Software Engineering Stage 6 (Year 12) – sample program of learning

Software automationContents

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# About this resource

## Purpose of resource

The resource is a sample program of learning for teaching Software automation in Year 12 during the Software Engineering 11–12 course.

## Target audience

This resource can be used by teachers to support effective syllabus implementation of Software Engineering 11–12.

## When and how to use

This resource is designed for implementing over 10 weeks or a term of learning on Software automation. The resource can be adapted and contextualised to the school setting. Adjustments can be made to the program of learning to suit students in the teaching and learning cycle.

# Rationale

The NSW Department of Education publishes a range of curriculum support materials, including samples of lesson sequences, scope and sequences, assessment tasks, examinations, student and teacher resource booklets, and curriculum planning and curriculum evaluation templates. The samples are not exhaustive and do not represent the only way to complete or engage in each of these processes. Curriculum design and implementation is a dynamic and contextually specific process. While the mandatory components of syllabus implementation must be met by all schools, it is important that the approach taken by teachers is reflective of their needs and faculty or school processes.

NESA defines [programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) as the process of ‘selecting and sequencing learning experiences which enable students to engage with syllabus outcomes and develop subject specific skills and knowledge’ (NESA 2022a). A program is developed collaboratively within a faculty. It differs from a unit in important ways, as outlined by NESA on their [Advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units) page. A unit is a contextually specific plan for the intended teaching and learning for a particular class for a particular period. The organisation of the content in a unit is flexible and it may vary according to the school, the teacher, the class and the learning space. They should be working documents that reflect the thoughtful planning and reflection that takes place during the teaching and learning cycle. There are mandatory components of programming and unit development, and this template provides one option for the delivery of these requirements. The NESA and department guidelines that have influenced this template are elaborated upon at the end of the document.

This resource has been developed to assist teachers in NSW Department of Education schools to create learning that is contextualised to their classroom. It can be used as a basis for the teacher’s own program, assessment, or scope and sequence, or be used as an example of how the new curriculum could be implemented. The resource has suggested timeframes that may need to be adjusted by the teacher to meet the needs of their students.

# Overview

**Description**: this program of learning addresses the Software automation focus area. The lessons and sequences in this program of learning are designed to guide students through the development of a mark estimation program using a machine learning algorithm. Teachers are provided with options to differentiate content, depending upon students’ experience. At a minimum, students complete the activities within this teacher support resource (TSR). They are guided through the development of a linear regression algorithm from the [Software Engineering course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022) (Course specifications) document to create a mark estimation program. A simple solution is provided in the Appendix of the teacher support resource. Sample code is available in the **Software Automation** folder under the **Files** tab of the [Software Engineering channel](https://schoolsnsw.sharepoint.com/:f:/r/sites/TASNSWStatewideStaffroom/Shared%20Documents/13.%20%F0%9F%A7%91%E2%80%8D%F0%9F%92%BB%20Software%20Engineering%2011-12/Secure%20Software%20Architecture?csf=1&web=1&e=6nkPE3) via the [TAS Statewide Staffroom](https://teams.microsoft.com/l/team/19%3acd41312b69a14cd38a7c429ffd90493a%40thread.tacv2/conversations?groupId=cd5a04e1-7742-47dd-b141-9519486d9e00&tenantId=05a0e69a-418a-47c1-9c25-9387261bf991). The Python code for a ‘middle-level solution’ is also provided in this channel and considerations for a ‘high- level’ solution discussed. There are at least 3 options in delivering this task:

1. A summative assessment if it fits within their existing assessment schedule (**Note**: the [assessment schedule](https://education.nsw.gov.au/teaching-and-learning/curriculum/tas/tas-curriculum-resources-7-12/tas-11-12-curriculum-resources/assessment-schedule-software-engineering-year-12) published by the department did not include this as one of the assessment tasks and suggested content be formally assessed in the trial examination). A formal assessment task is included in this document for teachers choosing this option. This is also available in the **Software Automation** folder under the **Files** tab of the [Software Engineering channel](https://schoolsnsw.sharepoint.com/:f:/r/sites/TASNSWStatewideStaffroom/Shared%20Documents/13.%20%F0%9F%A7%91%E2%80%8D%F0%9F%92%BB%20Software%20Engineering%2011-12/Secure%20Software%20Architecture?csf=1&web=1&e=6nkPE3) via the TAS Statewide Staffroom.
2. A summative assessment of the task that integrates Software automation, Programming for the web, Secure software architecture and Software engineering project into a yearlong progressive web app (PWA) solution. Students could create a web-based markbook with Structured Query Language (SQL) lite (SQLite) database and predictive capabilities. Other web-based catalogue type systems could include the machine learning aspects of this unit.
3. A formative assessment of a solution to the problem as a practical group-based project to deliver syllabus content within the Software automation focus area and Programming for automation topic. In this scenario, students would improve upon the existing ‘low-code’ solution.

All files, comma-separated value (CSV) markbooks and Python sample code in the **Software Automation** folder under the **Files** tab of the [Software Engineering channel](https://schoolsnsw.sharepoint.com/:f:/r/sites/TASNSWStatewideStaffroom/Shared%20Documents/13.%20%F0%9F%A7%91%E2%80%8D%F0%9F%92%BB%20Software%20Engineering%2011-12/Secure%20Software%20Architecture?csf=1&web=1&e=6nkPE3) via the TAS State wide staffroom.

**Duration**: the content for this focus area (TSR activities and task) could be delivered over 30 hours across one term. This would require a flipped classroom approach to delivering some of the video content. Teachers will need to choose alternative activities that best suit their context Alternatively, this task and content could be integrated with any or all of the other focus areas. A blended approach with the Programming for the web, Secure software architecture and Software engineering project focus areas could provide for a yearlong project (120 hours).

**Explicit teaching**: suggested learning intentions and success criteria are available for some lessons provided. Learning intentions and success criteria are most effective when they are contextualised to meet the needs of students in the class. The examples provided in this document are generalised to demonstrate how learning intentions and success criteria could be created.

# Outcomes

A student:

* justifies methods used to plan, develop and engineer software solutions **SE-12-01**
* applies structural elements to develop programming code **SE-12-02**
* analyses how current hardware, software and emerging technologies influence the development of software engineering solutions **SE-12-03**
* evaluates practices to safely and securely collect, use and store data **SE-12-04**
* explains the social, ethical and legal implications of software engineering on the individual, society and the environment **SE-12-05**
* justifies the selection and use of tools and resources to design, develop, manage and evaluate software **SE-12-06**
* designs, develops and implements safe and secure programming solutions **SE-12-07**
* tests and evaluates language structures to refine code **SE-12-08**
* applies methods to manage and document the development of a software project **SE-12-09**

[Software Engineering 11–12 Syllabus](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

**Prior to planning for teaching and learning, please consider the following**:

**Engagement**

* How will I provide authentic, relevant learning opportunities for students to personally connect with lesson content?
* How will I support every student to grow in independence, confidence and self-regulation?
* How will I facilitate every student to have high expectations for themselves?
* How will I identify and provide the support each student needs to sustain their learning efforts?

**Representation**

* What are some different ways I can present content to enable every student to access and understand it?
* How will I identify and address language and/or cultural considerations that may limit access to content for students?
* How will I make lesson content and learning materials more accessible?
* How will I plan learning experiences that are relevant and challenging for the full range of students in the classroom?

**Expression**

* How will I provide multiple ways for students to respond and express what they know?
* What tools and resources can students use to demonstrate their understanding?
* How will I know every student has understood the concepts and language presented in each lesson?
* How will I monitor if every student has achieved the learning outcomes and learning growth?

# Lesson sequence and details

**Teachers provide** specific**, actionable feedback throughout the learning process, rather than the end of a project. This could involve real-time feedback during practical tasks, or reflective discussions post-completion of stages in the Software automation development.**

## Weeks 1–2

Table 1 – Algorithms in machine learning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ****Outcomes and content**** | ****Teaching and learning activities**** | ****Evidence of learning**** | ****Differentiation and adjustments**** | ****Registration and evaluation notes**** |
| **Outcome**  **SE-12-01**  **SE-12-04**  **SE-12-06**  **Algorithms in machine learning**  Students:   * investigate how machine learning (ML) supports automation through the use of DevOps, robotic process automation (RPA) and business process automation (BPA). | Teacher:   * determines whether to run this unit as a ‘standalone’ or integrate into other focus areas * quizzes students’ background knowledge on software automation * defines ‘software automation’ and provides familiar examples.   Students:   * complete activities, including cloze passages, note making on relevant videos and class discussions about the fundamental concepts within the Software automation focus area.   Teacher:   * introduces subject-specific terminology of this focus area, including how machine learning (ML) supports automation through the use of DevOps, robotic process automation (RPA) and business process automation (BPA).   Students:   * complete a jigsaw activity on these concepts and compile class notes and a study guide * apply their understanding to consider a school-based scenario ‘The school library upgrade with machine learning’ * apply the machine learning operations (MLOps) stages from the [Course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022) to the school library upgrade with machine learning scenario.   Teacher introduces and explains the mark estimation program. This is the coding task for this unit. They reference the linear regression algorithm from the [Course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022).  A student named Alex has missed a maths exam. Her teacher needs to estimate Alex's score and has been told that machine learning can predict a student's mark on a missed assessment by analysing historical data, identifying patterns and using these patterns to make informed predictions.  Alex’s maths teacher has also been told that you are studying machine learning and may be able to help.  **Learning intention**  **By the end of** the **research, videos and jigsaw activities, students will be able to discuss how machine learning** (ML) supports automation through the use of DevOps, robotic process automation (RPA) and business process automation (BPA).  **Success criteria**  **I** can**:**   * **explain the importance of software automation** * **explain the difference and similarities between software automation processes and how ML supports them** * **recite the words that make up the acronyms** * **use the terminology appropriately.** | Students:   * share a common technical language while discussing software automation * correctly match glossary keywords with definitions * contribute to class discussions * respond to the revision quiz at the beginning of each lesson * complete Activities 1 to 9 from the teacher support resource (TSR) * make an active and purposeful contribution to jigsaw activities. | As a motivator for student interest, watch [DeepSeek is a Game Changer for AI – Computerphile (19:57)](https://www.youtube.com/watch?v=gY4Z-9QlZ64) and discuss the effect of this app on stock markets, investments, the environment and global politics.  Glossary terms and definitions could be used as a simple matching activity, delivered via group work. This will facilitate collaboration and contributions from students who have more experience and background knowledge.  ML, DevOps, RPA and BPA are confusing and closely-related acronyms. Students should be encouraged to develop their own meaningful mnemonics to remember them. For example:   * ML (machine learning) – ‘minds learn’ * DevOps (development and operations) – ‘developing operations daily’ * RPA (robotic process automation) – ‘robots perform actions’ * BPA (business process automation) – ‘business processes automated’.   [High potential and gifted education (HPGE)](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education) students can benefit from having the project ‘up front’ so they know what they are working toward, providing context for the content.  The complexity of the task (mark estimation program) has been differentiated into possible solutions: low-, middle- and high-level.  Teachers may guide inexperienced students through the low-level solution OR provide this to experienced students as a basis from which they attempt the middle- or high-level solution.  Teachers may seek opportunities for students to be involved in extra curriculum challenges, including:   * [WAICY Home – WAICY](https://www.waicy.org/) * [Kaggle](https://www.kaggle.com/) * [GovHack](https://govhack.org/). |  |

