How to choose, plan, carry out, and write up a project

Email us your ideas on info@theyoungdarwinian.com
See the web site – www.theyoungdarwinian.com for how to register with us, and how to submit.

A. Background

Natural history is describing component and events throughout the world and Universe. ***Natural Science*** on the other hand, is about how the Universe works, focussing on chemical, physical and biological mechanisms, based on principles, laws and theories.

What is a project?

A project is a planned piece of work by an individual or group, with a defined objective, based on a series of questions and/or hypotheses.

What is a hypothesis?

A scientific hypothesis is a proposed explanation of a group of facts or observations. It must be testable by experiment or collection of further data. In professional science, all hypotheses are tested by making positive predictions that are testable.

B. How to choose and plan a project

1. Always make notes.
2. Decide whether the project will be carried out by an individual or a group.
3. Identify the main subject area; e.g. biology, chemistry, physics, maths, engineering, astronomy, entrepreneurship.
4. Identify a specific area of interest; e.g. the environment, insects, trees, the solar system, food chemicals, the Fibonacci sequence.
5. Brainstorm some questions with a mentor and/or colleagues. Amongst the group, brainstorm questions. Throw around ideas,

statements and facts. Question the facts: is that really true? Has that been proven?

6. From the brainstorm, define some key questions, carry out some research on the Internet, and, if possible, formulate a hypothesis. If a mentor is present, their role is to facilitate, not to decide on the project question. That decision must come from the students, and must be a question that they are interested in answering. It may be that the students have time to research the area of focus, and meet again to hone in on the key questions and the hypothesis.
7. Design some experiments and data collection that will answer the questions, and test the hypothesis.
8. Design the controls needed.
9. Identify the resources needed; e.g. equipment, chemicals, software.
10. Identify how long it will take to complete the project. Is the project sensitive to the time of year? Can it be done in the right timeframe?
11. Make a risk assessment for health and safety.
12. List the skills you hope to develop from the project.

C. How to do a risk assessment

1. Make sure your risk assessment is written down, and a copy is kept with you when carrying out the project.
2. Identify the hazards
3. Physical; e.g. slippery rocks with seaweed, cliff edge, sharp utensils, heat and flames.
4. Chemical; e.g. acids, alkalis, bleach
5. Biological; e.g. stinging plants or animals, infectious agents, poisonous plants and fungi.
6. Decide what the hazard might do to you or others, and how dangerous the hazard.
7. Decide whether you need to wear protective clothing: e.g. lab coat, glasses, mask, gloves
8. Have a procedure if there is a spillage
9. Have a procedure if there is a fire
10. Have a procedure for disposal of chemicals and other materials
11. Keep safe
12. Print the risk assessment
13. Give a copy to anyone before working with you
14. Always have a copy with you when working on a lab

or out in the field

15. If there are any significant hazards, always have someone with you or close by
16. If you are on your own, always tell someone where you are, and report to them when you are finished.

D. How to carry out a project

1. If you are working alone, make sure someone knows where you are, and that you are not carrying out anything hazardous. Always tell someone when you have finished. Plan set times in the week dedicated to the project. If you have other group members, agree when and how often you will meet.
2. Make a plan of timing, when, where, and how you will collect data.
3. Check the risk assessment every time you are carrying out part of the project, so that you can contain any potential hazards and risks. If the experiments are in any way hazardous, do not carry out the experiments on your own, and always wear safety glasses and clothing when appropriate.
4. When you carry out experiments, or collect data, make sure you have identified the correct controls and standardised the method of data collection.
5. Store your data carefully, and always have a computer backup in a different location from your computer. Ideally also use a store on the Internet.
6. Collate your data and draw graphs when appropriate.
7. Make conclusions from your data.
8. Decide if these conclusions answer your original questions, and support or refute your hypothesis.
9. If not, why?
10. Decide what the future might be if you, or someone else, carries on with the project.

E. How to write up a project

1. Use the DISI model – **Discovery, Invention, Scholarship, Impact.**
2. Start by writing down in 1-2 sentences why you decided to do this project.
3. **Discovery** -Then write down in 1-2 sentences what you have found out.
4. Decide on a title.
5. Collate your data, plot graphs where appropriate, and ensure the data is in a form you can assess, and describe the results in words.

6. Write a background in bullet format.
7. **Invention -** Did you have to design any apparatus or method?
8. Describe the details of the resources you used, and the methods, together with why these were appropriate and valid.
9. Decide on an order for the results, which may be best presented in a different order from the experiments or measurements you carried out.
10. Describe the results, including graphs, in a way that the reader can grasp the details of what you have found out, and can relate these to the data you present in graphs, diagrams or pictures.
11. Each section of results should have an opening sentence stating what it is about, a middle section describing the results in detail, and a concluding sentence leading to the next section. Point out the validity of the controls you carried out.
12. Avoid at this stage coming up with overall conclusions.
13. You are now ready to write the Discussion and Conclusion section.
14. Start with stating in 1-2 sentences what you have found out, and whether any hypothesis you started with has been supported or refuted.
15. **Scholarship** - Then describe the overall strength of your data, and where there are limitations in your conclusions.
16. **Scholarship** Describe data and observations on your topic from others found in journals, books and on the Internet.
17. End with a final conclusion and future prospects.
18. Finally have a section on **impact**. How important are your findings generally to science or maths? How has the project affected you? Did you enjoy it? Did it inspire you? What have you learnt? Will it influence your University or career choices?
19. End the article with acknowledgements of help and a short Bibliography.

The structure of the write –up should be

1. Title
2. Full names (Only first names will be in final publication unless full names are specifically requested)
3. School address
4. Dates of birth
5. Contact emails (this will not be in final publication unless specifically requested)
6. Subject area
7. Parent name and email for any student under the age of 18
8. Teacher or mentor name and email

9. Key words (up to 6)
10. Abstract; a summary of you have found out (Discovery), how (Invention), how this relates to what has been found out before (Scholarship), and what impact your conclusions might have (Impact) in up to 250 words
11. Background
12. Aim
13. Invention and Methods
14. Results
15. Conclusions; to include what you have found out (Discovery), how (Invention), how this relates to what has been found out before (Scholarship).
16. Impact; what impact your conclusions might have on science as a whole, and on you.
17. Future prospects
18. Acknowledgements
19. Bibliography

You will also need to carry out a risk assessment before starting the project.

If in doubt you can always email us at **info@theyoungdarwinian.com** for advice.

Good luck.
Tony Campbell
Editor in Chief
22/09/2017

