

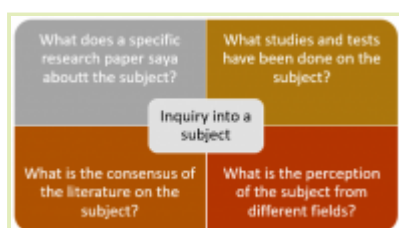
## Critical Thinking #2: Reading Research Papers - IVT BLOG



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By

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### INTRODUCTION

Research review remains fundamental to pharmaceutical and healthcare products development. This may be with new scientific discoveries, reports on drug efficacy, emerging novel methods, or when looking into something unexpected to work out the root cause or to understand the scientific underpinnings of an event. To undertake this involves identifying and reading research papers. Invariably there will be a range of research papers on a given subject, and sometimes there will be contradictory outcomes (or opinions) (1). To differentiate between these, and well as assessing the value of a paper rapidly, requires a branch of critical thinking (2) that can be defined as ‘critical reading’.

It is not a given that everyone working in pharmaceuticals and healthcare is a grounded critical thinker. These days, in the opinion of this writer, for undergraduate courses the acquisition of scientific information has taken precedence over learning scientific methods and concepts. This can lead to the ‘scientific method’ being less well understood, especially concepts like investigation, understanding, and evaluation of scientific data. While critical thinking can be learned and nurtured it can also be stifled if the workplace environments is not conducive to its development. Therefore, the pharmaceutical and healthcare workplace should be encouraging critical thinking and critical reading. This article is one of a three-part series about critical thinking in the context of pharmaceutical and healthcare organizations:

- Critical thinking #1: Why pharmaceuticals and healthcare needs more critical thinkers.
- Critical thinking #2: Reading research papers.
- Critical thinking #3: Self-questioning and questioning for a better outcome.

We follow on from the need for critical thinking with the process of critically evaluating research.

### APPROACHING CRITICAL READING

Good research skills are required for practicing the scientific method. With the scientific method, there are different conceptions. One of the simplest is:

1. Make an observation that describes a problem.
2. Ask a question.
3. Create a hypothesis that answers the question.
4. Make a prediction based on the hypothesis.
5. Test the hypothesis through research and experimentation.

6. Analyze the results.
7. Draw conclusions and refine the hypothesis.
8. Report the results.
9. Continue with the study as required.

When faced with a plethora of research papers to work through it is good practice to begin by reading the abstract and skimming the article. In doing so, pose the following questions (3):

- Does it meet your purpose?
- What questions do you want to answer?

If the paper appears to be of value, then it is useful to look at the introduction and the conclusion next. Reading the introduction is a good way of establishing the research questions and any hypothesis. With a well-written paper, the author(s) will provide signposts to the most important parts of their writing, and they will also mention the key issues and concepts. With the conclusion to a paper, this will help to confirm what the main ideas or outcomes are, and hence whether the overall paper is relevant to the inquiry.

When critically analyzing the research, it is useful to engage in purposeful reading, which is about reading actively rather than passively. As a paper is read, it can be useful to ask questions about what is being said. Active reading can involve posing yourself questions like:

- What is the main point of this paper/ article/ paragraph/ report/ blog?
- Who wrote it?
- Why was it written?
- When was it written?
- Has the context changed since it was written?
- Is the evidence presented robust?
- How did the authors come to their conclusions?
- Do you agree with the conclusions?
- What does this add to our knowledge?
- Why is this useful?

## SUMMARIZING RESEARCH

If the research is useful, then making a summary of the article helps with the recall later of the key points. In addition, it can be useful to reference the article. For example, noting the: Author, article title, volume, issue and page numbers, year of publication and journal title in an appropriate reference format.

To summarize the research, the following grid (or a variant) can be useful:

Title:	Author(s):	Full reference.
Date read/accessed:	Published date (online or in-print):	Subject:
How is this related to my current research?	<b>Main point(s):</b>	<b>Additional areas covered:</b>

Title: Author(s): Full reference.