## Weeks 3–4

Table 2 – Algorithms in machine learning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ****Outcomes and content**** | ****Teaching and learning activities**** | ****Evidence of learning**** | ****Differentiation and adjustments**** | ****Registration and evaluation notes**** |
| **Algorithms in machine learning**  Students:   * distinguish between artificial intelligence (AI) and ML * explore models of training ML   **Including:**   * supervised learning * unsupervised learning * semi-supervised learning * reinforcement learning. * investigate common applications of key ML algorithms   **Including:**   * data analysis and forecasting * virtual personal assistants * image recognition. | Students:   * list all school-based systems that could be automated with software (this list includes a mark estimation program) * distinguish between artificial intelligence (AI) and ML by completing Activities 10 to 11 of the TSR * explore models of training ML through close investigation of [Google’s Teachable Machine](https://teachablemachine.withgoogle.com/) * complete Activities 12 to 17 of the TSR * investigate common applications of key ML algorithms * complete a quiz that checks their understanding of Activity 18 * apply their understanding of [How to choose the Right Machine Learning Algorithm (23:04)](https://www.youtube.com/watch?v=uh6iYQEHyyI) to their mark estimation task * complete Activity 19 of the TSR * compile class notes and study guide.   **Learning intentions**  **By the end of the research, videos, role-plays, case studies and jigsaw activities, students will be able to:**   * **distinguish between artificial intelligence (AI) and ML** * **categorise and identify the main types of ML:** supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning * describe, in general terms, the algorithms used in common applications.   **Success criteria**  **I** can**:**   * **explain the difference between the terms ‘AI’ and ‘ML’** * **categorise the main types of machine learning algorithms** * **use the terminology appropriately** * **discuss common applications that use ML.** | Students:   * share a common technical language while discussing school-based systems that could be automated with software * correctly distinguish between AI and ML * contribute to class discussions * respond to the revision quiz at the beginning of each lesson * complete Activities 10 to 21 from the teacher support resource (TSR) * make an active and purposeful contribution to jigsaw activities. | The use and experimentation with [Google’s Teachable Machine](https://teachablemachine.withgoogle.com/) can provide for experienced computing students to look closely ‘under the bonnet’ of how this machine learning works. This is achieved by viewing the advanced settings within the application.  [How to choose the Right Machine Learning Algorithm (23:04)](https://www.youtube.com/watch?v=uh6iYQEHyyI) for students’ mark estimation task is an activity that lends itself to differentiation. Experienced students should explain clearly which algorithm should be chosen over others.  Data analysis and forecasting, virtual personal assistants and image recognition case studies have opportunities to explore algorithms that go beyond the scope of this course. |  |

## Weeks 5–6

Table 3 – Algorithms in machine learning lesson sequence and details

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| --- | --- | --- | --- | --- |
| ****Outcomes and content**** | ****Teaching and learning activities**** | ****Evidence of learning**** | ****Differentiation and adjustments**** | ****Registration and evaluation notes**** |
| **Outcome**  **SE-12-06**  **SE-12-07**  **SE-12-08**   * research models used by software engineers to design and analyse ML   Including:   * decision trees * neural networks * describe types of algorithms associated with ML   Including:   * linear regression * logistic regression * K-nearest neighbour. | Students:   * investigate case studies that demonstrate the common applications of key ML algorithms * form research teams and present their findings to the class, including a brief explanation of how their algorithms work * create presentations that form part of the class study notes * research models used by software engineers to design and analyse ML, including decision trees and neural networks * differentiate between ‘traditional’ decision trees used in computing from their use in ML * annotate the neural network diagram from the [Course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022), develop their understanding of the training and execution cycle and complete Activities 22 to 31 from the TSR.   **Learning intention**  **By the end of the research, videos and jigsaw activities, students will be able to discuss how** decision trees and neural networks are used to design and analyse ML.  **Success criteria**  **I can:**   * trace, describe and implement decision trees * explain neural networks and the training and execution cycles * describe and experiment with sample code that demonstrates types of algorithms associated with ML. | Students:   * share a common technical language while investigating case studies * explain, in general terms, how decision trees and neural networks work * contribute to class discussions * respond to the revision quiz at the beginning of each lesson * accurately identify and describe linear regression, logistic regression and K-nearest neighbour algorithms * complete Activities 22 to 31 from the teacher support resource (TSR) * make an active and purposeful contribution to jigsaw activities. | Machine learning algorithms referenced within this syllabus can be experimented with using the sample code provided.  Experienced students may be enticed by the depth, breadth and contemporary nature of this exciting field to pursue interests well beyond the syllabus.  They need to be guided into covering syllabus content assessable in the HSC examination before pursuing deeper dives into specific machine learning algorithms. |  |

## Weeks 7–9

Table 4 – Programming for automation lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ****Outcomes and content**** | ****Teaching and learning activities**** | ****Evidence of learning**** | ****Differentiation and adjustments**** | ****Registration and evaluation notes**** |
| **Outcome**  **SE-12-06**  **SE-12-07**  **SE-12-08**  **Programming for automation**   * design, develop and apply ML regression models using an OOP to predict numeric values   **Including**:   * linear regression * polynomial regression * logistic regression. * apply neural network models using an OOP to make predictions. | Students:   * describe types of algorithms associated with ML by investigating [Linear Regression (with Desmos) (9:25)](https://www.youtube.com/watch?v=_ldsNWOHHBk) * apply linear regression using Python code by importing [NumPy](https://numpy.org/doc/stable/) and [scikit-learn](https://scikit-learn.org/stable/getting_started.html) machine learning frameworks * annotate the [Course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022) example and modify the code work through the mark estimation program, including a class discussion on the best approach to take * consider the social and ethical issues that arise with this predictive system * consider other real-world examples of linear regression ML algorithms * complete activities on linear regression, polynomial regression, logistic regression * attempt Activities 32 to 47 from the TSR.   **Learning intentions**  By the end of the research, videos and jigsaw activities, students will be able to:   * **d**esign, develop and apply ML regression models using an OOP to predict numeric values * import machine learning frameworks to experiment with ML algorithms.   **Success criteria**  **I can:**   * describe and implement decision trees * explain neural networks and the training and execution cycles * describe and experiment with sample code that demonstrates types of algorithms associated with ML. | Students:   * use [Desmos](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/139) to model linear regression * share a common technical language while applying regression models * explain, in general terms, how linear, polynomial and logistic regression algorithms work * contribute to class discussions * respond to the revision quiz at the beginning of each lesson * experiment with neural network models * complete Activities 32 to 47 from the TSR * make an active and purposeful contribution to jigsaw activities * successfully import and apply [NumPy](https://numpy.org/doc/stable/) and [scikit-learn](https://scikit-learn.org/stable/getting_started.html) machine learning frameworks. | Students can experiment with modifying their ‘low.py’ solution to the task from using linear regression to using logistic regression.  Students can modify their low.py solution from using linear regression to using polynomial regression.  Students can make a basic perceptron by watching [Create a Simple Neural Network in Python from Scratch (14:14)](https://www.youtube.com/watch?v=kft1AJ9WVDk).  Students with coding experience can import a neural network library, such as [Keras](https://keras.io/) or [TensorFlow](https://www.tensorflow.org/), to create and train a simple neural network that solves the problem set in the task. |  |

