

**ΕΘΝΙΚΟ ΚΑΙ ΚΑΠΟΔΙΣΤΡΙΑΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ**  
**ΤΜΗΜΑ ΓΕΩΛΟΓΙΑΣ ΚΑΙ ΓΕΩΠΕΡΙΒΑΛΛΟΝΤΟΣ**

**ΠΜΣ ΕΠΙΣΤΗΜΕΣ ΓΗΣ ΚΑΙ ΠΕΡΙΒΑΛΛΟΝ**

*Ειδίκευση "Ορυκτοί Πόροι - Πετρολογία και Διαχείριση Περιβάλλοντος"*

**"ΟΠΠ-Ε08 ΜΕΘΟΔΟΛΟΓΙΑ ΕΡΕΥΝΑΣ ΚΑΙ ΣΥΝΤΑΞΗ**  
**ΕΠΙΣΤΗΜΟΝΙΚΩΝ ΚΕΙΜΕΝΩΝ"**

**ΔΙΑΛΕΞΗ 4**

**"Critical Thinking"**

**ΚΑΘΗΓΗΤΗΣ ΣΤΕΦΑΝΟΣ ΚΙΛΙΑΣ**  
**2021**

# Aims and background

The aims of this session are to:

- To emphasise the importance of critical thinking in a Newcastle Masters course, and show you what examiners of project dissertations are looking for
- To introduce you to the different elements of critical thinking
- To allow you an opportunity to practice each of these critical thinking skills
- To allow you an opportunity to construct logical arguments and have them tested and challenged by others

# What is a research dissertation? What isn't it?

- A research dissertation is not a diary and a successful thesis or practical write up needs to record more than what you did and what was found
- To be successful you need to demonstrate that you can think critically
- You will need to show that you can take the data that you have generated, and your knowledge of the relevant literature, and process this data in order that you can extract underlying meanings and synthesise new concepts, models or ideas that you can evaluate for validity using established disciplinary criteria

# Who says so? The examiners.

*“More critical analysis in terms of usefulness, usability and what the findings and general design principles and guidelines might be.”*

*“Also, in each of the case studies the discussion section should be renamed discussion and reflection, and the opportunity should be taken to discuss and reflect on what the experimental results mean.”*

*“whether the hypothesis has been supported or disconfirmed and what the significance of the implications of the results.... are”*

# Who says so? The examiners.

*“This is below the standard that I would expect for a thesis from a university with NKUA’s reputation. It is almost entirely lacking critical analysis. The discussion consists mainly of commenting on the relative size of values with no consideration as to why or their significance.”*

*“No argument is provided to support the statement that the concept is new, indeed, to the contrary, it is stated that the concept already exists.”*

*“There appear to be a number of paragraphs quoted almost verbatim from online sources, with limited added value in the form of the candidate’s own critical thinking.”*

# Introducing questions, problems and limitations (theory)

- A serious weakness with this argument, however, is that .....
- One of the limitations with this explanation is that it does not explain why... .
- One criticism of much of the literature on X is that .....
- The existing accounts fail to resolve the contradiction between X and Y.
- However, there is an inconsistency with this argument.
- Smith's argument relies too heavily on qualitative analysis of .....
- X's analysis does not take account of ..... nor does he examine

# Introducing questions, problems and limitations (method/practice)

- Perhaps the most serious disadvantage of this method is that .....
- One major drawback of this approach is that .....
- The main limitation of biosynthetic incorporation, however, is .....
- However, this method of analysis has a number of limitations.
- All the studies reviewed so far, however, suffer from the fact that .....
- However, one of the problems with the instrument the researchers used to measure X was .....

# Highlighting inadequacies of previous studies

- Most studies in the field of X have only focussed on .....
- Most studies in X have only been carried out in a small number of areas.
- The experimental data are rather controversial, and there is no general agreement about .....
- The existing accounts fail to resolve the contradiction between X and Y.
- Although extensive research has been carried out on X, no single study exists which adequately covers .....



# Five elements of critical thinking

In this lecture and group work, we will break down critical thinking into five discrete elements. I have taken these from the Watson Glaser critical thinking appraisal. This tests the following five aspects of critical thought:

- Inference
- Interpretation
- Deduction
- Recognition of assumptions
- Evaluation of arguments

# Inference

Inference is the ability to draw conclusions from facts (observed or supposed).

- These facts might be ones that you have drawn from the literature or they may be the outcomes of experiments that you have performed
- Sometimes, when making inferences, you will need to bridge a gap in the facts using commonly accepted knowledge (common sense?)
- In your thesis and essays, you will certainly want to use inference in the discussion, but possibly much earlier, when outlining your research question

# Inference

*“At university visit days, tuition fees and employment prospects are the main topic of discussion, since these are topics that students usually raise”*

Are these inferences true or false (and to what extent?)

1. Most students are aware of the recent introduction of university fees
2. Most students drive to the visit day rather than take the train
3. Most time on visit days is spent talking about university accommodation

# Interpretation

Interpretation might be called the ability to draw conclusions which are logical, and likely beyond all reasonable doubt, from existing information

- In your thesis, skills in interpretation would be used in the literature study
- They might be used when framing the research question
- And when interpreting your own data, and integrating these data with the work of others to identify the outcomes of your PhD work

# Interpretation

*“Average salary increases from £20,000 at age 25 to £40,000 at age 50”*

Which conclusion likely follows this statement beyond all reasonable doubt?

