

PLANNING		Complete / 2	Partial / 1	Not at all / 0
ASPECT	<b>Defining the problem and selecting variables</b>	States a focused problem/research question <b>and</b> identifies the relevant variables	States a problem/research question that is incomplete <b>or</b> identifies only some relevant variables.	Does not state a problem/research question and does not identify any relevant variables
	<b>Controlling variables</b>	Designs a method for the <b>effective</b> control of variables.	Designs a method that makes some attempt to control the variables.	Designs a method that does not allow for the control of the variables.
	<b>Developing a method for data collection</b>	Describes a method that allows for the collection of sufficient relevant data.	Describes a method that does not allow for the collection of sufficient relevant data.	Describes a method that does not allow for the collection of any relevant data.

PLANNING	<b>Aspect 1: Define the problem and select the variables</b>			
	<input type="checkbox"/> Research Question or Aim clearly stated <input type="checkbox"/> RQ/Aim includes IV and DV <input type="checkbox"/> Background to investigation included <input type="checkbox"/> IV correctly identified with units/range <input type="checkbox"/> DV correctly identified with units and precision	<i>If a hypothesis is required:</i> <input type="checkbox"/> It is quantitative <input type="checkbox"/> A sketch graph is included, with explanation <input type="checkbox"/> Prediction is explained using scientific theory <input type="checkbox"/> Sources are cited		
	<b>Aspect 2: Controlling Variables</b>			
<input type="checkbox"/> Materials listed with photos (if needed) <input type="checkbox"/> Annotated photo of field site or set-up <input type="checkbox"/> Method to manipulate IV, including specific details of range, increments, or trials <input type="checkbox"/> Method for recording results, including units and uncertainty of tools ( $\pm$ ___) <input type="checkbox"/> If secondary data, multiple sources averaged	<i>Controlled variables presented as a table:</i> <input type="checkbox"/> List & explain all variables to be controlled For <b>each</b> variable: <input type="checkbox"/> How could it impact the results? <input type="checkbox"/> Exactly how will it be controlled? (Value, method for achieving value)			
<b>Aspect 3: Developing a method for sufficient relevant data</b>				
<input type="checkbox"/> Method clearly presented in step-wise format and can be repeated by others <input type="checkbox"/> Results table, designed before investigation was planned, to guide design <input type="checkbox"/> How will results be presented? Reason. <input type="checkbox"/> What statistical test(s) will be used? Why? <input type="checkbox"/> Does plan to collect data address RQ? <input type="checkbox"/> Explain how the suitability of the IV & its range was selected	<input type="checkbox"/> Min. 5 increments over a suitable range for the IV (unless comparing populations) <input type="checkbox"/> Explain how raw data will be transformed into processed data for comparison/plotting <input type="checkbox"/> Sufficient repeats at each increment to ensure reliability and allows for stats <input type="checkbox"/> Safety/ethics concerns addressed, including <i>animal experimentation policy</i>			

DATA COLLECTIN AND PROCESSING		Complete / 2	Partial / 1	Not at all / 0
ASPECT	<b>Recording Data</b>	Systematically records appropriate quantitative and/or qualitative data* Including units	Records appropriate quantitative and/or qualitative data but with some mistakes and/or omissions.	Data is not recorded or is recorded incomprehensibly
	<b>Processing Data</b>	Process primary and/or secondary data correctly.	Processes primary and/or secondary data but with some mistakes and/or omissions.	No processing of data is carried out or major mistakes are made in processing.
	<b>Presenting Processed Data</b>	Presents processed data appropriately and effectively to assist analysis.	Presents processed data appropriately but lacks clarity or with some mistakes and/or omissions.	Presents processed data inappropriately or incomprehensibly.

DATA COLLECTION & PROCESSING	<b>Aspect 1: Recording Raw Data</b>			
	<input type="checkbox"/> Table presents only raw, unmodified data <input type="checkbox"/> Associated raw qualitative data recorded <input type="checkbox"/> Suitable range & repeats of data collection <input type="checkbox"/> Units of IV & DV are present & correct <input type="checkbox"/> Units and uncertainties are in row/column headings <b>ONLY</b>	<input type="checkbox"/> Decimal points & significant figures consistent throughout <input type="checkbox"/> Decimal points & sig. figs. consistent with precision of measuring equipment <input type="checkbox"/> Uncertainties are correct ( $\pm$ ___)		
	<b>Aspect 2: Processing Raw Data</b>			
<input type="checkbox"/> Calculations to determine DV carried out, if necessary (e.g. avg., standard dev., t-test) <input type="checkbox"/> Calculations/statistical tests appropriate to investigation and address RQ <input type="checkbox"/> Mathematics correctly applied	<input type="checkbox"/> One worked example of calculations given <input type="checkbox"/> Processed data (& decimal places) consistent with precision of <i>raw data</i> <input type="checkbox"/> Calculations/processing explained with science-based reasoning			
<b>Aspect 3: Presenting Processed Data</b>				
<input type="checkbox"/> Processed data tables separate from <i>raw</i> data tables for clarity <input type="checkbox"/> Uncertainties/errors included <input type="checkbox"/> Consistent decimal places Appropriate choice of graph for processed data is clear with appropriate coloring (can be hand drawn): <input type="checkbox"/> Tables & graphs do not break across pages <input type="checkbox"/> Titles self-explanatory and complete	<input type="checkbox"/> Axes labeled clearly, including metric/SI units and uncertainties of values <input type="checkbox"/> Axes scaled appropriately <input type="checkbox"/> Error bars included where appropriate <input type="checkbox"/> Error bars correct & <b>sources</b> stated (e.g. standard deviation, uncertainties, etc.) <input type="checkbox"/> Best fit line included if appropriate <input type="checkbox"/> Equation of the line calculated, where appropriate			

