ATHK1001 Analytical Thinking

Unit of Study Code: ATHK1001

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Format of Unit: 3 x 1 hour lectures/week x 13 weeks  
Tuesday 9am, Thursday 12pm in Eastern Avenue Auditorium  
Wednesday 9am in Wallace Theatre  
1 x 1 hour tutorial for 13 weeks

Credit Point Value: 6 Credit Points

Prerequisites: None

Assessment: Classwork:

- Assignment 1 (15% of the total mark) 750 word assignment  
  Due Date: Week 5, Friday 12th April 4pm (online submission)

- Assignment 2 (20% of the total mark) 1000 word assignment  
  Due Date: Week 9, Friday 10th May 4pm (online submission)

- Mastery quizzes (10% of the total mark): Every two weeks an on-line mastery quiz will be made available. Each quiz is worth 2% and can be done as often as you like. Your final score for the quiz is your best score. Only your five best quizzes count towards the 10% total. The primary goal of these quizzes is to encourage you to engage continuously with the lecture and tutorial material.

- Tutorial participation (5% of the total mark)  
  You must attend 90% or more of your tutorial classes to obtain any part of this 5% else you will receive 0 for this part of the assessment. NB: IT IS YOUR RESPONSIBILITY TO ATTEND THE TUTORIAL YOU ARE ENROLLED IN TO BE MARKED AS PRESENT.

Final Examination (50% of the total mark):  
Multiple choice questions for Data Concepts and Analysis (30%), multiple choice questions for Thinking Tools (40%), and short-answer questions for Logic and Critical Reasoning (30%)

Out of class prescribed student workload: Extra practice exercises associated with lectures and tutorials as will be assigned and working towards assessment tasks

NB You should read the general administrative guidelines for submission of written work, penalties for late work, assessment criteria, procedures for applying for extensions and special consideration on the School of Psychology web page (www.psych.usyd.edu.au).
Unit of study general description:
Analytical Thinking is a course covering aspects of reasoning, logic, data handling, research design, interpretation of data analysis, and understanding of relationships between variables. It is comprised of three sections: Data Concepts and Analysis, Logic and Critical Reasoning, and Thinking Tools. The section on data concepts and analysis covers aspects of research design, data collection, literature review and basic forms of hypothesis testing are statistical tests are introduced. The logic and critical reasoning section covers material ranging from valid and invalid forms of argument and errors in reasoning to critiques of arguments presented in case studies. The thinking tools section looks at the errors people make in reasoning, decision making and problem solving and how to avoid these errors. Together, the three course components teach foundational skills necessary for carrying out meaningful academic discussions, arguments, and research studies, which may be applied to any content area of scientific enquiry.

Graduate Attributes and Student Learning Outcomes for Analytic Thinking
Graduate attributes are generic skills that encompass not only technical knowledge but additional qualities that will equip students to be strong contributing members of professional and social communities in their future careers. The overarching graduate attributes identified by the University relate to a graduate’s attitude or stance towards knowledge, towards the world, and towards themselves. These are understood as a combination of five overlapping skills or abilities, the foundations of which are developed as part of specific disciplinary study.

1: Research and Inquiry
Graduates of the University will be able to identify and analyse problems, and be both creative and principled thinkers within their discipline.

Student learning outcomes for Analytical Thinking:
(i) Demonstrate the ability to critique the arguments of others.
(ii) Exercise logic and reasoning in the formation of arguments.
(iii) Understand and evaluate the quality of data based on its sources and the manner in which it was obtained.
(iv) Identify the best way of approaching the exploration of a research question.
(v) Identify errors in thinking and how to overcome them.

2: Information Literacy
Graduates of the University will be able to use information effectively in a range of contexts.

Student learning outcomes for Analytical Thinking:
(i) Demonstrate an understanding of different types of variables and the ways in which they can be used.
(ii) Demonstrate the ability to identify premises of arguments and evaluate these.
(iii) Understand potential sources of bias in information.
(iv) Understand the limitations of a source of information and incorporate this into the way in which that information is used.

3: Personal and Intellectual Autonomy
Graduates of the University will be able to work independently and sustain an attitude of openness and capacity to meet new challenges.