<p><b>My opinion: agree/disagree/unsure?</b></p>	<p><b>Why do I agree/disagree?</b></p> <p><b>Why I am unsure?</b></p>	<p>Do any other author(s)/pieces of work have the same opinion?</p>
<p>Who does the author work for?</p> <p>Who funded this work?</p> <p>Who are their affiliations?</p> <p>Do they have an agenda/ are they biased?</p> <p>Is this a trusted source?</p>	<p>Are there any holes within this article/work/method?</p> <p>How does this affect the results/argument/conclusions?</p>	<p><b>What is the main one point?</b></p> <p><b>What other questions or research areas has this paper stimulated?</b></p>

## EVALUATING CONTRASTING RESEARCH

It often arises that two or more research papers are contradictory. Where there are different outcomes (for example with drug efficacy), it is useful to ask yourself:

- Do the papers have the same theoretical basis?
- What previous research or influences was drawn upon?
- Is there evidence of bias?
- Is the experimental design appropriate?
- Is the data robust and reliable?
- Have alternatives been explored?
- What is the level of statistical significance?
- Are there any conflicts of interest?

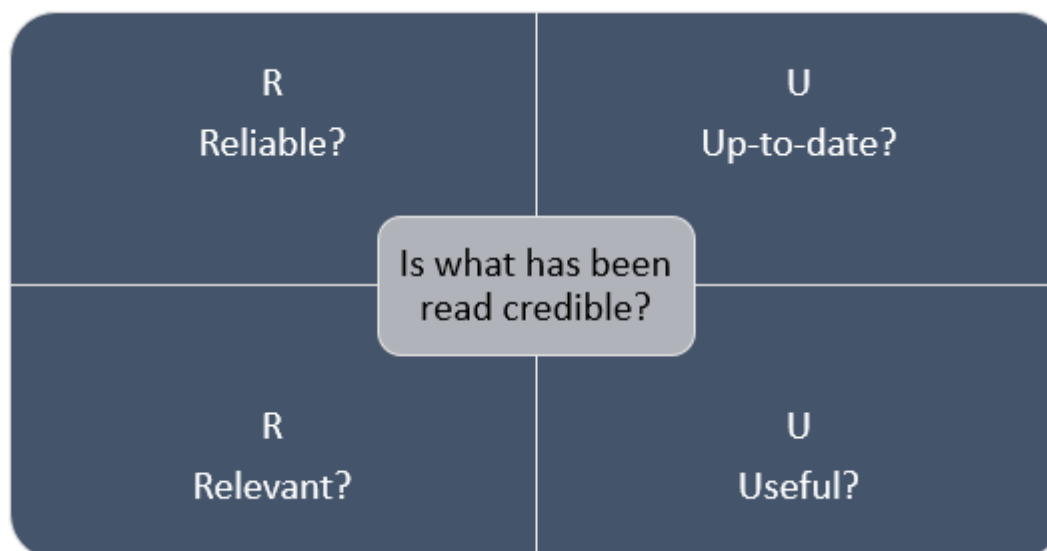
For this a compare and contrast framework can be useful. For example:

	Differences A:	Similarities	Differences B:
Factor			
Factor			
Factor			

With the above 'factor' represents a different aspects of the research. This could be an argument, an with the process, summarize using key phrases against the factors common to each of the sources. This way, instead of reviewing each source separately, notes are taken about each factor by making comparisons.

