UNSW SYDNEY | Arts & Social Sciences

School of Education

EDST6784: Science and Technology

Year 1, 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 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
EDST6784 Science and Technology (6 units of credit)
Semester 2, 2018

2. STAFF CONTACT DETAILS

Course Coordinator: Firase Elmouhamed
Email address: education@unsw.edu.au

3. COURSE DETAILS

Course Name	Science and Technology
Credit Points	6 units of credit (uoc)
Workload	Includes 150 hours including class contact hours, readings, class preparation, assessment, follow up activities, etc.
Lecture	Tuesdays (330-5pm) Off-site

Summary of Course

This course entails understanding of the syllabus, curriculum planning, appropriate assessment strategies, classroom management and development/selection of activities and resources relevant to the teaching of science and technology in the primary school classroom. Students will engage in evaluation and selection/development/evaluation of activities and resources relevant to the teaching of science and technology in the primary (K-6) classroom.

Aims of the Course

The aim of the course is to develop understandings of the nature of science and technology, key concepts, and the teaching of science and technology across years K-6. In order to focus on core skills of Working Scientifically and Working Technologically, students will develop competence and confidence in planning relevant learning experiences which take into account the pedagogies of science and technology and the needs of diverse learners. The course will examine scientific understandings and advances, as well as the technologies enabling rapid developments in understanding. Teaching the cross-curriculum priority of sustainability will be explored, in conjunction with the content strands of Natural Environment and Made Environment along with the capabilities of ICT, ethical understanding and critical and creative thinking.

Important Information

Assessment: Students must pass ALL assignments in order to pass the course. Only by passing all assignments and Hurdle Requirements can the Graduate Attributes (AITSL Professional Graduate Teaching Standards) be achieved.

Attendance: Students are expected to give priority to university study commitments. Unless specific and formal permission has been granted, failure to attend 80% of classes in a course may result in failure.

Student Learning Outcomes

Outcome		Assessment/s
1	Demonstrate awareness and understanding of appropriate ways to harness children's natural curiosities and their sense of wonder, and develop interest and enthusiasm for science and technology.	1, 2
2	Demonstrate how the skills, knowledge and understanding of syllabus documents relate across strands and sub-strands for all Stages.	1, 2
3	Demonstrate ability to critically examine and evaluate relevant research and pedagogies to enable primary-aged students to engage and learn the skills and concepts of science and technology effectively.	1

4	Demonstrate understanding of the nature of science as well as knowledge of areas of scientific and technological content	1, 2, 3
5	Demonstrate understanding of why ICT is integrated with science and ability to integrate it into Science and other KLAs effectively.	1, 3
6	Demonstrate ability to develop a unit of work which incorporates skill development embedded in effective learning experiences	2

Graduate Attributes (AITSL Professional Graduate Teaching Standards)

Standard		Assessment/s
1.1	Demonstrate knowledge and understanding of physical, social and intellectual development and characteristics of students and how these may affect learning	1
1.2	Demonstrate knowledge and understanding of research into how students learn and the implications for teaching	1
1.5	Demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities	2, 3
2.2	Organise content into an effective learning and teaching sequence	2
2.3	Use curriculum, assessment and reporting knowledge to design learning sequences and lesson plans	1, 2
2.6	Implement teaching strategies for using ICT to expand curriculum learning opportunities for students	3
3.2	Plan lesson sequences using knowledge of student learning, content and effective teaching strategies	2
3.3	Include a range of teaching strategies	2
3.6	Demonstrate broad knowledge of strategies that can be used to evaluate teaching programs to improve student learning	1
4.5	Demonstrate an understanding of relevant issues and the strategies available to support the safe, responsible and ethical use of ICT in learning and teaching	3

National Priority Area Elaborations

Priority area		Assessment/s
A. Aboriginal and Torres Strait Islander Education	1, 5, 8,	1,2
B. Classroom Management	1, 4, 5	1, 2
C. Information and Communication Technologies	1-7, 8, 9,10, 12	1, 2, 3
D. Literacy and Numeracy	1-19	1, 2, 3

