, studying ocean currents, waves.
Soil Sciences	includes researching soil classification, formation, chemistry and also interactions with living things.
Water Sciences	looks at the distribution and quality of ground and surface water and includes management of water resources, and water security.

7. ENERGY (ENP)	
Study of energy systems and various aspects including productivity, generation using renewable and non-renewable sources, as well as the efficient and sustainable use of energy	
Energy Productivity	is the total value gained from using a unit of energy and is concerned with new or improved processes and technologies at all stages of production. For example, acquiring and processing raw materials (coal, natural gas, nuclear, petroleum) storage, transmission and distribution of energy. Energy efficiency is the part of Energy Productivity focusing on minimising energy wastage, reducing costs, reducing energy consumption or some combination of these (e.g. using energy efficient light bulbs).
Non-renewable Energy	is the study and design of energy systems from non-renewable resources, such as fossil fuels (coal, petroleum, and natural gas).
Renewable Energy	is the study and design of energy systems using renewable resources (naturally replenished), for example sunlight, wind, rain, tides, waves, bio-energy, etc.

8. ENGINEERING (ENG)	
The use of scientific theories, mathematical methods and computer sciences to solve problems within society.	
Biomedical Engineering	is the study, design, control and application of medicine, biology and technology for healthcare purposes such as prosthetics and diagnostic equipment.
Chemical / Process Engineering	is the study, design, control, and application of systems and processes to convert input substances into desired output substances.
Civil & Industrial Engineering	***Civil*** Engineering is concerned with the planning, design, construction and maintenance of structures. ***Industrial*** engineering is about the optimisation and streamlining of complex processes, systems or organisations to reduce wastage of time, money and other resources and materials.
Electrical, Electronics and Embedded Systems	is the study, design, control and application of electricity, electronics, circuits, devices, microcontrollers and electromagnetism to solve problems.
Mechanical & Aeronautical Engineering.	***Mechanical*** Engineering is the study, design, control and application of mechanics, specifically for machines such as engines. ***Aeronautical*** Engineering uses similar principles, specifically for aircrafts.

Mining & Metallurgical Engineering	***Mining*** engineering applies science and technology to the extraction of minerals from the earth. ***Metallurgical*** engineering deals with the processes used to extract metals from their ores, purify, alloy, and create useful objects from metals.
9. ENVIRONMENTAL STUDIES (EVS)	
Deals with the components, process and preservation of nature and looks at human interactions with the environment, in interest to solve complex problems.	
Biological Control	is the intentional use of a specific organism or their metabolic by-products to limit the harmful impact of an invasive species.
Bioremediation	is the waste management technique that involves the use of organisms to remove or neutralise pollutants from a contaminated site.
Ecology	is the branch of biology that deals with the relations of organisms to one another and to their physical surroundings, including biodiversity.
Environmental Management	is the management of the interaction and impact of human activities on the natural environment.
Sustainable Development	is defined as a process of meeting human development goals while sustaining the ability of systems to continue to provide the natural resources and ecosystem services upon which the economy and society depends.
Sustainability	is the systematic approach to finding practical ways for saving water, energy, and materials, as well as reducing negative environmental impacts.
10. MATHEMATICS (MAT)	
The study of quantities, structures, space and change. Statistics is the branch of mathematics that deals with the collection, analysis, interpretation, and presentation of numerical data. Probability is the mathematical representation of the likelihood of an event occurring.	
Algebra	the study of the properties and relationships of abstract entities (such as complex numbers, matrices, sets, vectors, groups, rings, or fields), arithmetically using symbols e.g. x, y, ϖ. These symbols represent numbers and quantities in formulae and equations in order to solve them.
Game Theory	is the branch of applied mathematics that provides the tools for the analysis of strategies for dealing with competitive situations where choices are required.
Geometry	the area of mathematics relating to the study of space. It Involves the measurement (shape and size), properties, and relationships of points, figures, spaces, lines, angles, surfaces, and solids.
Number Theory	is the study of the set of whole numbers where the main goal is to discover interesting and unexpected relationships between sets of numbers, for example the Fibonacci Sequence

