Thinking Critically
An introduction

Patrick Onions
Leeds Metropolitan University
p.onions@leedsmet.ac.uk
December 2009

Abstract
Critical thinking is an essential skill for students, academics and those whose thinking forms an important aspect of their jobs. Critical thinking is a way of seeing things and a descriptive term for the set of methods used to consider problems. It leads to an informed, aware, systemic, considered and logical approach to deciding what to believe or do; with arguments and conclusions that are more likely to be valid, substantiated, resistant to criticism and representative of the situation. This paper introduces critical thinking and related concepts to students, and suggests methods of applying critical thinking to the process of writing of an academic paper.

Keywords
Critical thinking, critical analysis, critical evaluation, academic writing

1 Introduction

It is easy to fall into the habit of thinking and writing uncritically. Analysis can be tedious, Internet search engines allow us to dredge up copious quantities of literature to 'support' an opinion, and the contentious nature of 'proof' can make argumentation difficult and socially problematic.

As a mindset, critical thinking has broad and important application in academic and non-academic life. For the student, critical thinking is a set of skills that must be applied to a range of academic activities; including reading, research, analysis, argumentation and writing. Better understanding of critical thinking will improve assignments and dissertations, and compels students to diligently review literature and analyse data. For the practitioner, critical thinking underpins evidence-based decisions, encourages rational thought, and supports the decision maker against hype and emotive argument.

This paper offers an introduction to critical thinking; reviewing a small cross-section of available literature, describing the application of the critical mode of thinking, and providing a bibliography for study.

2 Definitions of critical thinking

Critical thinking is a complex and tacit activity, and may be regarded as an art form. This nature is reflected in the broad range of its definitions, with some disagreement as to what it is all about (Johnson, 1992).

Beyer (1987) defines critical thinking as a process of determining the authenticity, accuracy and worthiness of information or knowledge claims. Scriven and Paul (1996) see critical analysis as the "*reasoned and logical process of skilfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information.*"

Browne and Keeley (2001) define critical thinking as an awareness of a set of interrelated critical questions, the ability to ask and answer critical questions at appropriate times, and a desire to actively use the critical questions. Some quotations may also be found in Fisher (2001):

> *Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do.* (Norris and Ennis, 1989)

> *Critical thinking is that mode of thinking - about any subject, content or problem - in which the thinker improves the quality of his or her thinking by skilfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them.* (Paul, Fisher and Nosich, 1993)

Identifying what a subject is not is also a potentially useful exercise. One common misconception encountered whilst explaining critical thinking is that it is a negative, judgemental or fault-finding process. On the contrary, critical thinking is a positive and impartial approach to considering problems and situations. Critical thinking is not about 'academic pondering'; it is a transferable skill useful in most situations where instinct or 'gut feel' is unsatisfactory.

Common themes emerge from the above definitions. Some see critical thinking as a process, whilst others see it as an approach. Characteristics such as

questioning, improving, quality, veracity of arguments and claims and structuring recur. The following definition may be synthesised from these perspectives:

> *Critical thinking is a way of thinking, and a set of skills, that encourages an informed, aware, systemic, considered and logical approach to deciding what to believe or do. Critical thinking leads to arguments and conclusions that are valid, substantiated and resistant to criticism.*

3 The critical thinking approach

The above definitions describe critical thinking as a mindset, or way of thinking, and as skills that may be applied in a methodical fashion to examining and discussing a problem.

3.1 Critical thinking as a mindset

Writers cannot jump directly into critical thinking as if following a recipe. Critical thinking begins with a state of mind that may be described as capabilities:

- Learning to think from any perspective.
- Readiness to explore new ideas or conclusions.
- Becoming open to and willing to engage with different viewpoints.
- Relating personally held points of view to the argument.
- Building supportable interpretations.
- Recognising how any discourse reflects its author's argument and perspective.

There is evidence of cultural differences in critical thinking, and international students in particular should identify what their tutors expect of critical thinking (Kutieleh and Egege, 2004).