4. RATIONALE FOR THE INCLUSION OF CONTENT AND TEACHING APPROACH

The course structure allows students to explore and understand the content and organisation of the NSW K-6 Science and Technology curriculum. Students will develop and demonstrate the skills they need to plan programs, lessons and activities suitable for different learning styles and stages of development. Teaching and assessment tasks provide opportunities to develop resources and apply them to record and present their findings for an investigation into a scientific question. The importance of literacy and numeracy skills for science is demonstrated, along with opportunities to integrate science and technology with other KLAs.

5. TEACHING STRATEGIES

The course will run as a series of workshops including lecturer input, practical hands-on tasks, structured and collaborative discussions, computer-based activities (including simulations) and on-line activities. Students will also critically observe and evaluate lessons on-site with school students. Completing an ICT-focused pre-assessment is a hurdle requirement for this course.

6. COURSE CONTENT AND STRUCTURE

Week Date	Lecture/Tutorial Topic (Weeks 2-10)
Week 2 31 July	**Introduction** to the structure, organisation and content of the *Science K-10* Syllabus (inc. *Science and Technology K-6)* (NSW BOSTES); **Teaching Models and Approaches:** 5Es Instructional Model (Bybee, 2014); Generative Learning Model (Osbourne & Wittrock, 1985); Learners' Questions Model (Faire & Cosgrove, 1988); Science in School Model (Tytler, 2001); Representational Intensive Pedagogy (Tytler, 2010)
Week 3 7 Aug	**Aspects Contributing to Effective Teaching of Science:** 1. Classroom environment (science-friendly, science-rich, positive); 2. Conceptual Knowledge and Procedural Skills: (explicit teaching); 3. Teaching Strategies and Approaches (appropriate activities and pedagogies, linking science with ICT, thematic and/or integrated approach; discussions, investigations and questioning as teaching and learning tools); 4. Student Considerations (fostering student interest, curiosity and wonder, understanding and catering for students' needs and interests); 5. Teacher Considerations (increasing personal science knowledge and confidence; planning and preparation); 6. Context-Specific Considerations (preparing students for the future and for independent learning). [See Fitzgerald et al. (2013)]. **Constructivist Learning Approach**: building on own ideas (personal constructivism) and prior learning (socio-cultural constructivism), misconceptions (alternative conceptions) as barriers and bridges; foregrounding student's needs/problems; failing as a step for learning; using ICT to record learning
Week 4 14 Aug	**Evaluating personal Pedagogical Content Knowledge (PCK) - Science PCK** of: the syllabus; safe and appropriate instructional strategies and assessment; students' understanding of science; contextual, cultural and social issues relating to learning and the learning environment; attitudes and beliefs about science teaching. **ICT PCK** of: the syllabus; nature and characteristics of technology; appropriate instructional strategies (authentic application, grouping, resources, technical management and maintenance) and assessment; building on existing knowledge and expertise; importance of context and safe use of technology; attitude and confidence in using and teaching technology. **Teaching the language of science:** Writing factual texts (to explain)
Week 5 21 Aug	**Using Inquiry-Based Learning:** asking questions, investigating, constructing and testing ideas about the Natural and Made Environments using critical and creative thinking. Minds-on and Hands-on learning. Importance of using appropriate equipment to gather evidence, interpret data and explain and communicate results. Teachers and students work collaboratively to build a deep understanding. **Effective Questioning:** Groves-Edwards, Anstey and Bull's (2014) dialogic pedagogies; **Evaluation of resources:** safety considerations and availability