Statistics and Probability	Statistics is concerned with collecting, organising, analysing, interpreting and presenting data. Probability is the study of chance i.e. calculating the likelihood or "odds" of something happening in the future, and can be expressed as a fraction, decimal or percent.
11. PLANT SCIENCES (PLA)	
The study of plants.	
Aquatic Plants	is the study of plants that grow in an aquatic environment (freshwater or saltwater), whether rooted or floating, including the study of algae (Phycology).
Botany	is the scientific study of the behaviour, structure, physiology, taxonomy, distribution of plants, and plant pathology.
Plant Genetics	is the study of genetic variation, genes and heredity in plants, specifically mechanisms of hereditary transmission and variation of inherited characteristics. How plant genetics affect characteristics / morphology of the plant.
Plant Pathology	is the study of the organisms and environmental conditions that cause disease in plants, the mechanisms by which this occurs, the interactions between these causal agents and the plant (effects on plant growth, yield and quality), and the methods of managing or controlling plant disease.
Plant Physiology	is the study of the physical, chemical and biological functioning of plants.
12. PHYSICS, ASTRONOMY AND SPACE SCIENCES (PHY)	
Physics is the study of matter, energy, motion and forces. Astronomy and Space Sciences is the study of the universe and beyond, including its origins and the properties of objects in space.	
Astronomy and Space Sciences	is the study of the Universe and beyond, including its origins and the properties of objects in space.
Material Sciences	is the scientific study of the properties and applications of materials of construction or manufacture (such as ceramics, metals, polymers, and composites).
Matter and Materials	is the study of the property of the different phases of matter and their macroscopic properties which includes topics such as super-conductivity, semi-conductors, thin films and complex fluids.
Mechanics	is the branch of science that explains how masses behave when subjected to the effects of force and displacement. It includes Kinematics, Projectiles, Velocity and acceleration, Newton's Laws, Collisions, Rotational Motion and Fluid Mechanics.
Mechatronics and Robotics	integrates electronics, control and mechanics in the study and design of electromechanical systems, such as robots, to solve problems.

Optics	is the study of a part of the electromagnetic spectrum (specifically the infrared, visible, and ultraviolet light) as well as the devices used to measure, detect and produce this spectrum, for example photometers and lasers.
Theoretical Physics	is the description of natural phenomena in mathematical form.
13. SOCIAL SCIENCES (SOC)	
A branch of science that deals with the study of humans; their behaviour, interpersonal relationships, institutions and functioning within society.	
Anthropology	is the study of people, their evolutionary history; as well as how they behave and adapt to different environments; communicate and socialise with one another.
Education Studies.	***Education*** is the process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs, and habits. ***Education Studies*** looks at ways to promote the analytical, critical and logical aspects of learning, leading to overall growth and development of an individual. Educational methods include e-learning, inquiry based learning, discovery learning, storytelling, discussion etc. Studies include a focus on the various teaching and learning pedagogies. Research in this field includes the types, uses and efficacy of various educational resources including manipulatives such as geoboards, blocks to illustrate shape and space, tangrams etc.
Human Behaviour	relates to how humans act and interact based on factors such as culture, tradition, values, and attitudes, etc. It looks at human interpersonal relationships and interactions.
Human Settlements.	***Ekistics*** is the study of the various types of human settlements, including regional, city, community planning and dwelling design. This study draws from the vast areas of geography, ecology, human psychology, anthropology, culture, and aesthetics. Settlements can be as small as one house or large as a megacity.
Psychology	is the study of the mind and our behaviour. It integrates science, theory, and practice in order to understand, predict and relieve problems whilst promoting adaption, and personal development. There are a number of fields of psychology such as Clinical psychology, Child psychology and Developmental psychology, Cognitive psychology, Social psychology and Educational psychology.

APPENDIX F: PROJECT REPORT GUIDELINES

Pages should have 2.5-cm margins. It is preferable to use 12-point Sans-serif fonts that are easy on the eyes, i.e. Gill Sans MT, Times New Roman. Use 1.5-line spacing. Include page numbers on the bottom centre or right corner of each page. Spelling, grammar usage and punctuation should conform to the Oxford English Dictionary for UK English (not US English).

Paragraphs are useful tools for separating and organising your ideas. Different ideas should be split into separate paragraphs and common ideas should be grouped in the same paragraph. Your paragraph should have a topic sentence which gives the reader an indication of what to expect in that paragraph. If you present two hypotheses/engineering goals in the Introduction, then you should deal with those hypotheses/goals in the same order in the Methods, Results, and Discussion sections.

REMEMBER: Plagiarism is cheating by claiming someone else's work as your own. Don't do it!

A guide/template on how to write a project report to bring to the Eskom Expo Science Fair. It gives detailed instructions, that you need to read and follow. Ask your teacher if you do not understand any part of this section of the report guide.

