

## **Chapter 2 - Research Skills**



## 2.1 Introduction to Research Skills

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Research skills are at the foundation of academic work. Students are often required to obtain information from different sources and compile the information for specific purposes. In upper year courses and higher level assignments, students may be asked to locate data through research and then compile this data into a meaningful summary. Sorting through the significant volumes of research available at the push of a button or in the library requires students to think clearly about their research goals and to critically evaluate sources of information to eliminate weaker sources.

This section provides guidelines and suggestions on how to critically evaluate research and research questions in sections 2.2 - 2.4. Section 2.5 is a guide through the process of thinking about and creating higher level research and inquiry questions.

## 2.2 Universal Intellectual Standards

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Universal intellectual standards are standards which must be applied to thinking whenever one is interested in checking the quality of reasoning about a problem, issue, or situation. To think critically entails having command of these standards.

The standards are questions which probe the mind when assessing the quality of one's reasoning. The goal of these questions is to guide you to improving your reasoning skills.

The following is a quality of reasoning checklist:

1. **Clarity:** Could you elaborate further on that point? Could you express that point in another way? Could you give me an illustration? Could you give me an example? Clarity is the gateway standard. If a statement is unclear, we cannot determine whether it is accurate or relevant. In fact, we cannot tell anything about it because we do not yet know what it is saying. For example, the question, "What can be done about the education system in America?" is unclear. In order to address the question adequately, we would need to have a clearer understanding of what the person asking the question is considering the "problem" to be. A clearer question might be "What can educators do to ensure that students learn the skills and abilities which help them function successfully on the job and in their daily decision-making?"
2. **Accuracy:** Is that really true? How could we check that? How could we find out if that is true? A statement can be clear but not accurate, as in "Most dogs are over 300 pounds in weight."
3. **Precision:** Could you give more details? Could you be more specific? A statement can be both clear and accurate, but not precise, as in "Jack is overweight." (We do not know how overweight Jack is, one pound or 500 pounds.)

4. **Relevance:** How is that connected to the question? How does that bear on the issue? A statement can be clear, accurate, and precise, but not relevant to the question at hand. For example, students often think that the amount of effort they put into a course should be used in raising their grade in a course. Often, however, the “effort” does not measure the quality of student learning, and *when this is so*, effort is irrelevant to their appropriate grade.
5. **Depth:** How does your answer address the complexities in the question? How are you taking into account the problems in the question? Is that dealing with the most significant factors? A statement can be clear, accurate, precise, and relevant, but superficial (that is, lacking depth). For example, the statement “Just say No” which is often used to discourage children and teens from using drugs, is clear, accurate, precise, and relevant. Nevertheless, it lacks depth because it treats an extremely complex issue, the pervasive problem of drug use among young people, superficially. It fails to deal with the complexities of the issue.
6. **Breadth:** Do we need to consider another point of view? Is there another way to look at this question? What would this look like from a conservative standpoint? What would this look like from the point of view of ...? A line of reasoning may be clear, accurate, precise, relevant, and deep, but lack breadth (as in an argument from either the conservative or liberal standpoint which gets deeply into an issue, but only recognizes the insights of one side of the question.)
7. **Logic:** Does this really make sense? Does that follow from what you said? How does that follow? But before you implied this and now you are saying that; how can both be true? When we think, we bring a variety of thoughts together into some order. When the thoughts are mutually supporting and make sense in combination, the thinking is “logical.” When the combination is not mutually supporting, is contradictory in some sense, or does not “make sense,” the combination is not logical.

Source: Elder and Paul, 1996

## 2.3 Guidelines for Critical Thinking

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Critical thinking is an essential skill for any university student. Critical thinking is reasoned, reflective thinking that includes good judgment, is sensitive to the context, relies on identifiable criteria and is self correcting. Critical thinking skills require continued practice to develop. They are commonly used when reviewing arguments, reading reports, writing essays, reviewing of literature, and evaluating academic presentations. By developing critical thinking skills a student is better able to produce logical counter-arguments, identify weaknesses in an author's reasoning, identify misleading or inconsistent statements in literature, and present their own ideas, essays, and responses in an organized, coherent, and logical fashion.