Week 6 28 Aug	**Early Stage 1 and Stage 1: Identifying a problem and developing a procedure to explore and test ideas.** Communicating observation using words (written and oral), graphic organisers, drawings, photographs and models. Appropriate ways to access information. [Topics include living/non-living things, movement, seasons, properties of objects and how their design suits their purpose. Effective communication of ideas and observations orally and visually. Safe use of equipment. Science literacy and integration of science and ICT with other KLAs.] **Planning a lesson** integrating speaking, listening, viewing and representing.
Week 7 4 Sept	**Early Stage 1 and Stage 1: Exploring children's ideas about key science concepts** using purposeful play, curiosity, observation, questioning and exploring ideas. Ways of developing children's ideas about their world into more coherent views, and ways of investigating using all the senses. Link to measurement strand of Mathematics syllabus. Accommodating a range of prior digital experiences. [Topics include: physically changing and combining materials in nature and for manufactured products; links between purpose and design of man-made objects; the ways living things grow and change depending on their environment; sources of light and sound; effects of push and pull on objects.] **Planning a sequence of lessons** using the 5Es model and involving a field trip.
Week 8 11 Sept	**Stage 2**: **Importance of Science and Technology in students' lives**. Importance of exploring ways to improve design of investigative procedures and the collection and communication of observations/results. Wording of hypotheses to predict outcomes. Criteria for a fair test. Importance of comparing results (between groups and over time) and suggesting procedural improvements. [Topics include: changes on the Earth's surface (natural and caused by humans), consequences of the Earth's movement in space; life-cycles; classification of living and non-living things; contact and non-contact forces; links between heat and state of matter.] **Teaching the language of science:** Writing hypotheses and factual texts (to report).
Week 9 18 Sept	**Stage 2**: **Teaching the ICT skills students need to present data** in multiple formats; designing tables and graphs to represent data in different ways to suit different purposes. **Interpreting graphs and drawing conclusions** when data is presented as a table. Numeracy demands of science. ***Demonstration of kinesthetic learning activity (Assessment 2)**
Week 10 25 Sept	**Stage 3**: **Teaching integrity of scientific reporting**: importance of honesty and accuracy in science; critically evaluating different viewpoints relating to factors influencing our sustainable future; influences for different interpretations of the same phenomena and data and consequences. Sequence of defining problem, designing criteria for investigation, considering constraints, investigating, recording and reporting. [Topics include: causes of rapid changes on the Earth's surface, electricity, light, growth, properties of solid, liquid and gaseous materials, survival of living things, manufacturing] **Stage 3**: **Integrating Science and English** - writing biographies outlining the contribution of people from a range of cultures over time to the advancement of science. How science and technology inform personal, local, national and global decisions. Preparing students for their transition to Stage 4.

7. RESOURCES

Required Readings

Science K-10 Syllabus (inc. *Science and Technology K-6)* (NSW BOSTES) , https://syllabus.bostes.nsw.edu.au/science/science-k10/

NSW DET (2003) *Quality Teaching in NSW Public Schools,* Sydney, NSW.

Skamp, K. & Preston, C. (Eds.) (2015). *Teaching Primary Science Constructively* (5th ed.). Melbourne: Cengage.

Further Readings

Primary Connections units and associated information can be accessed at **http://primaryconnections.org.au/**

Aubusson, P., Schuck, S., Ng, W., Burke, P., Pressick-Kilborn, K., & Palmer, T. (2015). Quality learning and teaching in primary science and technology. Sydney: Association of Independent Schools NSW. Accessed 12 September 2016 at: https://www.aisnsw.edu.au/Services/EducationResearch/Latest%20Research%20Documents/Primary%20Science%20and%20Technology%20Literature%20Review%202015_FINAL.pdf

Fitzgerald, A., Dawson, V., & Hackling, M. (2013). Examining the beliefs and practices of four effective Australian primary Science teachers. *Research in Science Education*, *43*(3), 981- 1003.

Fleer, M. (2015). Science for children. Melbourne: Cambridge University Press.

Gregson, R. (Ed.) (2012). Connecting with Science Education: Teaching in the K-10 classroom. South Melbourne: Oxford University Press.