DISCUSSION, EVALUATION, AND CONCLUSIONS		Complete / 2	Partial / 1	Not at all / 0
ASPECT	<b>Discussing and Reviewing</b>	Discussion is clear and well-reasoned, showing a broad understanding of context and the implication of results.	Discussion is adequate, showing some understanding of context and implications of results.	Discussion is inadequate, showing little understanding of context and implication of results.
	<b>Evaluating procedure(s) and suggesting improvements.</b>	Identifies weaknesses and limitations and suggests realistic improvements.	Identifies weaknesses and limitations but misses some obvious faults. Suggests only superficial improvements.	The weaknesses and limitations are irrelevant or missing. Suggests unrealistic improvements.
	<b>Concluding</b>	States a reasonable conclusion, with a correct explanation, based on the data.	States a reasonable conclusion or gives a correct explanation based on the data.	States an unreasonable conclusion or no conclusion at all.

CONCLUSIONS AND EVALUATION	<b>Aspect 1: Discussing &amp; Reviewing</b>	
	<ul style="list-style-type: none"> <li><input type="checkbox"/> Patterns and trends (or lack thereof) in data stated, with reference to the graphs/tables</li> <li><input type="checkbox"/> Comparisons, if appropriate are made</li> <li><input type="checkbox"/> Associated qualitative referred to</li> <li><input type="checkbox"/> Data related to hypothesis or RQ – to what extent do they agree/disagree?</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Data &amp; RQ related to published scientific theory/research (if applicable)</li> <li><input type="checkbox"/> Quality of quantitative data is assessed (e.g. bias, anomalies, large/small standard deviations)</li> <li><input type="checkbox"/> Sources cited appropriately</li> </ul>
	<b>Aspect 2: Evaluating Procedure(s) and Suggesting Improvements</b>	
	<p><i>Evaluate random biological variation, measurement/instrument errors, systematic error (problems with method) in terms of:</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Possible effect on data</li> <li><input type="checkbox"/> Significance of the weakness/limitation in terms of the data set</li> <li><input type="checkbox"/> Explanation of reliability of results</li> <li><input type="checkbox"/> Are data sufficient to address RQ?</li> <li><input type="checkbox"/> Was the range of the IV appropriate?</li> <li><input type="checkbox"/></li> <li><input type="checkbox"/> Reference to error bars (or STDEV) with regard to variability of results</li> <li><input type="checkbox"/> Analysis of reliability of results</li> <li><input type="checkbox"/> Identify &amp; explain anomalous data points</li> <li><input type="checkbox"/> Refer to quantitative data</li> </ul> <p><i>Time management or human error may <b>NOT</b> be mentioned, the focus here should be on the investigation.</i></p>	<p>For each weakness/limitation mentioned, how could improved experimental design remove or reduce the impact of the error in terms of:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Techniques used to collect &amp; record data, including precision of equipment</li> <li><input type="checkbox"/> Design of the investigation, including range of values chose &amp; repeats of each IV data point</li> <li><input type="checkbox"/> More data, repeats, &amp;/or calculating averages</li> <li><input type="checkbox"/> Realistic (but not to simple) improvements</li> </ul>
<b>Aspect 3: Concluding</b>		
<ul style="list-style-type: none"> <li><input type="checkbox"/> RQ/hypothesis is restated &amp; answered from results</li> <li><input type="checkbox"/> Appropriate language used "(Does not) support my hypothesis" (not "proves" or "is correct")</li> <li><input type="checkbox"/> Specific reference to processed data or graphs/charts to explain conclusion</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Summary of important findings and trends mentioned in discussion</li> <li><input type="checkbox"/> Main limitation/weakness highlighted with realistic improvement</li> <li><input type="checkbox"/> Brief scientific explanation/interpretation of results</li> </ul>	