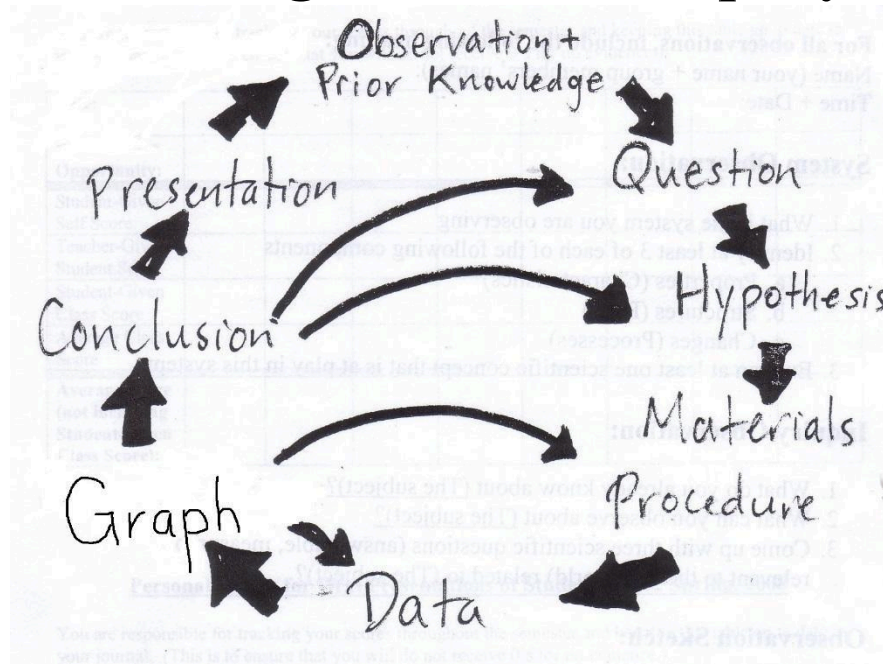


Scientific Investigations: The Inquiry Process



Inquiry Step	Expectation
Observation / Prior Knowledge	<ul style="list-style-type: none"> What do you observe and know about the subject? Include sensory observations and facts.
Question	How does the <i>independent</i> variable affect the <i>dependent</i> variable? <i>Independent variable</i> =Factor you are testing/changing <i>Dependent variable</i> =Results that are observed/measured/recorded
Hypothesis	If: What will you actually be doing/measuring? Then: What actual results do you predict you will find? Because: What is the scientific reason behind your prediction?
Materials / Procedure	M = Bulleted supply list including tool to measure dependent variable P = Numbered steps including all 3 variables (<i>controlled variables</i> stay the same), how often to measure and record, and repeated trials. <ul style="list-style-type: none"> Choose your first item to test and explain rules for the test Observe, measure and record your outcome (dependent variable) Repeat steps 1-2 two more times Repeat steps 1-3 with the other items to test (name them) Table (blank table with independent on left and dependent on right)
Data	Numbers in a table with independent variable on the left and dependent variable on the right. Include a column for averages on the far right.
Graph	Graph data with proper Title (independent vs. dependent), Axis (independent on X, dependent on Y), Intervals (start at 0, even jumps), Labels (units on Y, tested items on X), Scale (data fills most of graph)
Conclusion/CER (Claim, Evidence Reasoning)	<ol style="list-style-type: none"> Claim: Answer question (make a claim about the actual results) Evidence: Cite evidence (report and label averages) Evidence: Cite more evidence (compare data – subtract/manipulate) Reasoning: Explain with reasoning (state a science concept and explain how your results compare to the science concept)
Presentation	Include all steps of the inquiry process; Be professional

Location vs. Turbidity in Tumwater Creek

Observation/Prior Knowledge: At the downstream sites we heard cars and saw tracks from trucks near the creek. At the upstream sites we heard birds chirping and saw ferns next to the creek. We know Tumwater goes through Port Angeles and the bridge over the creek was replaced in 2008.

Question: What is the effect of location (river mile) on turbidity (cloudiness) of Tumwater Creek?

Hypothesis: If we test turbidity at different river miles, then lower river miles (downstream) will have higher turbidity levels because the creek gets bigger and stirs up more sediment downstream.