All reports must have a cover page (see next page)

Delete all guidelines under each heading once you have completed your Project Report

PROJECT TITLE: …

SUBTITLE *(if applicable)* …

First Name(s):

Surname:

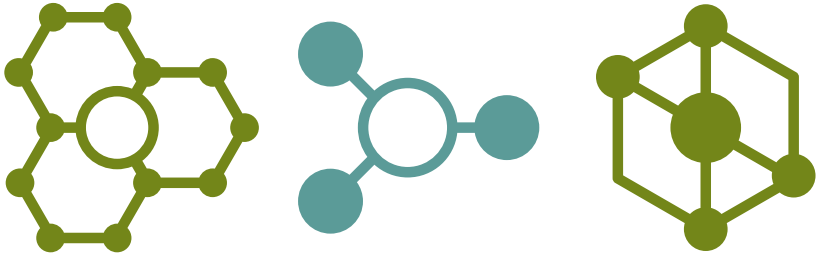
Category:

Province and Region:

School:

Grade:

(Cover page: All projects reports must have a cover page with the above details)



text. Thus, provide a brief description of the data and the column headings, and be sure to explain any abbreviations you use. When planning your figures, begin by deciding what the figure should look like. Normally, one places the independent variable (i.e., perceived to be causing the relationship) on the X-axis and the dependent or response variable (i.e., perceived to be affected by the independent variable) on the Y-axis.

If both variables are continuous (e.g. measurements, counts, time), a line graph is appropriate.

If the X-axis is categorical (e.g. male/female, juvenile/yearling/adult, low/medium/high treatments of an experiment), then a bar graph is appropriate.

Each graph should have values along the X and Y axes, clear labels for each axis (with units), and a complete description below it..

Introduction

In the introduction, just present a brief overview, sufficient to establish the need for your research. This tells the reader what the report is about. It sets the project in its broader context, identifies and explains the motivation of the project. It ranges between two to four pages. Never put your findings or decisions in the Introduction.

Literature Review

Briefly review relevant literature (e.g. journal articles, books, technical reports, etc.) to orientate the reader. You present an overview of what is known about the research project. In doing so, you will read previous and recent research done around your project and write what is most relevant to it. As you near the end of the literature review (*i.e.,* at the beginning of the last paragraph), identify the important gap that you are trying to fill. You need to build up to why you are doing this research project.

Problem Statement

Based on the gaps/ knowledge you found in the literature review, clearly write either a problem statement or phenomena. Give a basic statement of the problem or explain the importance of the phenomena.

Aim

State your aim clearly and concisely.

Research Question or Hypothesis

Clearly state the research question you want to answer or your hypothesis.

Engineering/Computer Science

Writing Style/ Format

Abbreviations

Use abbreviations sparingly and only if they will save substantial redundancy throughout your project report. Adding abbreviations (particularly abbreviations that are common in your choice of category) can make your writing more concise, but overuse simply adds confusion. If you are to use acronyms in your report, you need to tabulate the list of the acronyms along with the full names, at the beginning of the report. Do not begin a sentence with an abbreviation.

Tables and Figures

Tables and figures form part of what you say in the paragraph(s). They are accessories to the text. You cannot just put a table or figure anywhere and always refer to them in text e.g. "Viscosity decreases with increasing temperature as shown in Figure 1…"Whenever you refer to tables and figures in the paragraph(s), you need to be clear about what you are determining from them and why. Both should be able to stand alone and make sense to the reader. Tables and figures should have an appropriate title/captions and labels with correct units.

Titles and captions

Tables have a title at the top and figures have captions at the bottom which describes the purpose for which it has been presented (e.g. "Table 1: Measurements of the width of the cylinder" and "Figure 1: The viscosity of oil at different temperatures"). Table and figures are usually referenced by a number and should be numbered in sequence, e.g. Table 1, Table 2… Figure 1, Figure 2, etc.

Labelling of graphs

Label your axes so that the reader knows what scale points are plotted on the graph and specify units for quantities.

Introduction

In the introduction, just present a brief overview, sufficient to establish the need for your project. It sets the project in its broader context, identifies and explains the need/ motivation for the project. It ranges between two to four pages. Never put your results or conclusion in the Introduction.

Literature Review

Briefly review relevant literature (e.g. journal articles, books, technical reports, etc.) to orientate the reader. You present an overview of what is known about the research project. In doing so, you will read previous and recent research done around your project report and write what is most relevant to it.

As you near the end of the literature review (*i.e.*, at the beginning of the last paragraph), identify the important gap that you are trying to fill. You need to build up to why you are doing this research project.

Problem Statement
Based on the gaps/ knowledge you found in the literature review, you lead up to the need. Based on the need you identified, state the problem statement/ phenomena, as clearly as possible.

Aim
Clearly and concisely state your aim.

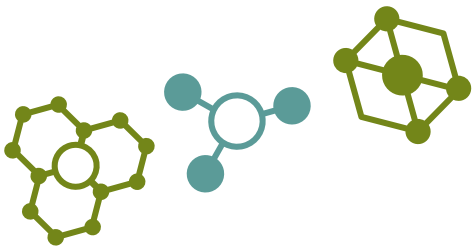
Engineering goals or Design goals
Clearly state the engineering goal/ design goal. These are linked to solving the problem and filling the knowledge gap identified.