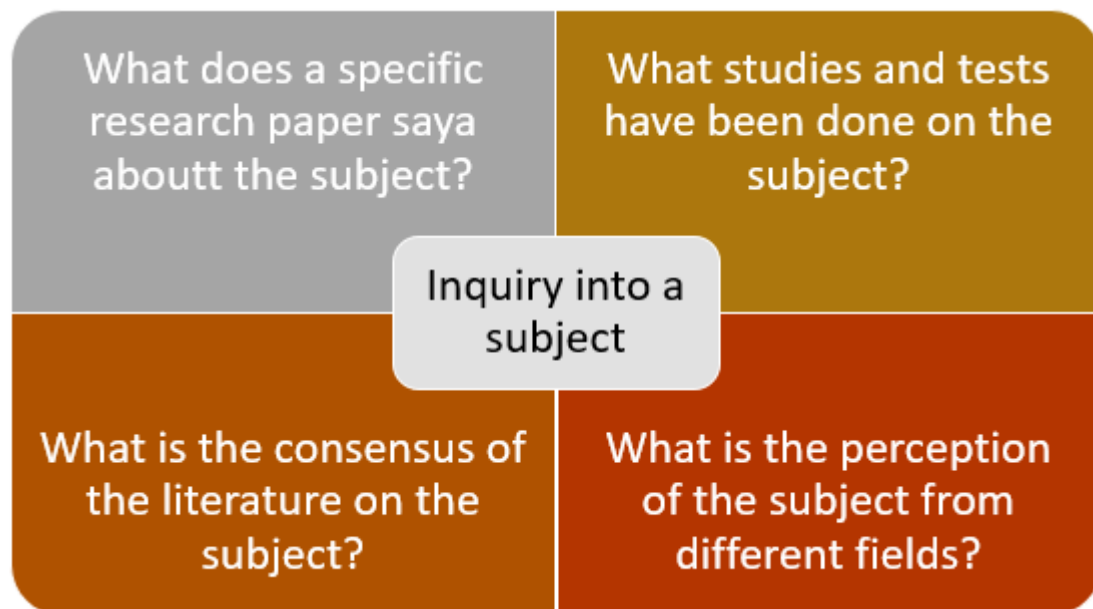
It is better to avoid using direct quotations and instead note down the points made as a summary of the key points. This simplifies the process and makes the notes easier to read at a later date.

A quadrant approach called RURU provides an example of a credibility criteria tool that can be used when deciding if an information source is 'believable'. This is presented as (Figure 1):



*figure 1: A quadrant for assessing research*

Once all of the information has been collected (or at least sufficient information to enable decision making to take place), the amassed information can be placed into a quadrant, such as with Figure 2:



*Figure 2: A quadrant for assessing overall research*

### **PUTTING RESEARCH INTO PRACTICE**

What has been assessed through research will often need to be put into practice (should the research area have stood up to scrutiny). Learning how to translate research to practice through the process of translational research is also something that can be followed through with critical thinking. For example, the following can be considered (4):

- Formulate a clinical issue into searchable and answerable questions.
- Find the relevant evidence for the questions identified.
- Critically appraise the evidence.
- Select appropriate models and/or strategies for translating research evidence to practice.
- Assess the implementation potential of the proposed evidence-based activities.
- Develop the evidence-based workplace guidelines.
- Develop plans to implement the proposed practice and evaluate the outcomes.
- Generate and justify the basis for deciding whether to adopt or modify what has been implemented.

To do so generally involves the support of others, especially under the requirements to make changes that impact upon Good Manufacturing Practice (GMP) via a change control process. There are different ways to achieve this, such as through focus group sessions with stakeholders to appraise and justify the need for the change, assessing implementation potential, formulating implementation plans, and negotiating for resources (5). This can be more successful with ‘critical questioning’ (as outlined in the third and final part of this series).

### **CONCLUSION**

Critical thinking involves reading read critically and with a degree of skepticism. This does not mean dismissing out of hand what has been read; doubt should not be cast until a level of understanding has been reached understand.

To reach a rounded view multiple sources need to be assessed as one research paper or textbook will undoubtedly leave out some relevant information. Furthermore, no two researchers approach a topic from exactly the same perspective.

Furthermore, the critical thinking approach involves asking yourself questions as you read, considering implications and the robustness of the material.

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