3.2 Critical thinking as a process

A methodical process is inherently easier to explain and learn than abstract concepts. Some authors have treated the subject from the process perspective. Meyers (in Varaki, 2006) separated critical thinking into problem-solving and decision-making processes, each with 8 steps:

Problem Solving

1. Recognise and define the problem to be solved.
2. Identify the problem's root causes.
3. Identify criteria for evaluating solutions.
4. Identify possible solutions.
5. Evaluate possible solutions against criteria.
6. Select "best" solutions.
7. Develop a detailed implementation plan.
8. Evaluate the effectiveness of the solution.

Decision-Making

1. Identify and define the goal to be achieved.
2. Analyze the opportunity/relevant issues.
3. Identify criteria to assess strategies and actions.
4. Identify possible strategies and actions.
5. Evaluate possible strategies and actions.
6. Select "best" set of strategies and actions.
7. Develop a detailed implementation plan.
8. Evaluate effectiveness and opportunities.

Meyer's two processes are quite broad and therefore may be applied to many situations. They are however too generic to be applied to academic writing without adaptation and further defining. This paper will therefore seek to illustrate critical thinking through the process of writing an academic paper.

3.3 Analytical stances

There are a variety of analytical stances that the critical thinker can adopt:

- Reflective - a deeply considered evaluation of a discourse and the context of its production (Clark, 2008).
- Reflexive - a consideration of the impact of the writer or one's own position on the discourse and how they interpret their situation.
- Questioning - a structured investigation into the issues at hand. The six interrogatives of who, where, when, why, what and how may be used, as may Paul's Socratic questions (1990):
  - Questions of clarification
  - Questions that probe assumptions
  - Questions probing reasons and evidence
  - Questions about viewpoints
  - Questions probing implications
  - Questions about the question.
- Dialogic - the collaborative construction of viewpoints or knowledge.
- Comparative - examining the similarities, differences and consequent implications of writers' positions in discussing a topic.

3.4 Critical thinking strategies

A writer may adopt three critical thinking strategies; non-critical, weakly critical and strongly critical:

Non-critical thinking identifies, regurgitates and describes a set of 'facts' without relating them to each

other or to a broader context or topic. An example illustrates:

> *Dove (1999) says that knowledge management has huge potential. Malhotra (2005) says knowledge management has failed to deliver on its promises.*

Here the reader is presented with the 'facts', that two authors each made statements about a subject. The reader is left to link them or draw conclusions, and cannot easily ascertain the writer's opinion or position.

Weakly critical thinking involves analysing situations, considering different viewpoints, and developing own conclusions. For example:

> *Whilst Dove (1999) says that knowledge management has huge potential, later authors such as Malhotra (2005) have refuted these claims by saying that few projects have delivered their intended benefits. One consequence would be waning commercial interest, which personal experience confirms to be the case.*

Here the two positions are presented, linked, conclusions drawn and the writer's position (and claim) is clearly stated. Weakly critical thinking roughly equates with critical analysis, discussed below.

Strongly critical thinking involves treating claims as human constructs that are complex, value laden and subject to challenge. Underlying assumptions, paradigms and logic require exploration. The reader would determine what meaning has been communicated through the writer's choice of language, medium, publication, authorities, evidence, position and arguments. In so doing the reader will understand why and how the author constructed their claims.

> *Dove's (1999) position that knowledge management has huge potential is strongly influenced and perhaps compromised by his commercial affiliations; evidenced by his position as consultant and the emotive selling and factually deficient style of language he uses. Time has proven this particular argument to be weak, with more recent and more credible authors such as Malhotra (2005) providing a rigorous and ultimately more plausible analysis of the reasons why such literature may be described as hype.*

In this example the reasons for the original authors' positions and the values inherent in their arguments are explored. The reader's opinion and values are clearly evident, and the reader could go further and explore their own reaction to this literature and their own values and judgements. Strongly critical thinking is required for critical evaluation, discussed below.

3.5 What does critical analysis mean?

Choice of strategy may be influenced by the subject, the problem, or by analytical objectives. Choice may also be dictated by the wording of a question or assignment brief. Exam or assignment questions may be prefixed with the instruction to 'critically analyse'. According to the University of Sussex website, critical analysis means "*considering the claims, what they are based on, and how far they seem to apply or be relevant to a given situation*."

