UNSW AUSTRALIA | Arts & Social Sciences

School of Education

EDST5303
Learning, Problem Solving, and the Development of Expertise

Semester 2

Contents

IMPORTANT :
For student policies and procedures relating to assessment, attendance and student support, please see website, https://education.arts.unsw.edu.au/students/courses/course-outlines/

The School of Education acknowledges the Bedegal and Gadigal people as the traditional custodians of the lands upon which we learn and teach.

1. LOCATION

Faculty of Arts and Social Sciences
School of Education
EDST5303 Learning, problem solving, and the development of expertise (6 units of credit)
Semester 2, 2016

2. STAFF CONTACT DETAILS

Course Coordinator:	Professor Paul Ayres
Office Location:	Goodsell Building 101
Email:	p.ayres@unsw.edu.au
Phone:	9385 3545
Availability:	By appointment

3. COURSE DETAILS

Course Name	EDST5303 Learning, problem solving, and the development of expertise
Credit Points	6 units of credit (uoc)
Workload	Includes 150 hours including class contact hours, readings, class preparation, assessment, follow up activities, etc.
Schedule	Monday 26, Tuesday 27, Thursday 29, Friday 30 September 2016 John Goodsell LG21

Summary of Course

The major focus of this course is to examine how the cognitive structures are organised into a coherent architecture enabling humans to learn, think, reason and solve problems. The central role played by active learning in this architecture is emphasised. The course examines how expertise develops and how teaching strategies should be matched to individual needs to promote knowledge acquisition. An introduction to cognitive load theory is made, and a number of applications for the classroom and other educational environments are discussed.

Aims of the Course

- To examine the mental processes that underlie human thought
- To present a unified cognitive framework that explains how we learn, think, reason and solve problems.
- To discuss how human cognitive structures may have evolved
- To discuss the general implications of our understanding of human cognitive architecture for teaching and instruction

Student Learning Outcomes

Outcome		Assessment/s
1	Understand the concept of information processing	1,2,3
2	Understand the structure and workings of human memory Understand how knowledge is constructed and its relation with memory	1,2,3
3	Understand how expertise develops and differences between experts and novices	1,2,3
4	Understand the evolutionary basis for knowledge	2,3
5	Gain knowledge of the higher cognitive processes	1,2,3
6	Gain some knowledge of the implications of human cognitive architecture for teaching and instructional design.	1,2,3

Program Learning Outcomes

Standard		Assessment/s
1	**Advanced disciplinary knowledge and practices** Demonstrate an advanced understanding of the field of education as it relates to their specialist area of study, and the ability to synthesize and apply disciplinary principles and practices to new or complex environments.	1,2,3
2	**Enquiry-based learning** Demonstrate an in-depth understanding of research-based learning and the ability to plan, analyse, present implement and evaluate complex activities that contribute to advanced professional practice and/or intellectual scholarship in education.	1,2,3
3	**Cognitive skills and critical thinking** Demonstrate advanced critical thinking and problem solving skills	1,2,3
4	**Communication, adaptive and interactional skills** Communicate effectively to a range of audiences, and be capable of independent and collaborative enquiry and team-based leadership	2
5	**Global outlook** Demonstrate an understanding of international perspectives relevant to the educational field	1,2,3
6	**Ethics** Demonstrate an advanced capacity to recognise and negotiate the complex and often contested values and ethical practices that underlie education	3

4. RATIONALE FOR THE INCLUSION OF CONTENT AND TEACHING APPROACH

EDST5303 places a large emphasis on the role played by memory processes in effective learning and instruction. The teaching in this course is based on an active learning philosophy.

5. TEACHING STRATEGIES

Student-centered activities will form the basis of the course, which will draw on the prior knowledge of the students and allow engagement in relevant and challenging experiences. The lectures are designed to be supportive and friendly, and include meaningful realistic learning tasks, as well as promote independent and collaborative study, and enquiry.

Teaching strategies used during the course will include:

- small group learning to understand the importance of teamwork in an educational context and to demonstrate the use of group structures as appropriate to address teaching and learning goals;
- explicit teaching including lectures and a range of teaching strategies to foster interest and support learning;
- structured occasions for reflection on learning to allow students to reflect critically on issues discussed;
- extensive opportunities for whole group and small group dialogue and discussion, allowing students the opportunity to demonstrate their capacity to communicate

These activities will occur in a climate that is supportive and inclusive of all learners.