1. Employees usually earn more as they get older
2. The salary of male workers increases more quickly than that of female workers

# Deduction

Deduction is a reasoning(αιτιολογία, λογική, συλλογισμός) skill which allows you to construct and/or evaluate arguments.

- It assesses whether a statement necessarily follows preceding statements (premises-προϋποθέσεις) on which it is based
- An argument is valid if it does necessarily follow the premises and it is invalid if it doesn't
- Of course, the premises might be untrue!
- In the thesis, you will want to use deduction in the discussion and to develop conclusions. You might also use it early on to identify the research question

# Deduction

*“Dogs chase cats. Cats chase mice. Therefore:”*

Which statements are true?

1. Dogs don't chase mice
2. Cats run from dogs
3. Cats chase rabbits

# Recognition of assumptions (υποθέσεις)

An assumption is present when something is taken for granted i.e. it is accepted as true even in the absence of supporting fact.

- Recognising the assumptions will allow you to make judgements regarding the robustness of arguments
- In your thesis, recognising assumptions that others have made will allow you develop a critical view of the work that you have read (literature review; context)
- Recognising assumptions in your own arguments (discussion; conclusions) is also Valuable and something that examiners might explore



# Recognition of assumptions

*“The house I’m looking for is on Dixon Street. I’m standing in Dixon Street so the house can’t be far away”*

- Assumption 1
- Assumption 2
- Assumption 3
- Assumption 4
- .....

# Evaluation of arguments

The previous elements have looked at skills of logic, integrated with some common sense. However, a logically correct argument is not always the same as an important one.

- A strong argument must be important, and directly related to the question
- If the argument is not directly related to the question, or is of only minor importance, then the argument is weak
- You will consider the strength of arguments when weighing up conflicting information and, of course, when challenged in the viva

# Evaluation of arguments

*“Should the North East of England have its own regional government?”* Which are the weak and strong arguments?

1. Yes, because people in the North East are more passionate about football
2. Yes, because economic policy in the UK is driven by the needs of the South East and this results in additional poverty and unemployment in the north
3. No, because regional government in Scotland has resulted in a call for independence

# Critical thinking 'stairway'

## (Open University)

**Process** - Take in the information (i.e. in what you have read or done).

**Understand** - Comprehend the key points, assumptions, arguments and evidence presented.

**Analyse** - Examine how these key components fit together and relate to each other.

**Compare** - Explore the similarities, differences between the ideas

**Synthesise** - Bring together different sources of information to serve an argument or idea you are constructing. Make logical connections between the different sources that help you shape and support your ideas.

**Evaluate** - Assess the worth of an idea in terms of its relevance to your needs, the evidence on which it is based and how it relates to other pertinent ideas.

**Apply** - Transfer the understanding you have gained from your critical evaluation

**Justify** - Use critical thinking to develop arguments, draw conclusions, make inferences and identify implications.

# INFERENCE STATEMENT 1

1. Probably True ( because, as is common knowledge, most people in their early teens do not show so much serious concern with broad social problems. It cannot be considered definitely true from the facts given because these facts do not tell how much concern other young teenagers may have. It is also possible that some of the students volunteered to attend mainly because they wanted a weekend outing.)
2. Probably False (because the students' growing awareness of these topics probably stemmed at least in part from discussions with teachers and classmates.)

# INFERENCE STATEMENT 1

3. Insufficient Data (because there is no evidence for this inference.)
4. False (because it is given in the statement of facts that the topics of race relations and means of achieving world peace were the problems chosen for discussion).
5. True (because this inference follows from the given facts; therefore it is true.)

# INFERENCE STATEMENT 2

1. Insufficient Data
2. Probably True
3. True
4. False

# INTERPRETATION STATEMENT 1

1. YES, the conclusion follows beyond a reasonable doubt since, according to the statement, the size of the spoken vocabulary at eight months was 0 words.
2. NO, the conclusion does not follow as there is no information given that relates growth of vocabulary to walking.



# INTERPRETATION STATEMENT 2

- Interpretation 1: YES
- Interpretation 2: NO
- Interpretation 3: YES

# DEDUCTION STATEMENT 1

- 1 NO, the conclusion does not follow. You cannot tell from the statements whether or not clear days are boring. Some may be.
2. YES, the conclusion necessarily follows from the statements as, according to them, the rainy holidays must be boring.
3. NO, the conclusion does not follow, even though you may know that some holidays are very pleasant.

# DEDUCTION STATEMENT 2

- Deduction 1: YES
- Deduction 2: NO
- Deduction 3: YES

# ASSUMPTIONS STATEMENT 1

1. YES, it is assumed in the statement that the greater speed of a plane over the speeds of other means of transportation will enable the group to reach its destination in less time.
2. YES, this is necessarily assumed in the statement as, in order to save time by plane, it must be possible to go by plane.
3. NO, this assumption is not made in the statement – the statement has to do with saving time, and says nothing about convenience or about any other specific mode of travel.



# ASSUMPTIONS STATEMENT 2

- Assumption 1: NO
- Assumption 2: NO
- Assumption 3: YES
- Assumption 4: NO

# EVALUATION STATEMENT 1

1. WEAK, this would be a silly reason for spending years in college.
2. STRONG. If it is true, as the directions require us to assume, it is a weighty argument against all young people going to college.
3. WEAK, this argument, although of great general importance when accepted as true, is not directly related to the question, because attendance at college does not necessarily require excessive studying.



# EVALUATION STATEMENT 2

- Argument 1: Strong
- Argument 2: Strong
- Argument 3: Weak