Critical analysis involves a thorough and ideally non-judgemental investigation, or weakly critical thinking. This involves identifying, scrutinising, describing, demarcating and testing the relevant subject. Analysis entails close inspection; by considering the subject or problem from various perspectives, breaking it down into its constituent components or premises, checking the accuracy of and evidence for each, and checking the logic or relationships that binds the argument or concept together.

3.6 What does critical evaluation mean?

Critical evaluation equates to strongly critical thinking, weighing up a statement or question, along with its underpinning premises, assumptions and evidence. It involves considering the arguments for and against, using a set of evaluation criteria that are relevant and meaningful, and arriving at a conclusion as to the soundness of the statement, position, argument or question.

Since critical evaluation is a judgement, claims may be assessed in terms of own experience - if that experience is relevant to the issue under discussion. Personal experience will ordinarily influence judgements made as well as selection of evidence. The disclosure and inclusion of these influences consequently helps establish the validity and credibility of critical arguments and claims subsequently made.

3.7 The argument

Critical thinking is structured by and expressed through an argument. Presenting a well-constructed argument is an essential skill for students to acquire, and no academic paper or text should be prepared without prior and due consideration to this aspect.

In the loosest sense an argument can be defined as a series of statements that lead to a particular conclusion. An argument is not the more colloquial understanding; a quarrel or clash (although some academic arguments can become heated). Arguments can be explained simply as:

- An argument begins with a situation, problem, question, objective or attempt to prove an idea.
- The argument consists of a series of premises, or declarations, which should each be supported by evidence or other argument.
- Premises are built up, lead into each other, or are connected by inferences, logic or reasoning.
- Assumptions may inform, group, prompt or constrain premises and evidence. They may also inform or determine the logic.
- Premises lead to claims; statements or positions of what is believed to be true.
- An argument concludes with an opinion, claim or position.

Arguments must be persuasive and reflective of the critical thinking. The writer must be able to convince the audience that each of the claims and conclusions are valid. The audience may know the subject, and even recognise many of the flaws in its contemporary thinking. Argument must be convincing irrespective of whether the writer proffers his or her own opinion, or chooses to agree with or adopt the opinion of someone else. The audience should also be convinced irrespective of whether they agree with the writer's position or beliefs. Evidence and logic are key to convincing the reader of the truth of claims.

Evidence should be supportive of the argument and well founded (accurate, convincing, well articulated, current, and based in its own right on substantial and convincing evidence). Platt (2009) suggests initiating an argument by asking a series of questions:

- What needs to be true to support my ideas (claims)?
- What theoretical basis is there to support my ideas, or what theoretical base considers similar issues that I wish to argue against?
- What factual evidence is there for my argument (typically literature or empirical evidence in surveys, cases or experiments)?
- Can I find the evidence I need?
- Is this evidence available and easily accessible, and where and how can I obtain it?
- Is there enough evidence to support my ideas (claims) or should I be less ambitious and reduce the focus of my work or think again?

Logic defines the overall structure and flow of an argument. Windschuttle and Elliot (1999) describe logic as "*the study of correct and incorrect reasoning and the application of correct reasoning*."

Research logic may be regarded as the sequence in which theorising, hypothesising, observing and empirical generalisation are conducted (Wallace, in Vuorimaa, 2005), illustrated in Figure 1 below. Wallace's model has implications for the structure of the argument:

- Does the writer commence with a literature review (theories), devise a hypothesis or synthesise a theoretical position, and then test it? This is a deductive logic, which Windschuttle and Elliot regard as arriving at a conclusion that is inherent in the premises and where the arguments are either valid or invalid according to the correctness of the logic.

- Or does the writer commence with observations and use the literature review to help formulate empirical generalisations and hence theory? This is the inductive argument, regarded by Windschuttle and Elliot as one that examines the real world to find evidence towards a conclusion, with arguments that should be assessed according to whether they are weak or strong.

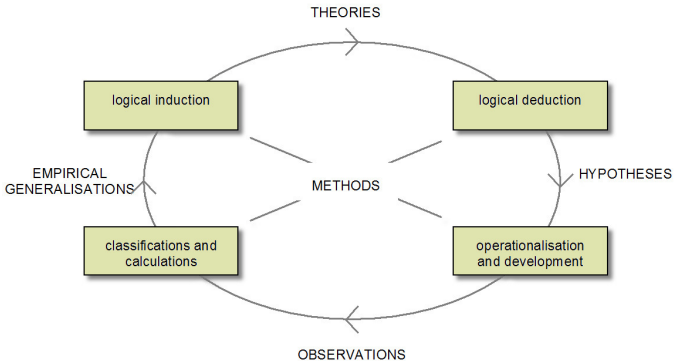

Figure 1: Wallace's Model of Research Logic

The soundness of an argument is a property called validity. Trochim (2004) said "*Validity is the best available approximation to the truth of a given proposition, inference, or conclusion*" and goes on to say "*The theory of validity, and the many lists of specific threats, provide a useful scheme for assessing the quality of research conclusions*". The validity of an argument may be determined through its limitations. Limitations may be critically analysed or critically evaluated, in areas such as the premises, supporting evidence, research method, logic, claims and conclusions.

Notwithstanding the need for logical argument, it should be recognised that there may a need for persuasive discourse and compromises where situation and subject demand it. Academic writers should be aware of the resulting limitations, and inform the reader accordingly.

3.8 Skills required to think critically

The critical thinker needs to employ a variety of skills. This begins with reflecting on and continually practicing the capabilities and adopting the stances described in section 3.1.

Facione (1998) identified the six core skills of critical thinking to be self-regulation, interpretation, analysis, inference, explanation and evaluation.

Hargreaves and Grenfell (2003) take a different approach in relating critical thinking skills to student learning outcomes. Their model shown in table 1 below is intended for science and mathematics, yet it is still valid in other contexts.

Skills	**Objectives** (student learning outcomes)
Designing experiments and testing hypotheses	Understand the need to isolate and control variables Select appropriate experimental techniques Use adequate sample sizes and avoid sampling bias Distinguish observations from inferences Critically evaluate the validity and reliability of data Establish relationships among variables Use inductive and deductive reasoning Calculate uncertainties Understand the limitations of extrapolation Use sound statistical approaches
Analysing arguments	Distinguish among data, opinions, and interpretations Structure an argument to support a proposal or interpretation Distinguish among premises, reasons, and conclusions Judge the credibility of an information source Identify relevant components that are missing from an argument Recognise common fallacies (e.g. circular reasoning, irrelevant reasons)
Solving problems	Restate the problem and the goal in order to consider different problem-solving approaches, particularly with ill-defined problems Represent the problem schematically Develop mathematical models Design algorithms Select appropriate problem-solving strategies Consider useful analogies Make sound decisions on the basis of critically reflective processes Appreciate the value of persistence
Thinking creatively	Demonstrate insight in recognising a problem Recognise patterns and visualise data Recognise and critically evaluate a number of solutions to a problem Select relevant information in relation to a problem and make unusual connections

Table 1: Critical thinking skills

4 Applying critical thinking

This paper has purposefully set out to describe critical thinking in the context of academic writing. Readers will be introduced to the idea that critical thinking is a process, and shown how to apply critical thinking to the generic sections of an academic paper.

4.1 The topic

The topic may be predetermined, in the form of a question or assignment. Thinking critically about a set question identifying the expectations of the examiner, producing the appropriate answer, and citing relevant and expected theories and literature. Consider the meaning of the question in the examiner's terms, and avoid interpreting the question according to the answer or argument you wish to provide. Furthermore, understand the analytical stance and critical thinking strategy that is expected.

The topic may also be at the discretion of the writer. An open subject is particularly relevant problem for Masters and Doctoral students seeking a dissertation topic. Topic selection is discussed in great length in a variety of academic guides, but it bears mentioning (or reminding) that critical thinking begins at this stage. Asking critical questions will help isolate a manageable, researchable and academically interesting research area and suitable analytical stance.

4.2 The literature review

A good literature review enables the writer to authoritatively inform and construct an argument. Critically reviewed literature performs several functions. It offers published evidence, logic and positions that the writer may build upon. A critical review may reveal gaps or flaws in the relevant body of knowledge, expose or question unchallenged assumptions, and inject creativity and progress into the field. A powerful application for theory is as a framework. Theoretical frameworks underpin a hypothesis or position, they may be used to compare situations against (i.e. theory says X, but Y happened on the project), and also offer criteria by which to assess what occurred or what was observed.

Research logic affects the employment of a literature review. A deductive approach would typically use a literature review to gather existing theories and formulate a position or hypothesis – an untested theory about the topic. Used inductively, a literature review informs the construction of an emerging theory and helps validate conclusions.

A critical analysis of literature would examine whether claims and positions are logical, unambiguous, impartial, supported by evidence, internally consistent

with other premises in their argument, and assess whether the conclusions are supported by arguments and evidence. Rice (2004) feels a critical analysis of literature should:

- Highlight the point the author is making
- Contextualise the argument
- Provide a counter argument
- Weigh up what has been said

A critical evaluation of literature would adopt a more questioning stance, supplement the advice offered by Rice (2004) as follows:

- What are the key relevant theories?
- Who are the key relevant authors?
- What are their positions and claims?
- Are these positions and claims valid?
- What are their strengths and limitations?
- Have these positions been challenged? How?
- Is the literature a well-regarded classic?
- Is there later theory that refutes or updates it?
- Does the author use persuasion or argument?

As critical evaluation involves judgement, the writer may ask probing questions. When looking at literature, ask whether the author is stating, implying, assuming, accepting or refuting? Is their choice of literature significant, convenient, lazy or informed? Ask what assumptions have been made, and why? Do the conclusions stand up to any common sense evaluation? Ask what has been included, what has been left out, and why? Importantly, also consider your opinion on the issue.

It is worth noting that an examiner, supervisor or reviewer will in turn question the literature review. Writers preparing a literature review should remember that their audience might wish to ask the following questions:

- Is the reviewed literature current?
- Is the review sufficiently comprehensive?
- Is the review relevant to the topic?
- Does the review support the argument?
- Does the review consider the target audience?
- Does the review express an opinion?
- Does the review arrive at a conclusion or position

It is suggested that writers begin mapping their argument as soon as they engage with literature and develop an understanding of the topic.

4.3 Analysing situations

Many phenomena can only be examined through analysing situations in which they appear, and situations are usually far more complex and affected by a greater breadth of factors than theory suggests. Discovering the causes of situations and drivers of behaviours is a key objective for analysis, but it can be the most challenging aspect of real-world research.

The starting point for analysis should be the theory that emerged during the literature review. Theory forms an important framework for analysis, as it should be used to identify, compare and evaluate behaviour and actions. Linking analysis to theory also ensures relevance, where problems are looked at from the perspective of the topic. A project management student should, for example, look at the problem from a project perspective and use project management theory.

Using the theoretical framework also helps ensure impartiality. This means the bias of the observer ideally should not affect the interpretation. In practice this is difficult, so observers need to recognise the effect of their position and limit its impact wherever possible.

Critical analysis of a situation involves asking questions similar to those asked of literature:

- What happened
- Where and when did it happen?
- How are events related?
- Are place and chronology significant?
- What triggered the events?
- What were the causes and underlying issues?
- What were the outcomes?
- What could have been done differently?
- What would the alternative or likely outcomes have been?
- What conclusions may be drawn from this?

Critical evaluation of a situation should build on this analysis by:

- Identifying assessment criteria.
- Judging efficiency.
- Judging effectiveness.
- Judging soundness of decisions made.
- Drawing recommendations.

Preparing a case study helps record the situation and grounds subsequent analysis. A series of headings derived from case studies described by Yin (2003) and

Tellis (1997) provides a template for analysing projects:

- Context - background and environment.
- Summary of project and approach.
- Project aims, objectives and deliverables
- Project metrics; including budgets, expectations and drivers.
- Organisation; including roles, participants, structure, decision makers and stakeholders.
- Project timeline/schedule.
- Project and decision evidence.
- Outcomes for project and business
- Conclusions and recommendations.

4.4 The conclusion

Argument leads to a conclusion. Conclusions that have been derived using deductive research logic should confirm or refute the hypothesis or research problem; and summarise the key theory, main findings and supporting evidence. Inductive research on the other hand should conclude with the theory that has been produced, and summarise the supporting theory, findings and evidence. No new evidence or theory should be lead in the conclusions.

Writers should ensure the concluding section addresses the following questions:

- Do the conclusions answer the assignment, research aims and objectives, or the problem?
- Are the conclusions supported by argument and evidence?
- Is the writer's position clear?
- Are limitations clearly stipulated?

The product of the argument may be an opinion, a claim, a position, a proven hypothesis or even recommendations.

Claims may be classified as positive and normative (Talessi, 1999). Positive claims are descriptive and describe how things are through statements of causation, comparison, explanation, observation, prediction and relationship. Normative claims on the other hand judge the importance, morality or value of something, and describe how things ought to be or should have been.

Claims should not be unsupported, by the evidence led or by the argument. Students and even authors frequently make claims as to the applicability of their findings and theories; yet their evidence, subjects, context and even methods often cannot support such claims.

What is an opinion? According to Platts (2009), it is:

> *…the view-point or conclusion you come to after considering the evidence for or against a particular theory (analysis/explanation of events) and with reference to factual evidence or the logic structure of someone else's argument. Opinion in academic terms has to be demonstrated using evidence. The role of students is to select evidence which is appropriate and present it in such a way that any intelligent person could come to a similar conclusion (opinion).*

Recommendations are appropriate if the paper is aiming at improvement or change, or if the topic is a practical subject like project management. Recommendations should be practical, relevant to the topic of the paper, relate to the argument, and be supported by the theory and evidence.

4.5 Writing up

A well thought out critical analysis or evaluation will not persuade the reader if it is not communicated properly. A good argument with few limitations will fail to convince the reader if it is poorly written. Well-written papers improve communication, clearly reveal and lead the reader through the argument, ensure key points are conveyed in a timely, appropriate and convincing manner, and ensure the reader arrives at the intended conclusion.

A writing style guide will not be provided here. Rather, the aim is to offer guidance on how to write up critical thinking so as to optimise the intended effect. Common mistakes encountered whilst marking assignments suggest attention should be paid in particular to the following four areas:

Structure

Structure helps the argument to flow and to convince:

- Grouping of premises, claims and supporting evidence helps the reader to understand the argument and appreciate its validity.
- Use headings to group concepts, to signpost the route, and use the title to grasp and inform the reader.
- Use paragraph and sentence structure to lead the reader through the discussion (Gopen and Swan, 1990).
- Introduce the topic and problem in a way that engages and interests the reader. Readers need to understand the context of the work, and will want to enjoy reading it.
- Make sure the paper reflects the topic, logic, argument and methods used. Choose the

appropriate research logic, analytical stance and critical thinking strategy. Do not blindly apply a template structure if that is not appropriate.

Terminology

Writers can use terminology, jargon, obscure language and even convoluted grammar in a way that makes reading difficult and alienates the reader.

- Readers should not feel inferior for not understanding what should be a comprehensible subject (Gopen and Swan, 1990).
- Defining ambiguous, vague or disputed terminology is a good habit for academic authors to get into. Definitions inform readers who are new to the subject, confirm the writer's knowledge of the subject, and establish what perspective the writer has chosen to adopt.
- Illustrating terminology through using examples reveals an ability to relate and apply theory and concepts to real world situations.

Language style

Style of language can subtly affect the readability of the writing and influence the attitude of the reader.

- Don't use forceful or emotive language to persuade. Logic, argument and evidence should be used instead.
- Use eloquent language to make reading enjoyable. Dry points may be technically correct, but can make progress difficult and boring. Difficult passages detract from the reader's ability to follow the argument.
- Care should be taken over use of pronouns like 'this,' 'that', 'it' etc. Opening a paragraph by saying "*This…*" forces the reader to retrace steps to remember what the writer is talking about.
- Excessive quotes demonstrate laziness to reword or interpret. Quotes should be context related, relevant and illustrative.
- Improving one's general literacy, diction and grammar will improve understanding and help articulate arguments.
- Writers who are familiar with the terminology, abbreviations, discourse and theoretical positions of the field being studied are better able to understand and correctly interpret literature.
- Writers can make their work unnecessarily incomprehensible through the use of jargon, subject specific language and excessively obscure or uncommon diction. Writers should demonstrate they know the language of the field, and find a balance between writing for a specific audience and writing in a manner that is accessible to a wider audience.

Writing as thinking

Many people construct and document arguments whilst writing. Writing as a way of thinking does not work well at the macro/strategy level or during the conceptualisation stages. Writing should begin once the core of the argument has been established.

Critical thinking and writing in an unfamiliar language can be difficult. Concentration and train of thought can be disturbed by translation and difficulties in properly expressing oneself. The strategy of writing the paper in a home language and then translating it can be tiresome, and isn't optimal in the long term.

Experience with foreign students suggests critical thinking in all cases should begin with gathering the knowledge, then structuring thoughts before articulating them in writing. Useful techniques include argument mapping (Twardy, 2004) and mind mapping (Buzan, 2000). A suggested process is to:

- Build a mind map or model of the problem, its components and relationships, and the relevant theory and literature. This allows the writer to conceptualise the various elements, gain an understanding of their relationships and the dynamics of the situation, and to quickly identify and remember all the concepts and issues to be discussed.
- Then build an argument map so as to structure the discussion into clear paragraphs and sections. This will keep the thinking critical and on track.
- Identify positions and potential conclusions. This will keep the discussion focused.
- Begin writing, with frequent reference to the argument map as a guide.

5 Conclusion

This paper considers critical thinking from the perspective of a student or novice authors wishing to think and write more critically. Critical thinking has been shown to be a complex activity that entails adopting a mindset and applying a range of skills. It is practically inseparable from arguments, logic, evidence, analysis and the process of writing. Critical thinking can be learnt through a process of observing, analysing, reconstructing and communicating. These processes have been described in this paper, and a number of references provided for further reading.

6 References

Beyer, B. (1987), *Practical strategies for the teaching of thinking*, Allyn and Bacon, Boston

Browne, M. and Keeley, S. (2001), *Asking the right questions: a guide to critical thinking*, Prentice-Hall, Upper Saddle River, N.J.

Buzan, T. (2000) *The Mind Map Book*, Penguin Books

Clark, D.R. (2008), *Critical Reflection*, Big Dog and Little Dog, available online at http://www.skagitwatershed.org/~donclark/hrd/development/reflection.html

Facione, P.A. (1998), *Critical Thinking: What It Is and Why It Counts*, California Academy Press

Fisher, A. (2001), *Critical Thinking: An introduction*, Cambridge University Press

Gopen, G.D. and Swan, J.A. (1990) "The Science of Scientific Writing", *American Scientist*, Vol. 78, pp. 550-558

Hargreaves, M.H. and Grenfell, A.T. (2003), "The Use of Assessment Strategies to Develop Critical Thinking Skills in Science", *ATN Evaluations and Assessment Conference*, Hilton Hotel, Adelaide, 24 - 25 November, available online at http://www.unisa.edu.au/evaluations/Full-papers/HargreavesFull.doc

Johnson, R. H. (1992) "The problem of defining critical thinking", in Norris, S.P. (Ed.) *The generalizability of critical thinking* (pp. 38-53), Teachers College Press, New York

Kutieleh, S. and Egege, Y.S. (2004) "Critical thinking and International students: A marriage of necessity", *First Year in Higher Education 2004 Conference*: Dealing With Diversity

Paul, R. (1990). *Critical Thinking: What Every Person Needs to Survive in a Rapidly Changing World,* Center for Critical Thinking and Moral Critique, Rohnert Park, California

Platts, M. (2009) "Critical Analysis, Argument and Opinion", University of Sussex website, available online at http://www.sussex.ac.uk/languages/1-6-8-2-3.html

Rice, G. (2004) Critical reading, thinking and writing

Scriven, M. and Paul, R. (1996) "Defining Critical Thinking", A draft statement prepared for the *National Council for Excellence in Critical Thinking and Instruction*, available on-line at http://www.criticalthinking.org/University/defining.html