Method

The method section describes what you did, why you did it and how you did it. This section must explicitly explain how you went about testing the engineering/ Design goals, to solve the problem. Describe your methods in enough detail that someone else could replicate your project. In other words, anyone should be able to duplicate your methods to verify or refute what you found. Briefly explain the rationale for the measures you made. This section is written in the past tense.

Materials
List the apparatus that you used for your project.

Procedure
In this section, you describe the series of repeatable steps that you took in creating and testing a functional prototype/process/solution.



Engineering Method

Engineering projects include multiple designs, you build, test, find new problems, make changes and test again (design-test-redesign-retest) before you can settle for a final design. For a clear transition between the designs, you need to mention the earlier designs (minimum two) and evaluations of the prototypes/processes that you did to eventually get to the final one. However, the full details of the initial prototype must be in the appendix. In this section, we are interested in the final design details. The final prototype/final process with the most desirable features, fewest negative characteristics and stays within the limitations of the need you identified.

Planning

The prototype/process design must be appropriately presented in this section. This can be done visually through drawings/ flow diagrams (These can include circuit diagrams, system drawings, technical plans, drawing blueprints, etc.) and must include all the necessary measurement units. Mention the name of the program used for the visual representations.

Creating

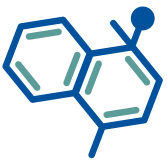
A detailed step by step description of how you built your prototype/ developed a process

Testing and Evaluating

Testing is the way a prototype/process under development is evaluated for correctness and robustness and is proved to meet the stated goals. It is done at each stage of creation and has characteristics unique to the level of the test being performed.

This section includes the quantitative aspects of your project. The prototype/ process components are compared against requirements and specifications through tests. The results from these tests can be represented graphically or in a table. The results are then evaluated to assess the progress of design/ process (performance, supportability, etc.)

If your project involves programming, the code must be in the appendix.



Social Sciences

Writing Style/ Format

Abbreviations

Use abbreviations sparingly and only if they will save substantial redundancy throughout your project report. Adding abbreviations (particularly abbreviations that are common in your choice of category) can make your writing more concise, but overuse simply adds confusion. Be sure to define abbreviations in full at first use by writing out the term in full, and then placing the abbreviation in parentheses; e.g., Schedule for Affective Disorders and Schizophrenia (SADS). Do not begin a sentence with an abbreviation.

Tables and Figures

Tables must have a title (above the table) and figures must be accompanied by a caption (below the figure). Both tables and figures must be referred to in the text. Thus, provide a brief description of the data and the column headings, and be sure to explain any abbreviations you use.

When planning your figures, begin by deciding what the figure should look like. Normally, one places the independent variable (i.e., perceived to be causing the relationship) on the X-axis and the dependent or response variable (i.e., perceived to be affected by the independent variable) on the Y-axis.

If both variables are continuous (e.g., measurements, counts, time) a line graph is appropriate.

If the X-axis is categorical (e.g., male/female, young/old, tec.), then a bar graph is appropriate.

Each graph should have values along the X and Y axes, clear labels for each axis (with units), and a complete description.

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Literature Review

Briefly review relevant literature (e.g. journal articles, books, technical reports, etc.) to orientate the reader. You present an overview of what is known about the research project. In doing so, you will read previous and recent research done around your project report and write what is most relevant to it. As you near the end of the literature review (*i.e.,* at the beginning of the last paragraph), identify the important gap that you are trying to fill. You need to build up to why you are doing this research project.

Problem Statement or Phenomena
Based on the gaps/ knowledge you found in the literature review, clearly write either a problem statement or phenomena. Give a basic statement of the problem or explain the importance of the phenomena.

Aim
Clearly and concisely state your aim.

Research Question or Hypothesis
Clearly state the research question you want to answer or the hypothesis.

Method

The method section describes what you did, why you did it and how you did it. This section must explicitly explain how you went about testing the research question/ hypothesis, to solve the problem. Describe your methods in enough detail that someone else could replicate your project. In other words, anyone should be able to duplicate your methods to verify or refute what you found. Briefly explain the reasons for the data you collected.

Participants
This section indicates the number of participants that took part, and an indication of their gender, age, and other demographics that may be relevant to the project. Include information on how they were recruited to participate in the project.

Instruments/ Sources
List all the instruments/ sources used for your project. This section is included only if you have the participants filling out questionnaires, or completed tests. Include any observation/interview, schedules and tests (Pre- and Post-, Behavioural and Psychometric). If you use existing data, provide details on where you found it, and give details on how you got permission to use the information.

Procedure
Describe the procedure used. What were the variables (if any)? How were they manipulated? – between or within participants? Describe the procedure in terms of what the participants did, rather than what you did e.g. "the participants, read a set of instructions, completed a block of four practice trials and completed two questionnaires." Items/questions in data collection method must be related to the aim. Remember to always maintain objectivity. This ensures that you minimise errors and bias.

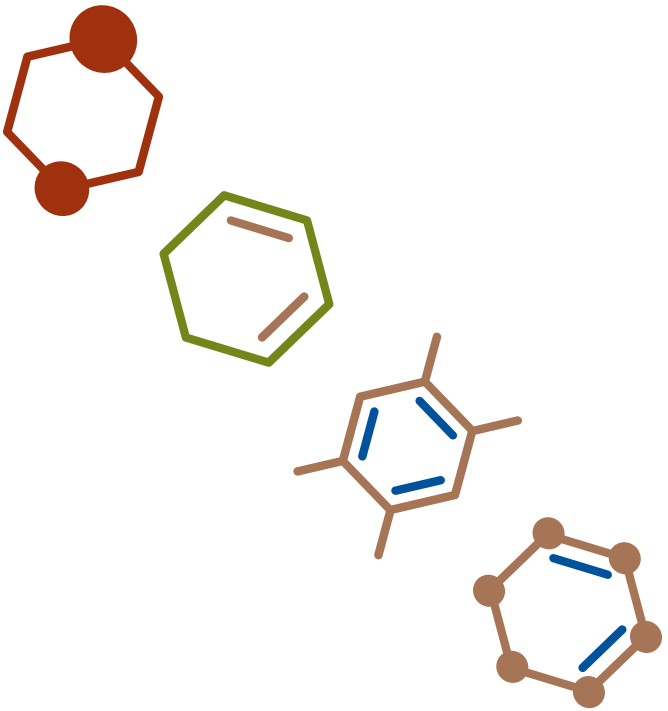
A sample of the questions asked on the tests/questionnaire must be put in the Appendix section. Also, explain how you maintain confidentiality when reporting on the participants: Identifiers e.g. names, photographs, personal details of participants; must not be used.

References

Referencing is a way to validate that you have done further reading, learning and comprehension by using relevant sources. Eskom Expo for Young Scientists uses the Harvard format for referencing. Formatting has to be consistent throughout the report.

Appendix

An appendix is placed at the end of your report, the full version is either inappropriate or too detailed for the body of the report. There may be more than one appendix, in which case the series is called the appendices. Examples of material suitable for an appendix are a new computer program specifically designed for the research, an unpublished test and its validation, or a list of stimulus materials



As you near the end of the literature review (*i.e.*, at the beginning of the last paragraph), identify the important gap that you are trying to fill. You need to build up to why you are doing this research project.

Problem Statement or Phenomena
Based on the gaps/ knowledge you found in the literature review, you lead up to the need. Based on the need you identified, state the problem statement/ phenomena, as clearly as possible.

Aim
State your aim and it should always be concise.

Hypothesis or Research question
Clearly state the hypothesis or the research question you want to answer.

Method

The method section must explicitly explain how you went about solving the problem or understanding the phenomena. It describes the mathematical/ theoretical techniques you used and thus must be written in the past tense.

Variables
State the variables of your research project.

Procedure
Explain which procedure you followed, why you chose it and gives a clear step-by-step description of how the procedure was carried out. Give enough detail in this section so that someone else could be able to replicate what you did, in order to verify or refute what you found. For theoretical work describe the theory with basic equations and indicate how such equations are solved. Details of long derivations should be put in the appendix. You need to mention the type of programming software you used e.g. MATLAB, R, Statistica, Wolfram Mathematica, etc. and the variables that will be influencing your data.

Results

The overall purpose of this section is to describe patterns, not to explain or interpret them. Think of the Results section as telling a story about what you found when conducting your experiments or theoretical calculations. You need to set the context within which the data were collected. That will help the reader to understand more fully the data and analyses specific to your hypothesis/ research question.

Results should be presented in a way that it aligns with the hypothesis/ research question. Begin by thinking about what information the reader will need to assess whether you achieved your aim or not. It should be presented in a form that is easy to read, which usually means putting it in a graph or a table.

Multiple books by the same author	
Brown (1982) / (Brown, 1982) Brown (1998) / (Brown 1988) Napier (1993a, 1993b)	Brown, P. 1982. *Corals in the Capricorn group.* Central Queensland University, Rockhampton. Brown, P. 1988. *The effects of anchors on corals.* Central Queensland University, Rockhampton. Napier, A. 1993a. *Fatal storm.* Allen & Unwin, Sydney. Napier, A. 1993b. *Survival at sea.* Allen & Unwin, Sydney.