Skamp, K. & Preston, C. (Eds.) (2015). Teaching Primary Science Constructively (5th ed.). Melbourne: Cengage.

8. ASSESSMENT

Assessment Task	Length	Weight	Learning Outcomes Assessed	Graduate Attributes Assessed	National Elaborations Assessed	Due Date
Pre-Assessment: Assessing for Learning in Science using ICT	~500 words	Hurdle				30 July @5pm
Assessment 1 Plans and progress for personal research project	1800 words equiv	30%	1, 2, 3, 4, 5	1.1, 1.2, 2.3, 3.6	A1,5,8; B1,4; C1; D1,5-8,10-19	27 Aug @5pm
Assessment 2 Demonstration of activity for kinesthetic learning and submission of a lesson plan for which the activity is a key part.	< 10 mins	30%	1, 2, 4, 6	1.5, 2.2, 2.3, 3.2, 3.3	A1,5,8; B1,4,5; C1,6,12; D1,5,6-19	18 Sept (in class)
Assessment 3 E-portfolio recording personal research project and demonstrating awareness of appropriate use of literacy in science.	3000 words	40%	4, 5	1.5, 2.6, 4.5	C1-7,9-10; D1-4,7-19	2 Oct @5pm
Reflection: Student impact, knowledge extensions or gaps	~500 words	Hurdle	3, 4	3,6		3 Oct @5pm

Pre-Assessment: Assessing for Learning in Science using ICT

Identify and briefly describe three examples of digital technologies which can be used to assess students' scientific understanding. Upload your 500 word response to Moodle before the beginning of the course.

Assessment 1: Plans and progress for personal research project (30%)

- Identify an issue suitable for a class investigation over a period of time.
- Explain the Stage the investigation is suitable for and how it relates to the NSW (NESA) Science and Technology syllabus.
- Outline the background to the issue or problem and the Internet research you have undertaken in order to understand the nature, scope and complexity of the issue.
- State your research question(s) and your hypothesis (hypotheses).
- What method will you use for your investigation?
- What equipment is needed?
- How long will it take?
- What difficulties might you and the class encounter?
- How will results be recorded?

You need to demonstrate your competence in ICT as one aspect of the presentation.

Assessment 2: Demonstration of activity for kinesthetic learning (30%)

Choose a different Stage from the one you selected for Assignment 1. Plan a lesson which includes a kinesthetic activity to help students understand a critical part of the lesson. The activity is not just practical and hands-on, it requires physical movement to represent/reinforce a key concept in the lesson. Your plan needs to include syllabus outcomes and a clear outline of the lesson sequence.

The demonstration should be less than 10 minutes, including an explanation about how the activity integrates into your lesson and how you will provide assessment for learning to move learning forward.

Assessment 3: E-portfolio with annotations to highlight key aspects of literacy for science (40%)

1. Use digital technologies to record and present all the steps in your research project. Include all the digital techniques used to research, record, analyse and present your findings.

2. Annotate your portfolio to highlight, identify and describe language features which are typical for a science research report. The features should highlight appropriate aspects of literacy at text, paragraph, sentence and word level.

Reflection: Student impact, knowledge extensions or gaps

Describe three ways in which you would assess the impact of your teaching in this KLA on your future students. If you have a specialisation in this KLA (e.g., a major in your undergraduate degree), describe how you could build on your advanced knowledge/skills to make improvements in student achievement in this KLA in your current school. If you do not have a specialisation in this KLA, identify three areas of your disciplinary knowledge /skills that require further development, and what strategies you will use to achieve that. Upload your 500 word response to Moodle before the end of the course.

Submission of Assessment Tasks

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. 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. https://education.arts.unsw.edu.au/students/courses/course-outlines/

UNSW SCHOOL OF EDUCATION

FEEDBACK SHEET

EDST6784 SCIENCE AND TECHNOLOGY

Student Name: Student No.:

Assessment Task: 1

SPECIFIC CRITERIA	(-) ⟶ (+)				
Understanding of the question or issue and the key concepts involved • Identified an issue suitable for a class investigation over a period of time. • Explained the Stage the investigation is suitable for and how it relates to the NSW (NESA) Science and Technology syllabus. • Outline the background to the issue or problem and the Internet research you have undertaken in order to understand the nature, scope and complexity of the issue. • State your research question(s) and your hypothesis (hypotheses).					
Depth of analysis and/or critique in response to the task • Addressed the following questions: What method will you use for your investigation? What equipment is needed? How long will it take? What difficulties might you and the class encounter? How will results be recorded?					
Familiarity with and relevance of professional and/or research literature used to support response • Appropriate research references to support responses • Sound range of research references					
Structure and organisation of response • Appropriate nature of structural organisation • Logical and coherent structure • Clear presentation of ideas to enhance readability					
Presentation of response according to appropriate academic and linguistic conventions • You need to demonstrate your competence in ICT as one aspect of the presentation. • Clarity, consistency and appropriateness of conventions for quoting, paraphrasing, attributing sources and information and listing references (APA style) • Clarity and appropriateness of sentence structure, vocabulary use, spelling, punctuation and word length (1800 words)					
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.**

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FEEDBACK SHEET

EDST6784 SCIENCE AND TECHNOLOGY

Student Name: Student No.:

Assessment Task: 2

SPECIFIC CRITERIA	(-) ⟶ (+)				
Understanding of the question or issue and the key concepts involved • Identified a different Stage from the one selected for Assignment 1. • Planned a lesson which includes a kinesthetic activity to help students understand a critical part of the lesson.					
Depth of analysis and/or critique in response to the task • The activity is not just practical and hands-on, it included physical movement to represent/reinforce a key concept in the lesson • Included an explanation about how the activity integrates into your lesson and how you will provide assessment for learning to move learning forward					
Familiarity with and relevance of professional and/or research literature used to support response • Appropriate research references to support responses • Sound range of research references					
Structure and organisation of response • Your plan included syllabus outcomes and a clear outline of the lesson sequence • Appropriate nature of structural organisation • Logical and coherent structure • Clear presentation of ideas to enhance readability					
Presentation of response according to appropriate academic and linguistic conventions • Clarity, consistency and appropriateness of conventions for quoting, paraphrasing, attributing sources and information and listing references (APA style) • Clarity and appropriateness of sentence structure, vocabulary use, spelling, punctuation in demonstration materials • The demonstration should be less than 10 minutes					
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.**

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FEEDBACK SHEET

EDST6784 SCIENCE AND TECHNOLOGY

Student Name: Student No.:

Assessment Task: 3

SPECIFIC CRITERIA	(-) ⟶ (+)				
Understanding of the question or issue and the key concepts involved • Used digital technologies to record and present all the steps in your research project • Included all the digital techniques used to research, record, analyse and present your findings					
Depth of analysis and/or critique in response to the task • Annotate your portfolio to highlight, identify and describe language features which are typical for a science research report. The features should highlight appropriate aspects of literacy at text, paragraph, sentence and word level					
Familiarity with and relevance of professional and/or research literature used to support response • Appropriate research references to support responses • Sound range of research references					
Structure and organisation of response • Appropriate nature of structural organisation • Logical and coherent structure • Clear presentation of ideas to enhance readability					
Presentation of response according to appropriate academic and linguistic conventions • Clarity, consistency and appropriateness of conventions for quoting, paraphrasing, attributing sources and information and listing references (APA style) • Clarity and appropriateness of sentence structure, vocabulary use, spelling, punctuation and word length (3000 words)					
GENERAL COMMENTS/RECOMMENDATIONS FOR NEXT TIME					

Lecturer **Date**

Recommended: /20 (FL PS CR DN HD) **Weighting: 40%**

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.**