Student learning outcomes for Analytical Thinking:
(i) Demonstrate an active participation in debate and discussion.
(ii) Demonstrate the ability to work independently and as a member of a group of students.
(iii) Show a willingness to engage with and respond to unfamiliar problems.
(iv) Demonstrate the ability to regulate learning independently by using course resources appropriately.
(v) Demonstrate the ability to autonomously direct inquiry for the purpose of answering an empirical question.
4: Ethical, Social and Professional Understanding
Graduates of the University will hold personal values and beliefs consistent with their role as responsible members of local, national, international and professional communities.

**Student learning outcomes for Analytical Thinking:**
(i) Recognise the ethical requirements of academic research and discourse.
(ii) Respect and support the practice of sound data collection and analysis.
(iii) Respect and uphold the value of diversity in opinions and beliefs.
(iv) Uphold the value of honesty, transparency, and rigour in all academic pursuits.

5: Communication Skills
Graduates of the University will use and value communication for negotiating, creating new understanding, interacting with others, and furthering their own learning.

**Student learning outcomes for Analytical Thinking:**
(i) Active participation in tutorials

**Evidence of learning**

*Data Concepts and Analysis*
Assessment will take the form of a 750 word assignment, which will focus on research skills. It will be based on skills taught in lectures and tutorials in the first third of the course. 30% of the final examination will further assess knowledge of lecture and tutorial material.

*Logic and Critical Reasoning*
This section will be assessed via a 1000 word assignment requiring students to apply critical reasoning skills and demonstrate mastery of these. 30% of the final examination will further assess knowledge of lecture and tutorial material.

*Thinking skills*
40% of the final examination will assess knowledge of lecture and tutorial material from this section.
**Data Concepts and Management**

**Structure of academic inquiry**
Introduction to the general process of investigation, be it theoretical or empirical. Understanding research questions and the types of empirical studies to which these may lead. Learning to pose good research questions and to design studies addressing them. Introduction to research ethics.

**Sources of data**
Understanding of the ways in which bias may be introduced into data. Introduction to the concepts of validity of interpretations and conclusions. Introduction to types of error and best practice for managing these.

**Numerical and graphical summaries**
Introduction to basic types of variables and basic numerical summaries of central tendency and variability.

**Hypotheses and Statistical testing**
Introduction to null and alternative hypotheses for research. Introduction to the overarching process of hypothesis testing. Brief coverage of research design and how this draws together aspects of research questions, hypotheses, testing, and analysis procedures. Introduction to the general form of a statistical test.

**Logic and Critical Reasoning**

**Elements of argument**
Introduction to the structure of arguments and explanations. Identifying deductive validity and soundness. The role of meaning and definition in argument.

**Non-Deductive Argument**
Induction and inductive scepticism. Distinguishing causation from correlation. Reasoning with conditional probabilities.

**Case Studies**

**Thinking Tools**

**Reasoning, decision making and problem solving**
Introduction to what research into thinking tells us about the errors in reasoning, how to be better decision makers and how to approach new problems.

**Effective learning**
Applying what we know about memory and skill acquisition to formulate principles for how people learn most effectively.

**Big data**
A brief exploration of how analysis of large data sets may be used to over-turn conventional wisdom.
# TIMETABLE

<table>
<thead>
<tr>
<th>WEEK (begin)</th>
<th>LECTURES</th>
<th>TUTORIALS</th>
<th>Due dates</th>
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| 1 (4/3)      | 1. Illusions of thinking  
2. Telling stories in Science  
3. Finding relevant information | Tutorial 1: Orientation | |
| 2 (11/3)     | 4. Trustworthy data  
5. Bias & error  
6. Sampling | Tutorial 2: Working with published research data | Quiz 1 due by 4pm 11/3 |
| 3 (18/3)     | 7. Quantitative data  
8. Study types  
9. Research design | Tutorial 3: Bias and error | |
| 4 (25/3)     | 10. Analysing means  
11. Analysing categorical data  
12. Correlational data | Tutorial 4: Summarizing and presenting data | Quiz 2 due by 4pm 25/3 |
| (1/4) NON-TEACHING WEEK | | | |
| 5 (8/4)      | 13. Arguments and Explanations  
14. Conditionals and Counterexamples  
15. Deduction, Validity and Soundness | Tutorial 5: Statistical tests | Assignment 1 due 4pm 12/4 |
| 6 (15/4)     | 16. Bi-conditionals & Definition  
17. Induction & Inductive Scepticism  
18. Abductive Arguments | Tutorial 6: Arguments, Conditionals, Deduction | Quiz 3 due by 4pm 15/4 |
| 7 (22/4)     | 19. Fallacies  
20. More Fallacies  
*No Thursday lecture – Public Holiday* | Tutorial 7: Definitions, Induction | |
| 8 (29/4)     | 21. Causal Explanations  
22. Science & Pseudo-Science  
23. Probabilistic Reasoning | Tutorial 8: Fallacies | Quiz 4 due by 4pm 29/4 |
| 9 (6/5)      | 24. Reasoning, the good the bad and the ugly  
25. Reasoning errors  
| 10 (13/5)    | 27. Making sound decisions  
28. Heuristics and biases  
29. Avoiding fallacies | Tutorial 10: Paradoxes | Quiz 5 due by 4pm 13/5 |
| 11 (20/5)    | 30. Problem solving skills  
31. Analogies  
32. Creativity | Tutorial 11: Heuristics | |
| 12 (27/5)    | 33. Effective learning 1  
34. Effective learning 2  
35. Effective learning 3 | Tutorial 12: Implicit learning | Quiz 6 due by 4pm 27/5 |
| 13 (3/6)     | 36. Big data 1  
37. Big data 2  
38. Revision & exam preparation | Tutorial 13: Learning and memory | Quiz 7 due by 4pm 7/6 |
Academic Dishonesty and Plagiarism