6. COURSE CONTENT AND STRUCTURE

Lecture	Date	Lecture Topic
1	26/9	Introduction to the course: Learning and instruction, human cognitive architecture
2		Information processing approach to human cognition. Introduction to CLT
3		Working memory
4	27/9	Long-term memory. The role of schema construction and automation in the development of expertise
5		The role of knowledge and expertise in problem solving performance, expert-novice differences and their role in problem solving behaviour
6		Expertise reversal effect, tailoring learning tasks to learner cognitive characteristics and goals
7	29/9	The evolutionary perspective on human cognitive architecture and its consequences for learning and instruction
8		Learning from collaboration, problem-based learning, instructional alternatives to problem solving
9		Learning from multimedia and animations (e-learning)
10	30/9	Strategies for effective learning and instruction.
11		**Student presentations**
12		**Student presentations**

7. RESOURCES

Required Readings

Textbook details: There are no set textbooks for this course, although the following will be frequently referred to:

Clark, R. Nguyen,F., & Sweller, J. (2006). *Efficiency in Learning*, San Francisco: John Wiley & Sons, Inc.

Mayer, R. E. (2008). *Learning and Instruction, 2nd edition*. New Jersey: Pearson

Sweller, J., Ayres, P. & Kalyuga, S. (2011). *Cognitive load theory*. New York: Springer.

Further Readings

Specific research articles are recommended for different lectures. Copies of the articles are provided on *Moodle*

Lectures 1 & 2

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.) (1999). How People Learn: Brain, Mind, Experience, and School. Washington, DC: National Academy Press http://www.nap.edu/openbook/0309065577/html/index.html **Chapter 2, pp,19-38**

Clark, R. Nguyen,F., & Sweller, J. (2006; Learning in Efficiency, San Francisco: John Wiley & sons, Inc. Ch. 2)

Guenther, R.K. (1998). Human Cognition. Upper Saddle River, NJ: Prentice Hall. **Chapter 1, pp. 11-21**

Mayer, R. E. (2008). *Learning and Instruction, 2nd edition*. New Jersey: Pearson Ed. (Chapter 1)

Mayer, R. (1992). Thinking, problem solving, cognition. New York: Freeman (**Chapter 8**)

Sweller, J. (1999). Instructional design in technical areas. Melbourne: ACER Press (Ch. 1 & 2)

Van Merriënboer, J. & Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. Educational Psychology Review, 17, 147-177.

Lectures 3-6

Baddeley, A.D. (1992). Working memory. *Science, 255*, 556-559.Sweller, J., van Merriënboer, J., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review, 10*, 251-296. (**pp.255-259**)

Miyake, A., & Shah, P. (Eds.). (1999). *Models of working memory: Mechanisms of active maintenance and executive control.* Cambridge, England: Cambridge University Press. (Introduction by Shah & Miyake)

Chi, M. T. H., Feltovich, P., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. *Cognitive science, 5,* 121-152.

Ericsson, K. A, & Staszewski, J. J. (1989). Skilled memory and expertise: Mechanisms of exceptional performance. In D. Klahr & K. Kotovsky (Eds.), *Complex information processing: The impact of Herbert A. Simon* (pp. 235-267). Hillsdale, NJ: Erlbaum.

Ericsson, K. A., & Charness, N. (1994). Expert performance: Its structure and acquisition. *American Psychologist, 49*, 725-747.

Kotovsky, K., Hayes, J. R., & Simon, H. A. (1985). Why are some problems hard? Evidence from Tower of Hanoi. *Cognitive Psychology, 17,* 248-294.

Atkinson, R. K., Derry, S. J., Renkl, A., & Wortham, D. (2000). Learning from examples: Instructional principles from the worked examples research. *Review of Educational Research, 70*, 181-214.

Renkl, A., Atkinson, R. K., & Groβe, C. S. (2004). How fading worked solution steps works—A cognitive load perspective. *Instructional Science, 32*, 59-82.

Kalyuga, S. (2007). Expertise reversal effect and its implications for learner-tailored instruction. *Educational Psychology Review, 19*, 509-539.

Lecture 7

Geary, D. (2002). Principles of evolutionary educational psychology. *Learning and Individual Differences, 12*, 317-345.

Geary, D. (2005). *The origin of mind: Evolution of brain, cognition, and general intelligence*. Washington, DC: American Psychological Association.

Sweller, J. (2003). Evolution of human cognitive architecture. In B. Ross (Ed.), *The Psychology of Learning and Motivation*, *Vol. 43* (pp.215-266). San Diego: Academic Press.

Sweller, J. (2004). Instructional design consequences of an analogy between evolution by natural selection and human cognitive architecture*. Instructional Science*, **32**, 9-31.

Lectures 8 & 9

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist, 41*, 75-86.

Hmelo-Silver, C.E., Duncan,R.G., & and Chinn, C.A. (2007). Scaffolding and Achievement in Problem-Based and Inquiry Learning: A Response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist, 42*, 99-107.

Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology, 93*, 187-198.

Moreno, R., & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology, 91*, 358-368.

Mayer, R. E., & Johnson, C. I. (2008). Revising the redundancy principle in multimedia learning. *Journal of Educational Psychology, 100*, 380-386.

van Gog, T., Paas, F., Marcus, N., Ayres, P., & Sweller, J. (2009). The Mirror-Neuron System and Observational Learning: Implications for the Effectiveness of Dynamic Visualizations. *Educational Psychology Review, 21*, 21-30*.*

Lecture 10

Lee H. S. & Anderson, J. R. (2013). Student learning: What has instruction got to do with it? Annual Review of Psychology.

Leahy, W., & Sweller, J. (2004). Cognitive Load and the Imagination Effect. *Applied Cognitive Psychology, 18*, 857-875.

Pollock, E., Chandler, P., & Sweller, J. (2002). Assimilating complex information. *Learning and Instruction, 12*, 61-86.

8. ASSESSMENT

Assessment Task	Length	Weight	Student Learning Outcomes Assessed	Program Learning Outcomes Assessed	Due Date
Task 1 Essay on memory processes	1,500 words	30%	1-3, 6	1-5	**August 22**
Task 2 Tutorial Presentation	10 minute presentation	20%	1-6	5-8	**September 30**
Task 3 Major Essay	2500 words	50%	1-6	1-8	**October 30**

Students are required to follow their lecturer's instructions when submitting their work for assessment. All assessment will be submitted online via Moodle by 5pm. Student no longer need to use a cover sheet. Students are also required to keep all drafts, original data and other evidence of the authenticity of the work for at least one year after examination. If an assessment is mislaid the student is responsible for providing a further copy. Please see the Student Policies and Procedures for information regarding submission, extensions, special consideration, late penalties and hurdle requirements etc.

Task 1: Minor Essay (1500 words). The following two articles were at the centre of a debate comparing the effectiveness of fully-guided instruction and problem-based (enquiry) learning.

a) Discuss some of the main issues involved in this debate
b) What are your conclusions?

Note: Include a further 10-20 (approximately) references of your own. Use evidence-based research sources rather than 'opinions'. Include some appropriate professional literature.

Key references

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist, 41*, 75-86.

Hmelo-Silver, C.E., Duncan,R.G., & and Chinn, C.A. (2007). Scaffolding and Achievement in Problem-Based and Inquiry Learning: A Response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist, 42*, 99-107.

Task 2: Seminar presentations *Students will be asked to prepare a 10-minute presentation on an application of the theory covered in this course using a short teaching episode of a topic (chosen by the student).*

A concise summary of the presentation should be provided (max 300 words)

Task 3: Major Essay *All students are required to complete a* 2500-word *essay based on the material covered in the course focusing on its application to specific individual teaching areas. The essay will consist of* ***an in-depth discussion of the theoretical and applied issues associated with a selected topic****. Possible essay topics will be discussed further in lectures.*

Feedback

Assessment Task	Feedback Mechanism	Feedback Date
One: Essay on memory processes	*Written*	**August 29**
Two: Tutorial presentation	*Written (feedback form only)*	**October 7**
Three: Major essay	*Written*	**November 7**

