ASELL SCHOOLS
Advancing Science & Engineering through Laboratory Learning

Welcome to the Inquiry Scaffold Tool (Australian Curriculum)

This tool was developed by the **ASELL for School – Victorian Node** from working with teachers and students to re-design engaging science laboratory learning activities (LLAs) in lower secondary classes (years 7-10). This work has also been extrapolated into a primary focus for year 3-6.
Some points to be considered in the **Inquiry Scaffold Tool** are as follows:

- The tool offers a conception of the way that teachers provide students with inquiry scaffolding at different levels. Across the levels in the tool, the dimension of change is the degree of agency and responsibility accorded the student for making informed decisions and exhibiting independent inquiry skills. At the prescription level, the teacher strongly frames inquiry, and models the skills through direction;
- The tool offers a way of thinking about the degree of scaffolding put around each skill, with support being reduced at each successive level;
- Teachers should focus on one or two of the seven inquiry skills in each laboratory learning activity; and
- Teaching inquiry skills necessitates direct teaching and skill learning prior to assessing the development of each skill.

Some ideas on the overall structure of the **Inquiry Scaffold Tool**.
Each outcome can be taken up through a practical activity in a developmental progression as described below:
Prescription: The student performs the skill strongly scaffolded by explicit instructions. This might involve a highly directive worksheet, or teacher instruction.
Confirmation: The student makes constrained choices within a set of instructions, or strongly guided class discussion. There is minimal room for variation.
Structured inquiry: The student interprets and modifies inquiry processes within an explicit framework. This may involve prior class discussion.
Guided inquiry: The student is involved in substantial decision making and interpretation within a broad outline of suggestions of possible approaches.
Open inquiry: The student engages with a question or problem that they have posed and are invested in, and conducts an investigation with minimal guidance.

Some of the flexibility built into the **Inquiry Scaffold Tool** is as follows:

- It would be understood that even if an inquiry was intended to develop the open inquiry level of a skill, in supporting individual students the teacher would provide guidance characteristic of the lower levels. This tool therefore supports the application of individualised learning and differentiation.
- If questions and planning occur at the higher levels then it is more likely that analysis, communication etc. will also occur at the higher levels.

Ways the **Inquiry Scaffold Tool** could be used include:

- Used to plan a structured program supporting the development of individual inquiry skills;
- To map the inquiry skill outcome for each practical activity and provide suggestions for differentiation of student learning;
- To map all inquiry skill outcomes across a unit or year level, scaffolding the development of each skill; and
- To map inquiry skills across all years, building student capacity towards the open investigations found in the senior secondary sciences.

ASELL SCHOOLS Advancing Science & Engineering through Laboratory Learning
Australian Council of Deans of Science
ReMSTEP
Australian Government Department of Education and Training Office for Learning and Teaching
DEAKIN UNIVERSITY

Advancing Science & Engineering through Laboratory Learning

Australian Curriculum - Years 3-4 and 5-6 (2014)

Curriculum outcome - Years 3-4 and 5-6	**Prescription**	**Confirmation**	**Structured Inquiry**	**Guided Inquiry**	**Open Inquiry**
Questioning and predicting 3-4: With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS053 and ACSIS064) 5-6: With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS231 and ACSIS232)	Student engages with a question provided by teacher.	Student chooses from a provided, constrained set of questions.	Student sharpens or clarifies a question or questions provided by teacher, or other source.	Based on discussion with teacher, or others, student poses and refines their own question.	Student autonomously poses a question of interest.
Planning and conducting 3-4: With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS054 and ACSIS065) 5-6: Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086 and ACSIS103)	Student follows a provided plan of investigation.	Student follows a plan that offers limited choices in approach, or that the teacher develops using guided discussion.	Student adapts and refines a plan outline that is provided, or developed in class discussion.	Student uses a planning framework to devise and enact a plan.	Student autonomously devises and enacts a plan for a chosen investigation.
3-4: Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS055 and ACSIS066) 5-6: Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS087 and ACSIS104)	Student follows instructions to use equipment and collect data.	Student makes limited decisions in following instructions to use equipment and collect data.	Student devises data collection and recording procedures using a structured framework.	Student makes substantial decisions in collecting and recording data, supported by an outline of possible approaches.	Student autonomously devises and enacts data collection and recording processes.
Processing and analysing data and information 3-4: Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS057 and ACSIS068) 3-4: Compare results with predictions, suggesting possible reasons for findings (ACSIS215 and ACSIS216) 5-6: Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS090 and ACSIS107) 5-6: Compare data with predictions and use as evidence in developing explanations (ACSIS218 and ACSIS221)	Student uses provided representations such as tables, to record /process data.	Student chooses from provided representations to record / process data.	Student draws on a structured framework, possibly developed through class discussion, to construct representations to record / process data.	Student draws on a provided outline of possible approaches to develop representations to record / process data.	Student autonomously develops representations to appropriately record / process data.
Evaluating 3-4: Reflect on investigations, including whether a test was fair or not (ACSIS058 and ACSIS069) 5-6: Reflect on and suggest improvements to scientific investigations (ACSIS091 and ACSIS108)	Fairness / methods of investigation is explained.	Student is strongly guided to evaluate fairness / methods of investigation.	Student uses structured framework to evaluate fairness / methods of investigation.	Student draws on an outline of principals to evaluate the fairness / methods of investigation.	Student autonomously evaluates the fairness / methods of investigation.
Communicating 3-4: Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS060 and ACSIS071) 5-6: Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (ACSIS093 and ACSIS110)	Student is directed how to communicate.	Student is given steps and procedures to frame communication.	Student communicates / argues using a structured framework.	Student is provided broad guidelines for arguing / communicating.	Student autonomously develops argumentation / communication of ideas.

