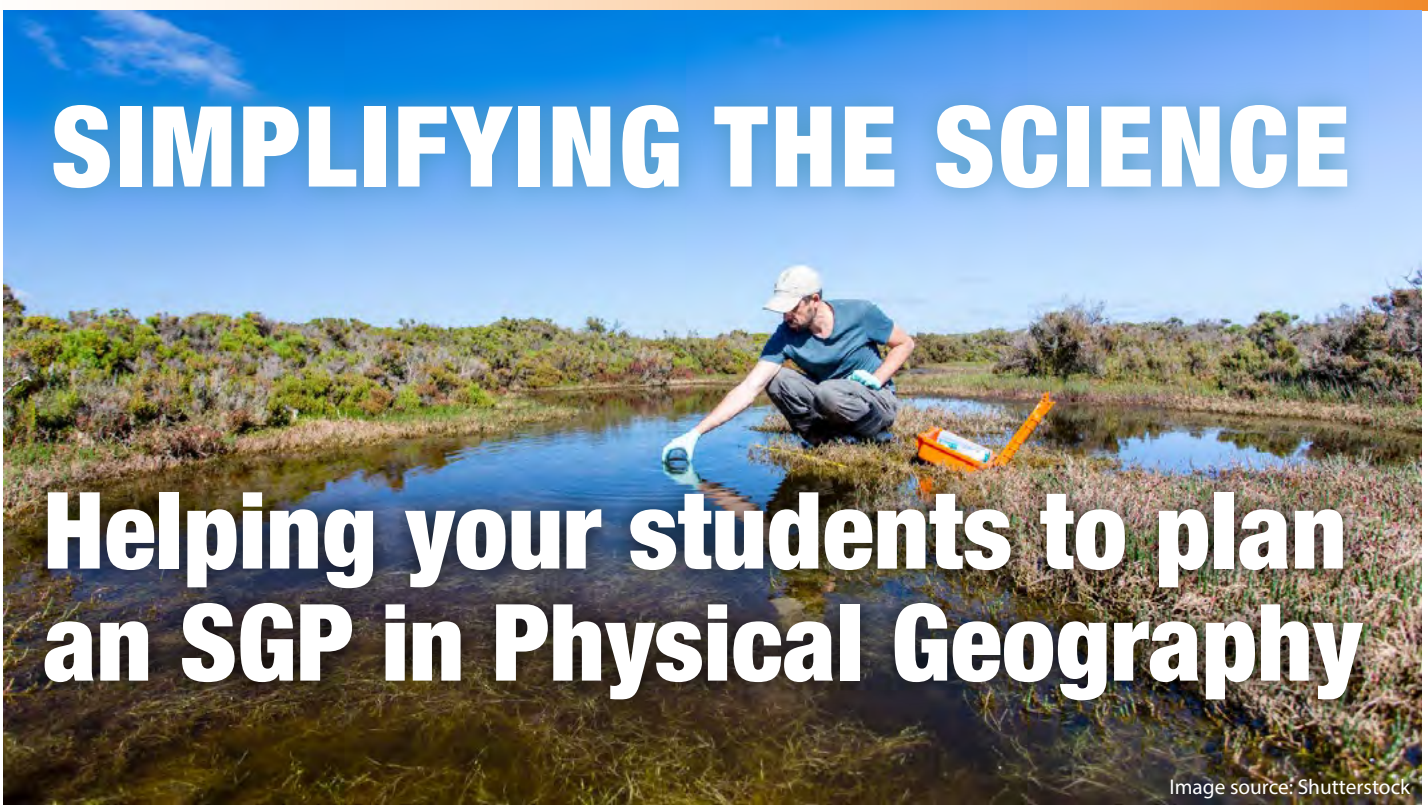
SIMPLIFYING THE SCIENCE



Helping your students to plan an SGP in Physical Geography

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Have you ever noticed that that trees grow taller in a gully? Have you ever wondered why weeds are found along a creek? Have you ever thought why does so much run-off come from a playing field or why do we never see tadpoles in the school creek anymore?

Designing fieldwork investigations based in physical geography can sometimes seem a little daunting, especially if you do not have a background in science. However, I'm going to try and break it down so that you can encourage your students to find answers to their questions by designing their own investigations, leading to deeper understanding of their local natural environments and their impacts upon them.

The Scientific method

When designing fieldwork to collect data on processes and interactions in the natural world the best place to start is the scientific method. This is a series of steps which help to structure investigations, as follows:

1. Make an observation
2. Form a hypothesis
3. Experimental methods
4. Collect data
5. Analysis
6. Conclusion

1. Observation

An observation is the first place to begin. This involves identifying or describing a problem or asking a question about something that you observe in the world. For example, 'Many invasive species of plants grow near the creek, however, less invasive species grow further up the hill.' This is closely linked to an Inquiry Question in Geography. The observation could be turned into the Inquiry Question, for example, 'Why do more invasive species of plant grow closer to the creek?' Spend some time with your students in a local natural area and ask them to write a list of observations from what they see around them.