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FEEDBACK SHEET
EDST5303 LEARNING, PROBLEM SOLVING, AND THE DEVELOPMENT OF EXPERTISE

Student Name: Student No.:
Assessment Task: Minor Essay

SPECIFIC CRITERIA	(-) ➤ (+)				
Understanding of the question • understanding of the debate • clarity and accuracy in use of key terms underpinning this debate					
Depth of analysis and/or critique in response to the task • depth of analysis • depth of conclusions • Implications for teaching and learning					
Familiarity with and relevance of professional and research literature used to support response • range of research literature used to support response • use of evidence-based research sources •					
Structure and organisation of response • Level of structure and organisation of response					
Presentation of response according to appropriate academic and linguistic conventions • clarity, consistency and appropriateness of conventions for quoting, paraphrasing, attributing sources of information, and listing references • appropriateness of overall structure and coherence of response • clarity and consistency in presenting tables and diagrams • clarity and appropriateness of sentence structure, vocabulary use, spelling, punctuation and word length					
GENERAL COMMENTS/RECOMMENDATIONS FOR NEXT TIME					

Lecturer **Date**
Recommended: /20 (FL PS CR DN HD) **Weighting: 30%**

NB: The ticks in the various boxes are designed to provide feedback to students; they are not given equal weight in determining the recommended grade. Depending on the nature of the assessment task, lecturers may also contextualize and/or amend these specific criteria. **The recommended grade is tentative only, subject to standardisation processes and approval by the School of Education Learning and Teaching Committee.**

UNSW SCHOOL OF EDUCATION
FEEDBACK SHEET
EDST5303 LEARNING, PROBLEM SOLVING, AND THE DEVELOPMENT OF EXPERTISE

Student Name: Student No.:
Assessment Task: Tutorial Presentation

SPECIFIC CRITERIA	(-) ➤ (+)				
Understanding of the question or issue and the key concepts involved					
Depth of analysis and/or relevance of specific examples					
Familiarity with and relevance of literature used to prepare presentation					
Structure and organisation of presentation					
Quality of presentation (use of media, interaction with audience, etc.)					
GENERAL COMMENTS/RECOMMENDATIONS FOR NEXT TIME					

Lecturer **Date**
Recommended: /20 (FL PS CR DN HD) **Weighting: 20%**

NB: The ticks in the various boxes are designed to provide feedback to students; they are not given equal weight in determining the recommended grade. Depending on the nature of the assessment task, lecturers may also contextualize and/or amend these specific criteria. **The recommended grade is tentative only, subject to standardisation processes and approval by the School of Education Learning and Teaching Committee.**

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FEEDBACK SHEET
EDST5303 LEARNING, PROBLEM SOLVING, AND THE DEVELOPMENT OF EXPERTISE

Student Name: Student No.:
Assessment Task: Major Essay

SPECIFIC CRITERIA	(-) ➤ (+)				
Understanding of the question or issue and the key concepts involved • understanding of the topic and its relationship to relevant areas of the course • clarity and accuracy in use of key terms and concepts • suitability of the topic					
Depth of analysis and critique in response to the task • depth of analysis • depth of critique of the issue • depth of implications/recommendations for improvement of learning and instruction					
Familiarity with and relevance of professional and/or research literature used to support response • effectiveness of examples to demonstrate instructional implications • variety of implications demonstrated • range of relevant research literature to support response					
Structure and organisation of response • Level of structure and organisation of response					
Presentation of response according to appropriate academic and linguistic conventions • clarity, consistency and appropriateness of conventions for quoting, paraphrasing, attributing sources of information, and listing references • appropriateness of overall structure and coherence of response • clarity and consistency in presenting tables and figures • clarity and appropriateness of sentence structure, vocabulary use, spelling, punctuation and word length					
GENERAL COMMENTS/RECOMMENDATIONS FOR NEXT TIME					

Lecturer **Date**
Recommended: /20 (FL PS CR DN HD) **Weighting: 50%**

NB: The ticks in the various boxes are designed to provide feedback to students; they are not given equal weight in determining the recommended grade. Depending on the nature of the assessment task, lecturers may also contextualize and/or amend these specific criteria. **The recommended grade is tentative only, subject to standardisation processes and approval by the School of Education Learning and Teaching Committee.**