

Title of ESS Investigation

- ❑ report can not be longer than 2250 words (not including data tables or Works Cited)

RESEARCH QUESTION

(CTX: Aspect 1) “States a relevant, coherent and focused research question. The topic of the investigation is identified and a relevant and fully focused research question is clearly described.”

- ❑ how does the IV (range & units) affect the DV (units)
- ❑ enough description that anyone could understand what you are talking about
- ❑ specific to your particular investigation, not general about the environmental context

CONTEXT AND CONNECTIONS

(CTX: Aspect 2) “Discusses a relevant environmental issue (either local or global) that provides the context for the research question.”

(CTX: Aspect 3) “Explains the connections between the environmental issue (either local or global) and the research question.”

- ❑ introduce and describe your issue to help explain why it is significant (worthy of investigation!)
- ❑ use hard data to illustrate why your problem is relevant, citing sources
- ❑ link the issue back to your research question and variables – how are the two connected?
- ❑ briefly describe how you will answer your research question and how the answers will help towards a solution for your issue

HYPOTHESIS

- ❑ Formulate a hypothesis to predict the outcome of the investigation and explain it using logical scientific reasoning. *If (planned change in IV), then (predicted change in DV) because (science reasons with supporting research)...*
- ❑ not specifically required in rubric, but useful for later discussion

VARIABLES

Note: Avoid using up too many words in the entire PLANNING section. Keep it all succinct.

(PLA: Aspect 1) “Designs a repeatable* method appropriate to the research question that allows for the collection of sufficient relevant data.”

<i>Independent Variable (manipulated factor)</i>	<i>How will it be manipulated (list out range, state units)</i>	<i>Why it is suitable</i>
	<i>range of min 3, preferred 5</i>	
<i>Dependent Variable (outcome measured)</i>	<i>How will it be measured (method and units)</i>	<i>Why it is suitable</i>

<i>Controlled Variables (what needs to be kept constant in each trial)</i>	<i>How will it be controlled</i>	<i>Why important / effect on data if NOT controlled</i>

MATERIALS & METHOD

(PLA: Aspect 1) “Designs a repeatable method appropriate to the research question that allows for the collection of sufficient relevant data.”*

- list of materials you intend to use, sizes and quantities
- could include a diagram or photo of setup if informative
- numbered steps method written in third person passive (not I did / we will / he said etc.)
- concise, but enough detail for the reader to replicate the procedure elsewhere

JUSTIFICATION

(PLA: Aspect 2) “Justifies the choice of sampling strategy used.”

- support and defend why you chose this method – what makes it ideal for answering the research question?

RISK ASSESSMENT AND ETHICAL CONSIDERATIONS

(PLA: Aspect 3) “Describes the risk assessment and ethical considerations where applicable.”

- safety concerns listed with how you will take precautions and manage risk
- if relevant, instructions for dealing with hazardous materials or waste
- if relevant, refer to the IB animal experimentation policy and/or data privacy and consent
- environmental impacts described with methods for overcoming them

DATA COLLECTION AND PROCESSING

(RAC: Aspect 1) “Constructs diagrams, charts or graphs of all relevant quantitative and/or qualitative data appropriately.”

- clear specific titles for tables (Table 1: ...) and graphs (Figure 1: ...)
- labelled table column headings and graph axes including units and uncertainties
- appropriate and consistent number of decimal places
- qualitative data (i.e. some observations) are noted, photos may be useful
- only graph mean values of trials, not all trials
- trend lines and error bars included as appropriate
- one sample of each type of calculation performed may be useful

ANALYSIS & INTERPRETATION

(RAC: Aspect 2) “Analyses the data correctly and completely so that all relevant patterns are displayed.”

(RAC: Aspect 3) *“Interprets trends, patterns or relationships in the data, so that a valid conclusion to the research question is deduced.”*

- describe and interpret any patterns and trends in your graph considering slope, R² values, error bars, standard deviation sizes, etc.
- support your descriptive statements with numbers from your charts and graphs
- address any outliers or anomalies (don't confuse these!)

CONCLUSION

(RAC: Aspect 3) *“Interprets trends, patterns or relationships in the data, so that a valid conclusion to the research question is deduced.”*

- the patterns and trends described above lead you to what conclusion? state succinctly
- briefly link this conclusion back to your hypothesis and/or research question

EVALUATION OF CONCLUSION

(DEV: Aspect 1) *“Evaluates the conclusion in the context of the environmental issue.”*

- considering your data, evaluate the degree to which the conclusion to your investigation is valid and significant (i.e. how well can answer your research question with your data)
- how do your findings relate to the broader context of the environmental issue?
- to what extent do your findings support or contrast with info available in research literature?
- what reasons can you suggest for any similarities or differences?

DISCUSSION OF METHOD

(DEV: Aspect 2) *“Discusses strengths, weaknesses and limitations within the method used.”*

- discuss strengths of your method and controls and how this affected your results positively
- discuss weaknesses/limitations in the experimental design that you recognized while/after carrying out the study
- how might the limitations of your method have affected your results and conclusion?

MODIFICATIONS & FURTHER RESEARCH

(DEV: Aspect 3) *“Suggests modifications addressing one or more significant weaknesses with large effect and further areas of research.”*

- how could you change your investigation so data generated were more valid or reliable?
- describe a practical way of improving the significant weaknesses or limitations you discussed above
- in light of your completed investigation, suggest thoughtful further research that would be a significant and meaningful next step, extension or alternative

APPLICATION

(APP: Aspect 1) *“Justifies one potential application and/or solution to the environmental issue that has been discussed in the context, based on the findings of the study.”*

(APP: Aspect 2) *“Evaluates relevant strengths, weaknesses and limitations of this solution.”*

- widen your thinking back out to the environmental issue discussed in the context

- describe a real life application/solution for your environmental issue, based on the findings of your study
- justify your suggested solution by providing evidence to support it
- evaluate potential benefits, drawbacks and limitations were your solution suggestion implemented
- can you find any literature/real life examples like this solution? how effective were they?

WORKS CITED

- proper MLA format
- several relevant sources, appropriate for DP level

COMMUNICATION (throughout entire report)

(COM: Aspect 1) "The report is well-structured and well-organized."

(COM: Aspect 2) "The report makes consistent use of appropriate terminology and is concise."

(COM: Aspect 3) "The report is logical and coherent."

- report can not be longer than 2250 words (not including data tables or Works Cited)
- easy to understand your report, spelling and grammar are excellent
- everything you write is always focused on your context or research question (no tangents)
- included as much ESS vocabulary in your writing as possible
- page numbers and subheadings used
- printed in colour if necessary