2. Hypothesis

The next step is turning those observations into a hypothesis. A hypothesis is simply a statement of what we are trying to prove and in science it is a statement which can be tested using the scientific method. Ask you students to get creative and brainstorm ideas to explain the observations they have made. There may be many ideas which come out of one observation, however, you will also need to ask the question, do I have the right tools to answer the question or verify the hypothesis?

Another way to look at a hypothesis is a 'cause and effect' statement of what we think we will find and the 'cause and effect' are made up of variables. Variables

are the things that are changing in an experiment. Too many variables in an experiment can make it hard to draw conclusions.

A hypothesis states the possible relationship between two variables in a way that can be tested by collecting data. The cause is called the independent variable, and the effect is called the dependent variable. For example, when designing a study based on where an organism exists (distribution) and how many are there (abundance), the locations selected for distribution (usually along a line transect) become the independent variable. We select each sampling location along the line and this can affect the species abundance at each location (the dependent variable). If we apply this to our hypothesis, 'As you move in the direction away from the creek (independent variable) less invasive species are present (dependent variable).'

3. Experiment method

The experiment part of the investigation involves designing a set of procedures to test the hypothesis. You should have already identified the variables and the data you want to collect. Before you design the procedure you will also need to:

- Visit the study area to select locations to carry out the data collection;
- determine equipment you will need and make sure it is working and you know how to use it;
- Create a data table for clear and efficient data collection on the day.

Example of data table

Distance from creek (m)	0	2	4	6	8	10	12	14	16	18	20
Weeds identified											
Common weeds	1 = Crofton weed, 2 = lantana, 3 = small leaf privet , 4 = asparagus fern										

Next, list the procedures step by step, for example:

1. Starting at the creek, lay out a 20m transect line in an uphill direction.
2. Using an invasive plant species identification sheet, identify all the invasive plants in the area.
3. Start at the 0m mark and identify all invasive plants present at this point and record them on your data sheet. Repeat this process at 2m intervals along the transect line.

Remember, don't let the student overcomplicate the investigation, keep it simple, make it achievable, use available equipment.

Some simple equipment and ideas include: transect lines (20m tape or rope) for distribution; quadrats for distribution and abundance; pH soil and water testing kits to investigate chemical characteristics of creeks and surrounding landuses; soil moisture probe and soil depth spike to compare different biophysical factors in different environments.

4. Collect data

Once the experiment procedures have been decided it is time to collect the data. As well as collecting numerical data on the data table observations about other environmental conditions on the day and a field sketch can be made. A few other considerations should also be taken into consideration when collecting data, these are validity, accuracy and reliability.

Accuracy is how close a measurement is to the true value. Accuracy can be improved by using and reading equipment properly and making sure it is calibrated before you collect your data.

Reliability is the consistency of a measure, whether the results can be reproduced under the same conditions. If you were to repeat the experiment at the same time of day, under the same weather conditions would results be similar? Reliability of data can also be improved by increasing the data set. The reliability of the experiment would be improved if data was collected from 10 transect lines rather than one or two.

Validity is how well a scientific test actually measures what it set out to. Will the experiments method actually address the aim of the experiment? For example, if you want to determine the number of weeds present moving away from a creek you need to be able to identify the plants which are weeds. (https://www.bmcc.nsw.gov.au/documents/priority-weeds-information-booklet)

5. Analysis

There is no point in collecting data unless you can analyse it to find meaning. A good way to visually represent your data is to graph it and this helps you to see relationships between the variables, or trends. A trend is an upwards or downwards shift in a data set over time and it allows you to predict what might happen in the future. A trend line is used to show the shape of scatter plot data and can be created by drawing a 'line of best fit' through the data points on the graph.

In practice, when you have an independent variable and a dependent variable you are able to graph you data in your analysis to see if a relationship exist between the two. The independent variable goes along the x-axis and the dependent variable on the y-axis. For example for our hypothesis 'As you move in the direction away from the creek less invasive species are present', the distance from the creek is the independent variable and is plotted on the x-axis, the number of invasive species is the dependent variable and is plotted on the y-axis.

6. Conclusion

Like any good conclusion you need to bring it all together interpreting your findings, stating if the hypothesis has been proved, what has been learnt, what could be done better next time and recommendations for future studies.

I hope this gives you and your students a small place to start when designing fieldwork investigations in physical Geography. I encourage you to give a simple investigation a go in a local area, get outside the classroom, learn while doing and gain a deeper appreciation of the natural world.

Please contact me for further help and information on designing simple fieldwork in physical Geography
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