## Week 10

Table 5 – Significance and impact of ML and AI lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ****Outcomes and content**** | ****Teaching and learning activities**** | ****Evidence of learning**** | ****Differentiation and adjustments**** | ****Registration and evaluation notes**** |
| **Outcome**  **SE-12-04**  **SE-12-05**  **SE-12-06**  **Significance and impact of ML and AI**   * assess the impact of automation on the individual, society and the environment   Including:   * safety of workers * people with disability * the nature and skills required for employment * production efficiency, waste and the environment * the economy and distribution of wealth. * explore by implementation how patterns in human behaviour influence ML and AI software development   Including:   * psychological responses * patterns related to acute stress response * cultural protocols * belief systems. * investigate the effect of human and dataset source bias in the development of ML and AI solutions. | Students:   * investigate the Robodebt case study * explore how patterns in human behaviour influence ML and AI software development * investigate the effect of human and dataset source bias in the development of ML and AI solutions * attempt Activities 48 to 57 from the TSR * present their mark estimation project, submit the code and documentation * complete activities within the TSR and submit.   **Learning intentions**  By the end of the research, videos and jigsaw activities, students will be able to:   * assess the impact of automation on the individual, society and the environment * explain how patterns in human behaviour influence ML and AI software development * discuss the effect of human and dataset source bias in the development of ML and AI solutions.   **Success criteria**  I can:   * discuss the impact of automation on the individual, society and the environment by referencing relevant case studies * explain how patterns in human behaviour influence ML and AI software development * warn about human and dataset source bias in the development of ML and AI solutions. | Students:   * explain, in general terms, how Robodebt occurred and what could have been done to mitigate its effects * contribute to class discussions on human and dataset source bias * respond to the revision quiz at the beginning of each lesson * complete Activities 48 to 57 from the TSR * make an active and purposeful contribution to jigsaw activities * present the task to the class and respond to Q&A. | The significance and impact of ML and AI content should be delivered throughout this course.  The task for this focus area has been designed with differentiated solutions – ‘low-’, ‘middle-' and ‘high-level’ – with increasing degrees of complexity and challenge. The questions in the Q&A should be commensurate with the level students have attempted.  The Robodebt case study could be issued as a mini assignment and require a deeper analysis of the algorithms used.  This focus area content could be delivered via a debate where teams are provided time to research their case. |  |

# Overall program evaluation

Collating ongoing evaluations and reflecting on the strengths and areas for development within the program creates opportunities to enhance student outcomes. The following prompts can be used to support your evaluation of the program:

* Did the program assist all students to improve in their learning?
* How could the sequencing of the program be improved?
* What did the student evaluations of the program indicate? How can these be actioned to improve the program?
* The strategies and resources that were most effective for student learning were …
* Teaching strategies and resources that would benefit from review and refinement are …

## Capturing student voice when evaluating a program

Student voice is useful in the evaluation process for programs. The statements below could be useful as a starting point when asking students to provide feedback on their learning experiences. These statements are derived from some of the themes from [What works best: 2020 update](https://education.nsw.gov.au/about-us/education-data-and-research/cese/publications/research-reports/what-works-best-2020-update) (CESE 2020a) and could be useful in teacher reflection on how these themes could be incorporated into a teaching program. The statements could also prompt student reflection on their metacognitive processes while learning.

**Please rate how much you agree with these statements**:

* My teacher had confidence that I could achieve and improve in my learning. (CESE 2020a Chapter 1: High expectations)
* I had a clear idea of what I was learning and why. (CESE 2020a Chapter 2: Explicit teaching)
* I used the feedback provided to improve my performance. (CESE 2020a Chapter 3: Effective feedback)
* I understood the feedback on the assessment task. (CESE 2020a Chapter 3: Effective feedback)
* I was able to predict the marks I achieved in the assessment tasks. (CESE 2020a Chapter 5: Assessment)
* The activities in the unit prepared me for the assessment task. (CESE 2020a Chapter 5: Assessment)
* I found the activities in the lessons interesting to me. (CESE 2020a Chapter 7: Wellbeing)
* I made valuable contributions to the class during this unit. (CESE 2020a Chapter 7: Wellbeing)
* I ask questions in class when I don’t understand yet. (CESE 2020a Chapter 7: Wellbeing)

**Optional open-ended prompts**:

* The lessons and/or activities that I most enjoyed were when we … because …
* When the learning was difficult, the strategy I used was …
* If I was giving advice to a student who was starting this unit, I would tell them to …
* If I was giving advice to a teacher who was teaching this unit, I would tell them to …

# Additional information

For additional support or advice, contact the TAS curriculum team by emailing [TAS@det.nsw.edu.au](mailto:TAS@det.nsw.edu.au).