2. Articles:

In-text reference	Reference List
Journal Articles:	
Only author's surname and write the year in brackets **OR** author's surname and the year in brackets, separated by a comma,	Author surname, Initials. Year. Title of article. *Journal name.* Volume number (Issue or part number): first and last page numbers.
Author known – one/ two author(s)	
Van Wilgen (2009) / (Van Wilgen, 2009) Archibald and Bond (2003) / (Archibald and Bond, 2003)	Van Wilgen, B. W. 2009. The evolution of fire and invasive alien plant management practices in fynbos: review article. *South African Journal of Science.* 105(9-10): 335–342. Archibald, S. and Bond, W. J. 2003. Growing Tall vs Growing Wide: Tree Architecture and Allometry of Acacia karroo in Forest, Savanna, and Arid Environments. *Oikos* 102(1): 3–14
Author known – more than two authors	
Govender *et al.* (2006) / (Govender *et al.,* 2006)	Van Wilgen, B. W., Reyers, B., Le Maitre, D. C., Richardson, D. M. and Schonegevel, L. 2008. A biome-scale assessment of the impact of invasive alien plants on ecosystem services in South Africa. *Journal of Environmental Management* 89: 336–349.
Two/ more articles by the same author(s), in a single year	
Assign letter suffixes (a, b, c, d, etc.) to the year and arrange the titles alphabetically.	

(Noakes, 2011a, 2011b) Noakes (2011a, 2011b) – if same idea. If different, separate.	Noakes, T. D. 2011a. Is it time to retire the A.V. Hill model? A rebuttal to the article by Professor Roy Shephard. *Sports Medicine.* 41: 263–277. Noakes, T. D. 2011b. Time to move beyond a brainless exercise physiology: the evidence for complex regulation of human exercise performance. *Applied Physiology, Nutrition & Metabolism.* 36(1): 23–35.
Theses and Dissertations	
Mawela (2008) / (Mawela, 2008)	Mawela, K. G. 2008. *The toxicity and repellent properties of plant extracts used in ethnoveterinary medicine to control ticks.* Masters Dissertation. University of the Pretoria. Available: https://repository.up.ac.za/handle/2263/29224 [Accessed 06 June 2019]
Magazine/ Newspaper Articles:	
Daily Newspaper / Monthly Magazine articles (Hardcopy)	
Masipa (2019) / (Masipa, 2019)	Masipa, N. 2019. Rapist Haunts Cemetery. *Daily Sun* (Johannesburg). 25 June: 1.
Online Newspaper Articles: with author	
Malsang (2019) / (Malsang, 2019)	Malsang, I. 2019. Sorghum making a rebound in Europe thanks to climate change [online]. *Mail & Guardian,* 05 June. Available from: https://mg.co.za/article/2019-06-05-sorghum-making-a-rebound-in-europe-thanks-to-climate-change [Accessed 24 June 2019]
Online Newspaper: no author	
(“Teen dagga usa”, 2019)	Teen dagga use linked to later depression and suicide attempts [online]. 2019. *News24*, 28 February. Available from: https://www.health24.com/Medical/Addiction/Dagga/teen-dagga-use-linked-to-later-depression-and-suicide-attempts-20190228 [Accessed 24 June 2019]

3. Images/Visual Mediums

In-text reference	Reference List
Using acronyms: It is usual practice to specify the full name of an organisation the first time it is used, followed by its abbreviated name in brackets. After this it is acceptable to use the acronym only.	
Images	
If you are the photographer	
Do not include in the Reference list. Under the photograph, write Figure and a number. In your writing, refer to the photograph by figure number, e.g. Figure 1 illustrates…	
With Author	
Burden (2016) / (Burden, 2016)	Burden, A. 2016. *Fountain pen on black lined paper* [Image]. Available at: https://unsplash.com/photos/y02jEX_B0O0 [Viewed 21 June 2019].
No Author	
(Terminalia sericea flowers, n.d)	*Terminalia sericea flowers.* n.d. Available at: http://pza.sanbi.org/terminalia-sericea [Viewed 21 June 2019].
Illustrations and Diagrams	
(Adapted from Crouzat *et al.,* 2016: 39)	Crouzat, E., Martín-López, B., Turkelboom, F., and Lavorel, S. 2016. Disentangling trade-offs and synergies around ecosystem services with the influence network framework: illustration from a consultative process over the French Alps. *Ecology and Society* 21(2):32–49. Available: http://dx.doi.org/10.5751/ES-08494-210232
Blogs	
Grohol (2018) / (Grohol, 2018)	Grohol, J. M. 2018. While you sleep, your brain keeps working. *Psych Central* [Blog, 8 July]. Available at https://psychcentral.com/blog/while-you-sleep-your-brain-keeps-working/ [Accessed 24 June 2019]
Online Videos (YouTube)	
(Brown, 2011)	Brown, B. 2011. *The power of vulnerability* [Video file]. Available: https://youtu.be/iCvmsMzlF7o [Accessed: 24 June 2019]
Email	