AS ALL SCHOOLS
Advancing Science & Engineering through Laboratory Learning

Australian Curriculum - Years 7-8 and 9-10 (2014)

Curriculum outcome - Years 7-8 and 9-10	**Prescription**	**Confirmation**	**Structured Inquiry**	**Guided Inquiry**	**Open Inquiry**
Questioning and predicting 7-8: Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124 and ACSIS139) 9-10: Formulate questions or hypotheses that can be investigated scientifically (ACSIS164 and ACSIS198)	Student engages with a question provided by teacher.	Student chooses from a provided, constrained set of questions.	Student sharpens or clarifies a question or questions provided by teacher, or other source.	Based on discussion with teacher, or others, student poses and refines their own question.	Student autonomously poses a question of interest.
Planning and conducting 7-8: Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125 and ACSIS140) 9-10: Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSIS165 and ACSIS199)	Student follows a provided plan of investigation.	Student follows a plan that offers limited choices in approach.	Student adapts and refines a provided plan outline.	Student uses a planning framework to devise and enact a plan.	Student autonomously devises and enacts a plan for a chosen investigation.
7-8: Measure and control variables, select equipment appropriate to the task and collect datawith accuracy (ACSIS126 and ACSIS141) 9-10: Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately (ACSIS166 and ACSIS200)	Student follows instructions to use equipment and collect data.	Student makes limited decisions in following instructions to use equipment and collect data.	Student devises data collection and recording procedures using a structured framework.	Student makes substantial decisions in collecting and recording data, supported by an outline of possible approaches.	Student autonomously devises and enacts data collection and recording processes.
Processing and analysing data and information 7-8: Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS129 and ACSIS144) 7-8: Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS130 and ACSIS145) 9-10: Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS169 and ACSIS203) 9-10: Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170 and ACSIS204)	Student uses provided representations such as tables to record / process data.	Student chooses from provided representations to record / process data.	Student draws on a structured framework to construct representations to record / process data.	Student draws on a provided outline to develop representations to record / process data.	Student autonomously develops representations to appropriately record / process data.
Evaluating 7-8: Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements (ACSIS131 and ACSIS146) 9-10: Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (ACSIS171 and ACSIS205)	Student is strongly directed towards a conclusion.	Student follows instructions involving limited decisions on analysing / concluding.	Student draws on a framework suggesting approaches to analysing / concluding.	Student develops approaches to analysing / concluding, supported by a provided outline.	Student autonomously develops approaches to analysing data and drawing conclusions.
7-8: Use scientific knowledge and findings from investigations to evaluate claims based on evidence (ACSIS132 and ACSIS234)9-10: 9-10: Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems (ACSIS172 and ACSIS206)	Student is directed to link conclusions to science concepts.	Student chooses from possible links between conclusions and science concepts.	Student argues for a link between conclusions and science concepts using a guiding framework.	Student constructs links between conclusions and science concepts, supported by an outline of principles.	Student independently pays close attention to scientific concepts in evaluating conclusions.
Communicating 7-8: Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS133 and ACSIS148) 9-10: Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS174 and ACSIS208)	Student is directed how to communicate.	Student is given steps and procedures to frame communication.	Student communicates / argues using a structured framework.	Student is provided broad guidelines for arguing / communicating.	Student autonomously develops argumentation / communication of ideas.

References

National Research Council (2000). Inquiry and the national science education standards: A guide for teaching and learning. Washington DC: National Academic Press.

National Institutes of Health. (2005). Doing Science: The Process of Scientific Inquiry. Bethesda (MD): National Institutes of Health.

Copyright and Creative Commons