1. It is your responsibility to know what academic dishonesty and plagiarism are. Here is the link to the University's policy:


   Make sure that you understand what counts as academic dishonesty and the various types of plagiarism. The Library’s [http://www.library.usyd.edu.au/skills/ ‘Plagiarism and Academic Honesty’ program will help.](http://www.library.usyd.edu.au/skills/)

2. Note that:

   i) the School of Psychology will penalise **all** submitted work that is plagiarised.

   ii) Students should note that all assignments (including group projects) will be run through similarity detecting software. This software detects similarities between (a) your assignment and both print and online sources, and (b) assignments submitted by other students, from both current and previous years. If similarities are found, they will be investigated so as to determine the nature of the plagiarism. See Part 5 of the University's policy.

Avoiding plagiarism – key points

- Plagiarism is a serious offence and may result in failure in the course. Even where students are completing an exercise together, each student must submit separate written work. Incorporation of any material from another student’s assignment is regarded as plagiarism.

- In writing essays or reports to meet coursework requirements, you should use your own words. In some contexts (e.g., theoretical research) it is appropriate to use an occasional quotation. This should be indicated in the conventional way by enclosing the passage within quotation marks and by providing a precise (page number) reference for the source of the quote. In many contexts, especially reports of empirical work, quotations are best avoided.

- “Using your own words” means that you should **not** borrow from the writing of others – whether from fellow students or published authors. For example, it is not acceptable to base an essay on text from various sources that you have then edited to some degree – even if you cite these sources. First of all, there is the ethical issue arising from the dishonesty of presenting as your own work something which is essentially the work of others. In addition, there are good educational reasons for avoiding this, even where you feel that someone else has expressed some idea far more clearly than you could. One reason is that you must learn to express yourself clearly in writing; like most other skills, this only comes with practice. Another, is the failure to understand information or ideas at all thoroughly if all you have done is reproduce (with some editing) what someone else has written about the topic.

- When you express in your own words what you have learned from various sources, you should cite each source. The standard convention for most written work in psychology is to list references at the end of your essay or report, rather than, for example, to use footnotes. To express some idea without giving a citation implies that it is your own idea. Therefore, if it is in fact an idea obtained from someone else, this needs to be acknowledged. Listing a set of sources implies that you have read them all. Therefore, you should list as references only those you have actually read. If you are depending on a secondary source, then make this clear, e.g., ... salivary conditioning (Pavlov, 1927; cited in Mazur, 1998).

- The points made here also apply to non-textual material. For example, graphs or tables of data included in a report should be your own work and not copied from others. Very occasionally you may need to ‘quote’ a figure from some other source; if you do so, you should make its origin quite clear.
• In general, avoid letting other students use your work for any kind of assessment. On the rare occasion where this may be appropriate, make sure that the other student acknowledges your contribution as the original author.

• In some cultures, students show their respect for a teacher by copying what the teacher has said or written. In Australian University education, copying a teacher (even if paraphrasing) is plagiarism if the source is not cited.

Special consideration (e.g., for health issues)

If your study is affected by factors such as health you may request special consideration. All requests from ATHK1001 students should be submitted to the Faculty of Science. Information and procedures can be found on the Faculty of Science Webpages, in particular: