VCE Environmental Science: Sample teaching plan

Sample Course Outline – VCE Environmental Science Unit 1: How are Earth’s dynamic systems interconnected to support life?

**Note:** This is a sample guide only and indicates one way to present the content from the *VCE Environmental Science Study Design*. VCE units are designed on the basis of a minimum of 50 hours class time; this sample teaching plan is based on 3 hours per week over 19 weeks and includes activities covering the nine scientific methodologies. Teachers are advised to consider their own contexts in developing learning activities: Which local fieldwork sites would support learning in the topic area? Which local case studies and issues lend themselves to debate and investigation? Which experiments can students complete within the resource limitations of their learning environments?

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| **Week** | **Area of study** | **Key knowledge** | **Learning activities**  | **Science skills focus** | **Assessment tasks** |
| **1** | ***Area of Study 1: How are Earth’s systems organised and connected?*** | **Investigation of local ecosystems** (biotic and abiotic components that determine the environmental conditions of varied habitats within aquatic and terrestrial ecosystems; including the interrelationships represented by food chains, food webs, energy and biomass pyramids) | * *Fieldwork* and/or *controlled experiment*: in a local context investigate water quality or soil properties
* *Fieldwork*: terrarium construction
* *Product, process or system development*: groups construct Winogradsky columns, including one half of one side of each bottle covered in aluminium foil
* *Practical activity*: biogeochemical cycles
* *Group research task*: *Does high plant diversity equal high animal diversity?*
* *Modelling*: construct a mouth-in-mouth collage of a food chain
* *Simulation:* use an interactive program to generate datato construct biomass and energy pyramids
* *Classification and identification:* use the example of *Echium Plantagineum* (Salvation Jane/ Patterson’s curse) to define a ‘weed’
 | * design and conduct investigations: select and use methods appropriate to the selected investigation methodology, including consideration of sampling technique and size, equipment and procedures
* select appropriate sampling techniques in fieldwork (including grids, quadrats, transects)
* use appropriate environmental science terminology, representations and conventions, including standard abbreviations, graphing conventions and units of measurement
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| **2** |  |
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| **4** | **Earth systems thinking** (natural interactions between Earth’s four systems that support and are affected by the movement of energy and nutrients within and between local and global ecosystems; systems thinking as a way of exploring relationships in environmental systems by identifying inputs, outputs, structures and processes that may be visible or invisible to the human eye, including representation of a local or regional environmental system) | * *Graphic organiser*: compare a world with and without humans
* *Poster*: energy flow through a selected ecosystem
* *Correlational study*: use an aquarium or local ecosystem to investigate system types (open, semi-permeable, closed)
* *Case study*: Borneo parachuting cats
* *Case study*: Explore the ways in which Aboriginal peoples in Queensland have managed water resources
* *Literature review*: research and annotate maps of Earth’s surface to show key locations of outputs (e.g. coal, oil, gas, phosphate rocks) of the different biogeochemical cycles
 | * apply Earth systems thinking to analyse and evaluate responses to environmental science scenarios, case studies, issues and challenges in terms of supporting and sustaining ecological integrity
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| **5** |  |
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| **7** | **Reflective annotations of practical activities** (5 minutes at the end of 4 selected practical activities); students respond to a general question at the end of each of four practical activities |
| **8** | ***Area of Study 2: How do Earth’s systems change over time?*** | **Earth’s dynamic systems (**transformative processes occurring during Earth’s deep history that shaped the formation of Earth’s four interrelated systems; changes and disruptions to landscapes, ecosystems and biomes that influence their distribution and ecological characteristics)  | * *Modelling:* group jigsaw timeline modelling activity to show Earth’s formation
* *Simulations:* online interactives investigating effects of short and long-term cycles and/or abrupt changes such as volcanoes, earthquakes and tsunamis on the Earth’s systems
* *Data interpretation*: Plot plate boundaries, seismic activity and/or other major disruptions on a world map identifying relationships and similarities
* *Practical activity*: simulate factors that affect ocean currents, coastal regions or river systems
* *Video*: visualisation of New Zealand volcanic eruption; discuss why eruptions are difficult to predict
* *Group work*: Presentation on a selected local ecosystem and the natural and human induced changes that are influencing the ecological characteristics
* *Graphic organiser* or *jigsaw activity*: use of different time scales to demonstrate the changes that could or do occur to the four Earth systems in a selected ecosystem
 | * analyse and explain how models and theories are used to organise and understand observed phenomena and concepts related to environmental science, identifying limitations of selected models/theories
* work independently and collaboratively as appropriate and within identified research constraints, adapting or extending processes as required and recording such modifications
* process quantitative data using appropriate mathematical relationships and units
* evaluate investigation methods and possible sources of error
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| **9** |  |
| **10** |  |
| **11** | **Data and modelling** (ways of using data and models to study Earth’s systems and changes in Earth over time) | * *Data analysis*: interpret data from a monitoring program using paleoclimatology, marine and ocean, weather balloon, land-based stations or other online databases
* *Correlational study*: explore the use of Aboriginal and Torres Strait Islander peoples’ seasonal calendars as data records of Earth’s changing features over time
 | * systematically generate and record primary data, and collate secondary data, appropriate to the investigation, including use of databases and reputable online data sources
* process and analyse data to identify cause-and-effect relationships, correlations, and linear, non-linear or cyclical patterns
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| **12** | **Data analysis task** (30 minutes): students are presented with a set of data related to an unfamiliar scenario involving change in Earth’s systems - temperature data over time; plot data and interpret trends |