Only author's surname(s) and write the year in brackets OR both the author's surname (s) and the year in brackets, separated by a comma,	Sender's Last name, First initial. Year. Subject Line of Email. [email].
Niles (2013) / (Nile, 2013)	Niles, A. (2013). Update on my health. [email].
Social Media	
Only author's surname (s) and write the year in brackets OR both the author's surname (s) and the year in brackets, separated by a comma,	Author's surname, Initial. Year. Title of page [Social media format]. Day/month/year written. Available from: URL. [Accessed: Day/month/year]
Proud (2014)/ (Proud, 2014)	Proud, F. 2014. Food lovers group [Facebook]. Written 5 June 2016. Available from: www.facebook.com/foodloversgroupproudf2016 [Accessed 25 September 2018].
Acts	
(National Environmental Management Act, No. 107 of 1998)	National Environmental Management Act, No. 107 of 1998. *Government Gazette.* 401(19519). 27 November. Government Notice No. 1540. Cape Town: Government Printer.
Policy Documents: White/ Green Papers	
1st parenthetical citation: (Department of Minerals and Energy [DME], 1998) **Subsequent citation:** (DME, 1998)	Department of Minerals and Energy. 1998. White Paper on the Energy Policy of the Republic of South Africa. Pretoria: Department of Minerals and Energy.
Media Release	
1st parenthetical citation: (Department of Environmental Affairs [DEA], 2019) **Subsequent citation:** (DEA, 2019)	Department of Environmental Affairs. 2019. *The Department of Environmental Affairs welcomes the arrest of a man at OR Tambo International Airport for alleged rhino horn smuggling.* 24 May 2019. Available: https://www.environment.gov.za/mediarelease/deawelcomes_arresofanalleged_rhinohornsmuggler [Accessed 20 June 2019].
Treaties, Declaration & Charters	

(United Nations, 1945)	United Nations. 1945. *The Charter of the United Nations.* 26 June, San Francisco. Available: https://www.un.org/en/charter-united-nations/index.html [Accessed 20 June 2019]. Note: Charter or treaties signed by a country, international governmental organisation or groups of countries are listed under the name of the organisation or country.
Quotes	
Short quotes	
If your quotation is fairly brief - up to two lines, say - you should place it in quotation marks within your own paragraph. Author's surname, year and page number are shown in brackets immediately following the quotation.	
Long quotes	
Longer quotes should: be preceded by a colon, be indented from the main text, not have quotation marks and cite the author, year and page number. **Note** that the author details are right-justified, and only the year and page number are in parentheses.	

Useful Links

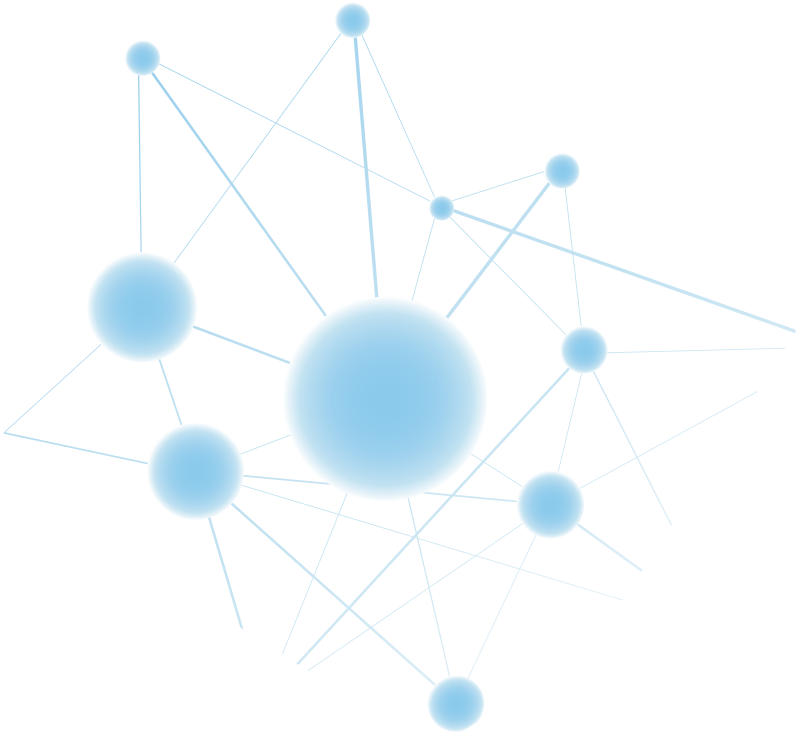
Harvard Style (Beginners, Intermediate and Advanced Tutorials)

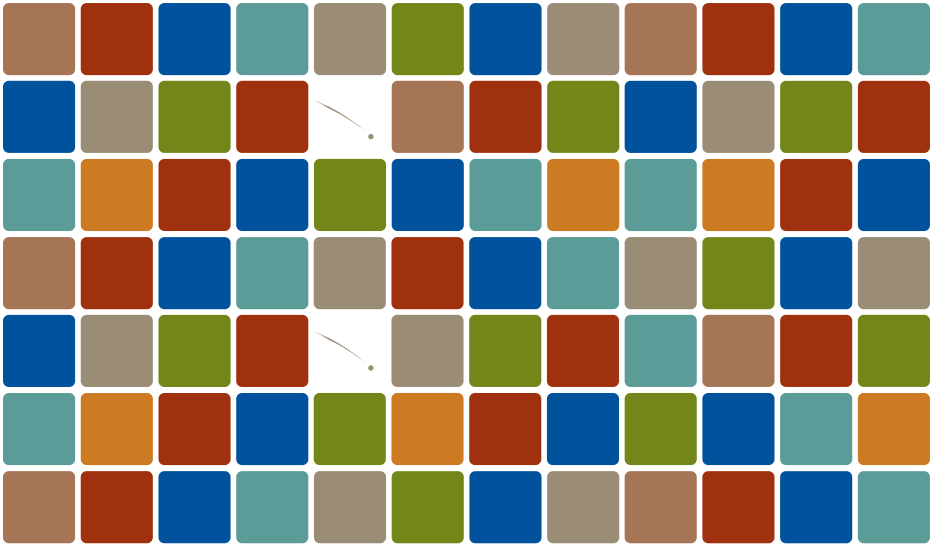
GLOSSARY

Aim	Purpose for doing your research project, emphasises what is to be accomplished. Usually stated '*the aim of this project is… to develop, to establish, to build, to understand…*'
Algorithm	An unambiguous process or set of rules to be followed in calculations or other problem-solving operations.
Arguments	In *computer science:* a value that is passed between programs or functions and are variables that contain data or codes. In *mathematics:* an input to a function, usually the independent variable, e.g. $f(x;y) = x^2 + y^2$; x and y are arguments.
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 and should be replaced by Brand A etc.
Conclusion	Relates to the hypothesis/engineering goal 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. Relevant literature is mentioned.
Engineering goals	These are the beginning of the design processes that an engineer does when he/she identifies a problem or need and then creates or develops a solution.
Errors and limitations	What went wrong that you can change next time and what could you have done if you had more time or resources?
Hypothesis	A testable prediction about what is going to happen in your project. It answers to the problem statement/ research question and provides guidance for investigation.
Mentor	A person who assists you as you develop your project and gives you professional help (e.g. scientist or a teacher)
Observation	Something interesting (a phenomenon) that you have noticed e.g. Elephants prefer to eat leaves off trees.
Problem Statement	This is what you want to know about the phenomenon e.g. why do elephants prefer to eat tree leaves?
Procedure	A series of actions followed to get a desired result.
Proof	In mathematics: an argument which convinces other people that something is true

References	ALL the books, magazine and newspaper articles and Internet pages that you consulted while doing the project and referenced in the correct way.
Reliability	Implies consistency and stability of tests done. There should be evidence of repeated testing and increasing sample size. If you measure leaf sizes of plants exposed to the same conditions, you should roughly get the same results every time.
Research Question	The research question is based on what you want to answer and the reason why you are asking this question. What is the main question that will be answered by your research.
Sampling	A process where a subset of a larger group is chosen/ selected to perform tests; There are differerent types of sampling mehods.
Scientific Notation	A way of writing very large or very small numbers, e.g. 650,000,000 can be written in scientific notation as 6.5×10^8
Solution	A means of solving a problem or the result of a problem-solving process.
Trials	Replication of the entire experiment to increase reliability.
Triangulation	Is the use of more than one approach to researching a question, done to increase accuracy and reliability.
Validity	Means a test/ instrument is accurately measuring what it is supposed to measure.
Variables	Factor that can change value during and between experiments. Your investigation depends on measurable items, factors or conditions that can change due circumstances of your experiment or test. These are regarded as variables and include; controlled/fixed, independent and dependent variables.
Independent	A factor(s) that is systematically changed in order to see what effect the changes have in an experiment.
Dependent	A factor(s) that is measured or observed to see how it responds to changes made to the independent variable
Controlled	Factor(s) that remains the same throughout the experiment in order to isolate the relationship between the independent and dependent variables

Constants	Values that do not change either during or between experiments, e.g. standard gravitational force (**g** = 9.80665 m/s^2), Pi (ϖ = 3.14), etc.
Vector	A quantity having direction as well as magnitude, especially as determining the position of one point in space relative to another.





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