## Further implementation support

Curriculum design and implementation is a dynamic and contextually specific process. The department is committed to supporting teachers to meet the needs of all students. The advice below on assessment and planning for the needs of every student may be useful when considering the material presented in this sample program of learning.

## Assessment for learning

Possible formative assessment strategies that could be included:

* Learning intentions and success criteria assist educators to articulate the purpose of a learning task to make judgements about the quality of student learning. These help students focus on the task or activity taking place and what they are learning and provide a framework for reflection and feedback. [Online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622) can assist implementation of this formative assessment strategy.
* Eliciting evidence strategies allow teachers to determine the next steps in learning and assist teachers in evaluating the impact of teaching and learning activities. Strategies that may be added to a learning sequence to elicit evidence include all student response systems, [exit tickets](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/543), mini whiteboards (actual or [digital](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/575)), [hinge questions](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/560), [Kahoot!](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/621), [Socrative](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/587), or quick quizzes to ensure that individual student progress can be monitored and the lesson sequence adjusted based on formative data collected.
* Feedback is designed to close the gap between current and desired performance by informing teacher and student behaviour (AITSL 2017). Australian Institute for Teaching and School Leadership (AITSL) provides a [factsheet to support evidence-based feedback](https://www.aitsl.edu.au/teach/improve-practice/feedback#:~:text=FEEDBACK-,Factsheet,-A%20quick%20guide).
* [Peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549) is a structured process where students evaluate the work of their peers by providing valuable feedback in relation to learning intentions and success criteria. It can be supported by [online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Browser?cache_id=1d29b).
* Self-regulated learning opportunities assist students in taking ownership of their own learning. A variety of strategies can be employed and some examples include reflection tasks, [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645), [KWLH charts](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562), [learning portfolios](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583) and [learning logs](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583).

The primary role of assessment is to establish where individuals are in their learning so that teaching can be differentiated, and further learning progress can be monitored over time.

Feedback that focuses on improving tasks, processes and student self-regulation is the most effective. Students engaging with feedback can take many forms including formal, informal, formative, summative, interactive, demonstrable, visual, written, verbal and non-verbal (CESE 2020a).

## Differentiation

Differentiated learning can be enabled by differentiating the teaching approach to content, process, product and the learning environment. For more information on differentiation go to [Differentiating learning](https://education.nsw.gov.au/teaching-and-learning/professional-learning/teacher-quality-and-accreditation/strong-start-great-teachers/refining-practice/differentiating-learning) and [Differentiation](https://education.nsw.gov.au/campaigns/inclusive-practice-hub/primary-school/teaching-strategies/differentiation).

When using these resources in the classroom, it is important for teachers to consider the needs of all students in their class, including:

* **Aboriginal and Torres Strait Islander students**. Targeted [strategies](https://education.nsw.gov.au/teaching-and-learning/aec/aboriginal-education-in-nsw-public-schools) can be used to achieve outcomes for Aboriginal students in K–12 and increase knowledge and understanding of Aboriginal histories and cultures. Teachers should utilise students’ Personalised Learning Pathways to support individual student needs and goals.
* **EAL/D learners**. EAL/D learners will require explicit English language support and scaffolding, informed by the [EAL/D enhanced teaching and learning cycle](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald/enhanced-teaching-and-learning-cycle) and the student’s phase on the [EAL/D Learning Progression](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/planning-eald-support/english-language-proficiency). In addition, teachers can access information about [supporting EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/planning-eald-support/english-language-proficiency) and [literacy and numeracy support specific to EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald).
* **Students with additional learning needs**. Learning adjustments enable students with disability and additional learning and support needs to access syllabus outcomes and content on the same basis as their peers. Teachers can use a range of [adjustments](https://education.nsw.gov.au/teaching-and-learning/disability-learning-and-support/personalised-support-for-learning/adjustments-to-teaching-and-learning) to ensure a personalised approach to student learning. Subject specific curriculum considerations can be found on the [Inclusive Practice hub](https://education.nsw.gov.au/campaigns/inclusive-practice-hub).
* **High potential and gifted learners**. [Assessing and identifying high potential and gifted learners](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/assess-and-identify#Assessment1) will help teachers decide which students may benefit from extension and additional challenge. [Effective strategies and contributors to achievement](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/evaluate) for high potential and gifted learners help teachers to identify and target areas for growth and improvement. In addition, the [Differentiation Adjustment Tool](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/implement/differentiation-adjustment-strategies) can be used to support the specific learning needs of high potential and gifted students. The [High Potential and Gifted Education Professional Learning and Resource Hub](https://schoolsnsw.sharepoint.com/sites/HPGEHub/SitePages/Home.aspx) supports school leaders and teachers to effectively implement the High Potential and Gifted Education Policy in their unique contexts.