Materials:

- Turbidity meter (including sample vials and wipes)
- Waterproof boots and gloves
- Data sheets and pencils

Procedure:

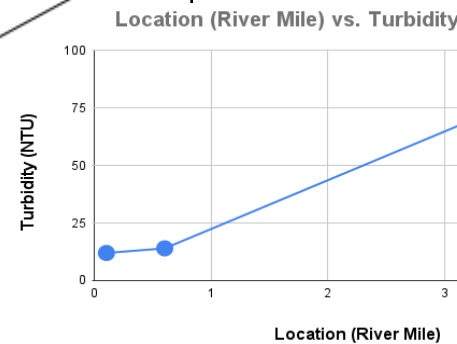
- 1) Choose the downstream site (river mile 0.1) and without stirring up the bottom collect a full vial of creek water. Wipe the vial to clean and dry the vial, then put it in the turbidity meter.
- 2) Observe, measure and record the turbidity level in Nephelometric Turbidity Units (NTU).
- 3) Repeat steps 1-2 two more times.
- 4) Repeat steps 1-3 upstream at three different sites (river miles 0.6, 4.0 and 4.4).
- 5) Repeat steps 1-4 every year starting in 2006.

Data:

HINT: The independent variable goes here

Location (River Mile) vs. Turbidity level (NTU)				
Location (River Mile)	Turbidity level (NTU)			
	Trial 1	Trial 2	Trial 3	
0.1	90	87	93	
0.6	79	86	93	
4.0	12	12	18	
4.4	11	12	13	

HINT: The dependent variable goes here (results)



Graph:

Conclusion:

Downstream locations have higher turbidity levels than upstream locations on Tumwater Creek. The furthest downstream sites at river miles 0.1 and 0.6 had average turbidity of 90 and 86 NTU and the furthest upstream sites at river miles 4.0 and 4.4 had average turbidity of 14 and 12 NTU. The average of the 2 downstream sites, 88 NTU, was 75 NTU higher than the average of the 2 upstream sites, 13 NTU. Sediment raises the turbidity (cloudiness) of a stream, and downstream sites on Tumwater Creek are surrounded by the city of Port Angeles, so the sediment running into the stream from city streets causes higher turbidity downstream as compared to upstream where the creek is surrounded by forest.

OBSERVATION/PRIOR KNOWLEDGE (O/PK): Strong observation/background

Extremely perceptive + thoughtful work	Observation and prior knowledge present	Observation or prior knowledge present	Observation or prior knowledge lacking thought	No evidence
4	3	2	1	0

QUESTION (Q): Answerable, measurable, and relevant

All elements + two or more variables present	All elements present	One of three elements incorrect/missing	Two of three elements incorrect/missing	No evidence
4	3	2	1	0

HYPOTHESIS (H): Use the proper format and include thoughtful content

Format + content very thoughtful	Format correct and content plausible	Format incorrect or content implausible	Format incorrect or content implausible	No evidence
4	3	2	1	0

MATERIALS/PROCEDURE (M/P): Bulleted list + easy to follow steps-use CORRT on p.1

Comprehensive list and specific steps w/CORRT	Bulleted list and numbered steps are clear w/CORR	Bulleted list or numbered steps are lacking two items	Bulleted list and numbered steps are lacking four items	No evidence
4	3	2	1	0

DATA (D): Organized in a table with independent on left and dependent on right

All data present and very clearly organized	All data present and clearly organized	Some data not present or poor organization	Some data not present and poor organization	No evidence
4	3	2	1	0

GRAPH (G): Include: Title (independent vs. dependent), Axis (independent on X, dependent on Y), Intervals (start at 0, even jumps), Labels (units on Y, tested items on X), Scale (data fills most of graph)

T.A.I.L.S. all present	One element missing	Two elements missing	Three or more elements missing	No evidence
4	3	2	1	0

CONCLUSION (C): Claim (answer question), Evidence (cite data + compare data)
Reasoning (explain with scientific concepts)

Four elements present + strong	Three elements present	Two elements present	One element present	No evidence
4	3	2	1	0

PRESENTATION (P): Include all steps of inquiry method and be professional

All elements present + strong	All elements present	Could be more professional	Missing pieces or unprofessional	No evidence
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4	3	2	1	0
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