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| **13** |  | **Managing environmental challenges** (the role of innovation and science in responding to challenges because of environmental change and disruption; including the contribution of scientific data, new technologies, regulatory frameworks and diverse stakeholder values and priorities in managing environmental challenges of regional relevance) | * *Discussion*: explore ways to innovate to ensure developments are sustainable in areas prone to natural disasters
* *Literature review*: Murray Darling Basin plan (or plan for an area of local significance) research task incorporating scientific data, new technologies, regulatory frameworks and stakeholder values
* *Modelling:* annotate a design of the features of an earthquake-resistant building
 | * use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with evidence and relevant to the question under investigation
* acknowledge sources of information and assistance, and use standard scientific referencing conventions
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| **14** | **Response to a media article** (20 minutes):students respond to a media article about the local council’s planned management strategies for controlling erosion at a beach  |
| **15** |  | **Investigation design** (environmental science concepts and methodology; techniques of primary qualitative, quantitative data generation; accuracy, precision, reproducibility, repeatability and validity of measurements; and health, safety and ethical guidelines relevant to the selected scientific investigation)  | * *Formulating hypotheses*: practice converting investigation questions into hypotheses
* *Register an individual research question*: develop a research question, aim and hypothesis; make a prediction about the investigation outcome; outline the purpose of communication and target audience; propose investigation methodology and method, and check safety requirements
 | * formulate hypotheses to focus investigations
* predict possible outcomes of investigations
* apply relevant occupational health and safety guidelines while undertaking practical investigations
* demonstrate ethical conduct when undertaking and reporting investigations
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| **16** | ***Area of Study 3: How do scientific investigations develop understanding of how Earth’s systems support life?*** | **Scientific evidence** (distinction between an aim, a hypothesis, a model, a theory and a law; scientific models or theories; characteristics and ways of organising, analysing and evaluating generated primary data; identification of patterns, relationships and sources of error; use of a logbook to authenticate generated primary data; limitations of investigation methods and data generation and/or analysis) | * *Reflection on others’ investigations*: Evaluate the pros and cons of the methodology and data generation method used in a selected previously completed investigation; suggest improvements
* *Data generation and analysis of own investigation*: generate primary data; analyse and evaluate data and methods; evaluate limitations of conclusions
 | * evaluate data to determine the degree to which the evidence supports the aim of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation
* identify and analyse experimental data qualitatively, handling, where appropriate, concepts of: accuracy, precision, repeatability, reproducibility and validity of measurements
* evaluate data to determine the degree to which the evidence supports or refutes the initial prediction or hypothesis
* identify, describe and explain the limitations of conclusions, including identification of further evidence required
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| **17** | **Science communication** (conventions of scientific report writing for the selected scientific investigation; presentation of findings) | * *Critique*: Consider the characteristics of effective science communication; review an existing investigation and its presentation, and evaluate the effectiveness of the communication
* *Communicate*: present investigation findings in an appropriate format for a designated audience
 | * use clear, coherent and concise expression to communicate to specific audiences and for specific purposes in appropriate scientific genres, including scientific reports and posters
 | **Scientific poster communication** (500 words):students may work on investigation in groups, but poster presented individually, including logbook authentication of data |
| **18** | **Unit revision** | **End-of-semester examination** |
| **19** |