When reviewing information it is important to address the following critical thinking questions:

- What is the main purpose and conclusion(s)?
- Is the purpose clearly and logically articulated?
- Are there any conflicts or assumptions present in the reasoning?
- Do fallacies exist in the reasoning?
- Do alternative ways to solve the problem exist?
- Are the alternatives a better option?
- Is the evidence used to support the argument credible and accurate?
- Has any significant information been omitted or manipulated?
- Have all possible conclusions been evaluated from the arguments presented?

Whether writing or reading an essay, an individual utilizing critical thinking skills will be more capable of gathering all relevant information, note inconsistencies or errors in the information, and then respond with an educated rebuttal. Learning and perfecting critical thinking skills will provide a student with an academic advantage.

## 2.4 Hypothesis Testing

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Developing a hypothesis involves making an assumption of a particular outcome that you expect to occur in your research project.

Forming a hypothesis requires two steps:

- finding a question for which you want some kind of answer; and,
- stating your present assumption in such a way that you will be able to test it

Your hypothesis should be phrased in such a way so that you will know the type of data or evidence that you will need to look for. You should also have a clear sense of the means you are going to use to assess and analyse the evidence that you find.

When investigating your hypothesis, you should objectively and critically examine the data and evidence in order to determine if your assumption is valid. You will be asking yourself this question:

Do the available facts and evidence support the assumption I am making?

At the end of the research process, your answer to this question may be:

Yes, the available facts and evidence do support my original assumptions.

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*Or it may be:*

No, the available facts and evidence do not support my original assumption.

*Or it may be:*

To a certain extent, the available facts and evidence support my original assumption.

Any one of these conclusions is legitimate. However, it is necessary to thoroughly explain how you came to such a conclusion. Readers of your report will be interested in your testing procedures and the way you analysed your data. As they read your paper, they will be asking these questions:

- Is this researcher actually testing the stated hypothesis?
- Does this researcher's final conclusion rest upon legitimate, relevant data?
- Do I consider the reasoning in this paper to be logical, valid?
- Has this researcher found and considered all the important evidence?

Be sure to keep these questions in mind when you conduct a hypothesis test.

### ***Example:***

You are working as the chief hydrologist for Environment Canada in the City of Hamilton. It appears that Cootes Paradise experiences a period of high pollutant levels each summer. You have been asked to investigate this problem.

To begin your research, you need to develop a hypothesis. After examining the area and potential sources of pollutants, your hypothesis may be:

Cootes Paradise has high levels of pollutants during the summer since evaporation rates are higher, reducing the lake's dilution factor on the incoming sewage effluent (discharged from the Dundas Sewage Treatment Plant).

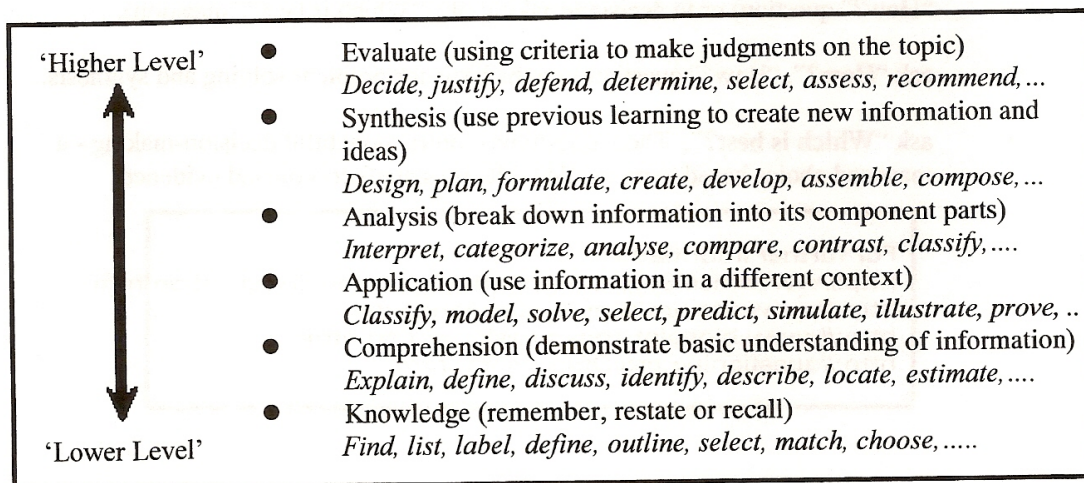
This hypothesis helps the researcher determine their data needs. The researcher will need to obtain data on evaporation rates, lake levels and amount of incoming effluent to determine whether the hypothesis is valid. After data is collected and analysed, the researcher will conclude that either the hypothesis is in fact supported, not supported or only partially supported.

## 2.5 How to Create a Good Inquiry/Research Question

Some forms of inquiry-based learning require students to create, and find resources to help answer questions related to a particular topic of interest. Creating a question that allows fruitful research and investigation is not an easy task and requires some guidance and practice. The wording and structure of a question can have considerable effect on the type of research and learning that occurs. Here are some useful tips that may help you create a good inquiry question.

### ***Bloom's Taxonomy of Learning***

'Bloom's Taxonomy of Learning' identifies a number of different levels of learning ranging from remembering (knowledge), through application and analysis to evaluation. Good inquiry questions should stimulate 'higher level' learning such as **synthesis and evaluation**, rather than allow the restatement of known facts (i.e. knowledge). Some trigger verbs are provided below (from highest level to lowest level) to help with the construction of questions.



Good inquiry questions:

- should leave the answer open to a **number of possible correct responses** (divergent questions) rather than a single right answer.
- should be **well structured** and direct the research toward a particular aspect of the subject area. The questions should be answerable by doing research in the allotted time frame.

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- should be **stimulating** and engage a sense of curiosity and desire to understand something of significance and importance. The answers to such questions must be created, not repeated from other sources. The answer to the question should not be known before research has begun!
- should lend themselves well to **multidisciplinary** investigations, requiring that students apply the skills and perspectives from a variety of disciplines.
- should be **clear and straightforward** and should address one issue at a time. More complex questions may require breaking down into a number of smaller questions.
- should avoid "What is?" questions such as "What is an earthquake?" or "What is a seismic wave?". While these are important questions, they do not require higher level learning.
- ask **“Why?”**. “Why?” questions require analysis of cause-and-effect and the relationships between variables. They lead naturally to problem-solving (the “How?” question) or to decision-making (the “Which is best?” question).
- ask **“How?”**. “How?” questions are the basis for problem-solving and synthesis.
- ask **“Which is best?”**. These questions require thoughtful decision-making - a reasoned choice based upon explicit (clearly stated) criteria and evidence.

### For further information:

[http://cll.mcmaster.ca/resources/misc/good\\_inquiry\\_question.html](http://cll.mcmaster.ca/resources/misc/good_inquiry_question.html)

<http://www.fno.org/sept96/questions.html>

<http://trainingthetrainers2010.pbworks.com/f/Inquiry+Based+Learning.pdf>

<http://questioning.org/Q6/question.html>



## 2.6 Evaluating an Inquiry Question

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In order to determine whether or not your formulated inquiry question is a good one, it must possess a number of components. Using the grid below, test your formulated inquiry question by answering ‘yes’ or ‘no’ to each of the “Weak Questions”. If your answer was ‘yes’ to any of these, your question should be modified until it passes the test to receive an answer of ‘no’ to all of the “Weak Questions”. Upon completion of this, your inquiry question will become a “Stronger Question”, and will be suitable to complete any inquiry exercise.

<b>WEAK QUESTIONS</b>	<b>STRONGER QUESTIONS</b>
<b>Passing Interest</b>	<b>High Interest</b>
<ul style="list-style-type: none"> <li>▪ Does it minimally address assignment requirements?</li> <li>▪ Did you choose this topic to get a better grade?</li> <li>▪ Do you just want to get it done?</li> </ul>	<ul style="list-style-type: none"> <li>▪ Is it of real interest to you? (This is key)</li> <li>▪ Do you care about whether you are getting it “right” and are you using the best sources possible?</li> </ul>
<b>Minimal Research Potential</b>	<b>High Research Potential</b>
<ul style="list-style-type: none"> <li>▪ Will you be reporting and paraphrasing content?</li> <li>▪ Is it a textbook explanation or a question for which the answer is already known?</li> </ul>	<ul style="list-style-type: none"> <li>▪ Does it require application, analysis, synthesis, integration or evaluation?</li> <li>▪ Does it elicit higher-order thinking?</li> <li>▪ Are there multiple possible answers?</li> </ul>
<b>Convergent</b>	<b>Divergent</b>
<ul style="list-style-type: none"> <li>▪ Does it imply there is a single right answer to the question?</li> </ul>	<ul style="list-style-type: none"> <li>▪ Does it suggest multiple possible correct responses or directions?</li> </ul>
<b>Biased Phrasing</b>	<b>Unbiased Phrasing</b>
<ul style="list-style-type: none"> <li>▪ Does it make an assumption(s)?</li> <li>▪ Have you already decided on the answer?</li> <li>▪ Do you choose sources selectively to support your position?</li> </ul>	<ul style="list-style-type: none"> <li>▪ Are you sure a particular outcome is not specified?</li> </ul>
<b>Unfocused</b>	<b>Focused</b>
<ul style="list-style-type: none"> <li>▪ Is it vague, non-specific, too broad?</li> </ul>	<ul style="list-style-type: none"> <li>▪ Is it direct?</li> <li>▪ Does it narrow the field?</li> <li>▪ Is there a clear direction?</li> </ul>

## 2.7 Writing a Thesis Statement

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Writing in university often requires that you convince or persuade your reader that your interpretation or understanding of a topic is correct. The way to do this in an academic paper is to decide on a topic and after a brief introduction, state your point of view on the topic directly and often in one sentence. This sentence is the thesis statement, and it serves as a summary of the argument you'll make in the rest of your paper.

### A thesis statement:

- tells the reader how you will interpret the significance of the subject matter under discussion.
- is a road map for the paper; in other words, it tells the reader what to expect from the rest of the paper.
- directly answers the question asked of you. A thesis is an interpretation of a question or subject, not the subject itself. The subject, or topic, of a paper might be ground water contamination; a thesis must then offer a way to understand the subject.
- makes a claim that others might dispute.
- is usually a single sentence somewhere in your first paragraph that presents your argument to the reader. The rest of the paper, the body, gathers and organizes evidence that will persuade the reader of the logic of your interpretation.

### Tips for Writing Your Thesis Statement

1. Determine what kind of paper you are writing:
  - An **analytical** paper breaks down an issue or an idea into its component parts, evaluates the issue or idea, and presents this breakdown and evaluation to the audience.
  - An **expository** (explanatory) paper explains something to the audience.
  - An **argumentative** paper makes a claim about a topic and justifies this claim with specific evidence. The claim could be an opinion, a policy proposal, an evaluation, a cause-and-effect statement, or an interpretation. The goal of the argumentative paper is to convince the audience that the claim is true based on the evidence provided.
2. Your thesis statement should be specific—it should cover only what you will discuss in your paper and should be supported with specific evidence.
3. The thesis statement usually appears at the end of the first paragraph of a paper.
4. Your topic may change as you write, so you may need to revise your thesis statement to reflect exactly what you have discussed in the paper.

## Some Myths about Thesis Statements

- *A thesis statement must come at the end of the first paragraph.* This is a natural position for a statement of focus, but it's not the only one. Some theses can be stated in the opening sentences of a paper; others need a paragraph or two of introduction; others can't be fully formulated until the end.
- *A thesis statement must be one sentence in length, no matter how many clauses it contains.* Clear writing is more important than rules like these. Use two or three sentences if you need them. A complex argument may require a whole tightly-knit paragraph to make its initial statement of position.
- *You can't start writing a paper until you have a perfect thesis statement.* It may be advisable to draft a hypothesis or tentative thesis statement near the start of a big project, but changing and refining a thesis is a main task of thinking your way through your ideas as you write a paper. And some papers project need to explore the question in depth without being locked in before they can provide even a tentative answer.
- *A thesis statement must give three points of support.* It should indicate that the paper will explain and give evidence for its assertion, but points don't need to come in any specific number.