Talessi (1999) Teaching and Learning Resources, The Talessi Project, University of Greenwich, available online at http://w3.gre.ac.uk/~bj61/talessi/

Tellis, W. (1997), "Introduction to Case Study", *The Qualitative Report*, Vol. 3, No.2, July, available online at http://www.nova.edu/ssss/QR/QR3-2/tellis1.html

Twardy, C.R. (2004) "Argument Maps Improve Critical Thinking", *Teaching Philosophy*, Vol. 27 No. 2, June

Varaki, B.S. (2006), "A Reflection on Three Web-Based Teaching Critical Thinking: Toward A Compromise Approach", *Journal of Faculty of Educational Sciences*, Vol. 39 No. 2, pp. 177-191

Vuorimaa, P. (2005) "How to conduct scientific research", *Research Seminar on Digital Media*, Helsinki University, February

Wallace W.L. (1969), *Sociological Theory*, Aldine, Chicago

Windschuttle, K. and Eliot, E. (1999), *Writing, researching, communicating: communication skills for the information age*, 3rd ed., McGraw-Hill, Sydney

Yin, R.K. (2003), *Case Study Research, Design and Methods*, 3rd ed. Sage, Newbury Park

7 Bibliography

Bradbeer, J. (2000) "Academic Writing: Tips for Students", Miscellaneous Paper No. 4, *Integrating People and Technology Project*, University of Portsmouth

Carr, N. (2008), "What the Internet is doing to our brains", *Atlantic Monthly*, July/August

Chalmers, A. (1988) *What is this Thing called Science?* 2nd ed. Open University Press, Milton Keynes

Chalupa, M. and Sormunen, C. (1995) "You Make the Difference in the Classroom: Strategies for Developing Critical Thinking", *Business Education Forum*, February, pp. 41-43

Cottrell, S. (2005) *Critical Thinking Skills: Developing Effective Analysis and Argument*, Palgrave Study Guides

Creme, P and Lea, M (1997), *Writing at University: A Guide for Students*, Open University Press

Dix, A. (2006), "Writing as third order experience", *Interfaces*, Autumn , Vol. 68, pp. 19-20, available online at http://www.hcibook.com/alan/papers/writing-third-order-2006/

Fairburn, G. and Winch, C. (1996), *Reading, Writing and Reasoning: A Guide for Students*, SRHE and Open University Press

Gee, J.P. (2000), "Discourse and sociocultural studies in reading", *Reading Online*, Vol. 4 No. 3, available online at http://www.readingonline.org/articles/art_index.asp?HREF=/articles/handbook/gee/index.html

Grinols, A.B. (1988) *Critical Thinking: Reading and Writing Across the Curriculum*, Wadsworth

Jones, P., Merritt, Q. and Palmer, C. (1999) "Critical thinking and interdisciplinarity in environmental higher education: the case for epistemological and values awareness", *Journal of Geography in Higher Education*, Vol. 23 No. 3, pp. 349-357

Kuhn, T. (1962) *The Structure of Scientific Revolutions*, University of Chicago Press

Maker, J. and Lenier, M. (1996) *Academic Reading with Active Critical Thinking,* Wadsworth

Northedge, A. (1990) *The Good Study Guide,* Open University Press

Northedge, A., Thomas, J., Land, A. and Peasgood, A. (1997) *The Sciences Good Study Guide*, Open University Press, Milton Keynes

Ruggiero, Vincent Ryan (1999) *Becoming a Critical Thinker*, 3rd edition, Houghton Mifflin

Thoms, K.J. (n.d.)"Critical Thinking Requires Critical Questioning", http://faculty.valenciacc.edu/development2/curriculumSecure/critical/V10N7.htm

Thomson, A. (1996) *Critical Reasoning: A Practical Introduction*

Thomson, A. (1998) *Critical Reasoning in Ethics: A Practical Introduction*

Useful web sites:

http://www2.selu.edu/Academics/Faculty/elejeune/critique.htm
http://lrc.sierra.cc.ca.us/writingcenter/litcrit.htm
http://www.deakin.edu.au/current-students/study-support/study-skills/handouts/critical-analysis.php
http://www.open.ac.uk/skillsforstudy/critical-thinking.php, 2008