All students need to be challenged and engaged to develop their potential fully. A culture of high expectations needs to be supported by strategies that both challenge and support student learning needs, such as through appropriate curriculum differentiation (CESE 2020a:6).

## Support and alignment

**Resource evaluation and support**: all curriculum resources are prepared through a rigorous process. Resources are periodically reviewed as part of our ongoing evaluation plan to ensure currency, relevance and effectiveness. For additional support or advice contact the TAS curriculum team by emailing [TAS@det.nsw.edu.au](mailto:TAS@det.nsw.edu.au).

**Differentiation**: further advice to support Aboriginal and Torres Strait Islander students, students learning English as an additional language or dialect (EAL/D), students with a disability and/or additional needs and high potential and gifted students can be found on the [Planning, programming and assessing 7–12](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12) webpage. This includes the [Inclusion and differentiation advice 7–10](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12/inclusion-and-differentiation-advice-7-10) webpage.

**Assessment**: further advice to support formative assessment is available on the [Planning, programming and assessing 7–12](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12) webpage. This includes the [Classroom assessment advice 7–10](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12/classroom-assessment-advice-7-10-). For summative assessment tasks, the [Assessment task advice 7–10](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12/assessment-task-advice-7-10) webpage is available.

**Consulted with**: Curriculum and Reform and subject matter experts

**Alignment to system priorities and/or needs**: [School Excellence Policy](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468)

**Alignment to the School Excellence Framework**: this resource supports the [School Excellence Framework](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468) elements of curriculum (curriculum provision) and effective classroom practice (lesson planning, explicit teaching).

**Alignment to Australian Professional Standards for Teachers**: this resource supports teachers to address [Proficient Teacher Standard Descriptors](https://educationstandards.nsw.edu.au/wps/portal/nesa/teacher-accreditation/meeting-requirements/the-standards/proficient-teacher) 1.1.2, 1.2.2, 1.3.2, 2.1.2, 2.2.2, 2.6.2, 3.2.2, 3.3.2, 3.4.2, 4.5.2, 6.2.2.

**NSW Syllabus**: Software Engineering 11–12

**Syllabus outcomes**: SE-12-01, SE-12-02, SE-12-03, SE-12-04, SE-12-05, SE-12-06, SE-12-07, SE-12-08, SE-12-09

**Author**: TAS, Curriculum Secondary Learners, Curriculum Reform

**Publisher**: State of NSW, Department of Education

**Resource**: sample program of learning

**Related resources**: further resources to support Software Engineering 11–12 can be found on the [TAS curriculum page](https://education.nsw.gov.au/teaching-and-learning/curriculum/tas).

**Professional learning**: relevant professional learning is available through [HSC Professional Learning](https://education.nsw.gov.au/teaching-and-learning/professional-learning) or in the TAS Statewide Staffroom.

**Creation date**: 2024

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# Evidence base

[Software Engineering 11–12 Syllabus](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

[Software Engineering course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

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