



Module 1: Understanding AI

Unit overview

Unit introduction

The Foundations of AI unit is part of the Experience AI educational program, developed by the Raspberry Pi Foundation in collaboration with Google DeepMind. Amid young people's increasingly independent use of these technologies, Experience AI offers engaging and accessible resources on artificial intelligence (AI) and machine learning (ML) for learners aged 11 to 14 to empower them to use AI and ML in informed, responsible ways.

Through the 4 lessons in Module 1, learners explore what AI is, how ML models are developed and trained, and how these technologies are shaping the world around them. They will also examine the risks and responsibilities that come with AI systems, including fairness and bias in data, and the ethical challenges involved in building these rapidly evolving technologies.

Lesson-by-lesson overview

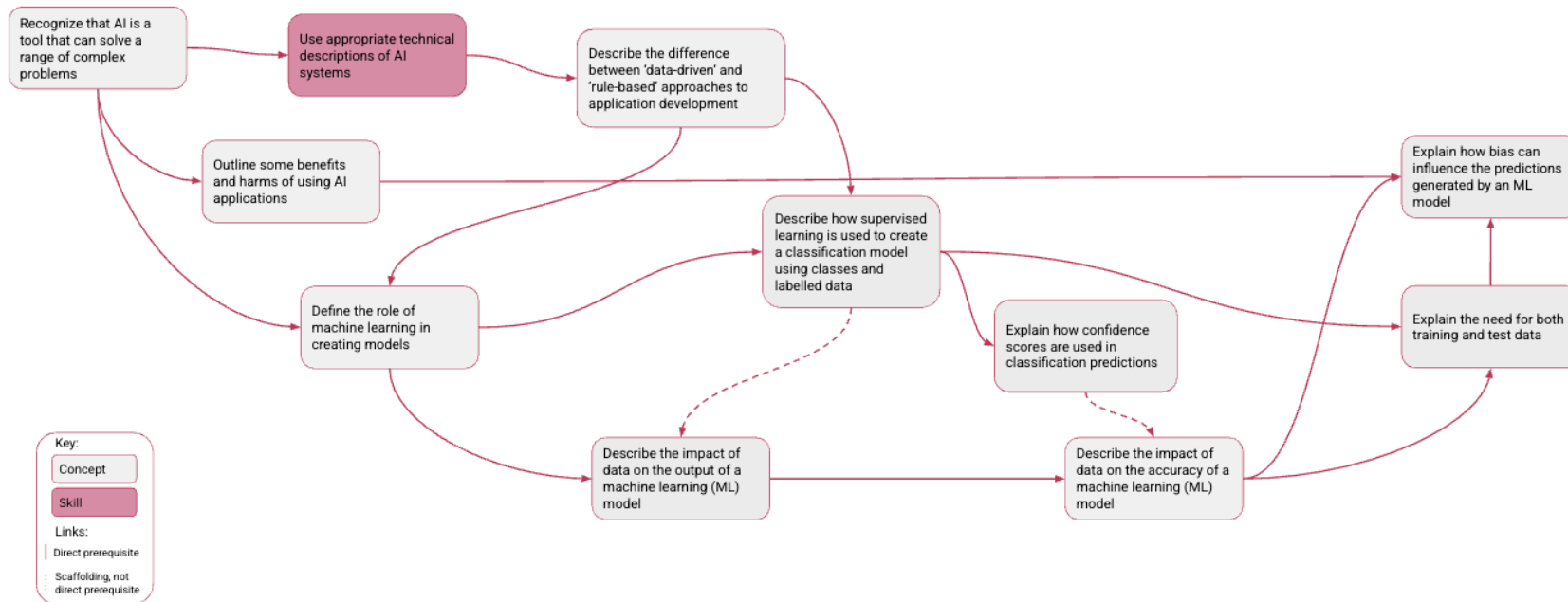
Lesson	Brief overview	Learning objectives
1: What is AI?	Learners will be introduced to the term 'artificial intelligence' (AI) and complete activities to describe what AI is, what AI is not, and how AI systems can be used to benefit society. They will be encouraged to analyze the language that is used to describe AI and to use appropriate and technical terms.	<ul style="list-style-type: none">● Recognize that AI is a tool that can solve a range of complex problems● Outline some benefits and harms of using AI applications



		<ul style="list-style-type: none"> ● Use appropriate technical descriptions of AI systems
2: Machine learning	In this lesson, learners will learn to describe the difference between data-driven and rule-based approaches to solving problems. They will explore how machine learning systems are created using a data-driven approach, including supervised learning.	<ul style="list-style-type: none"> ● Describe the difference between 'data-driven' and 'rule-based' approaches to application development ● Define the role of machine learning in creating models ● Describe the impact of data on the output of a machine learning (ML) model
3: Classification	Learners will explore how machine learning (ML) models are created with supervised learning. They will build their understanding of how labeled training data is used to train classification models by interacting with Quick, Draw!, an interactive AI tool. Finally, they will examine how confidence scores are used in ML model predictions.	<ul style="list-style-type: none"> ● Describe how supervised learning is used to create a classification model using classes and labeled data ● Explain how confidence scores are used in classification predictions
4: Bias in, bias out	Learners will explore how bias can appear in machine learning models due to the data used to train them. They will create their own machine learning model to classify images of apples and tomatoes, and discover how a limited dataset can lead to biased and inaccurate predictions. Finally, they will investigate two types of bias that can appear in training data.	<ul style="list-style-type: none"> ● Describe the impact of data on the accuracy of a machine learning (ML) model ● Explain the need for both training and test data ● Explain how bias can influence the predictions generated by an ML model

Progression

We have carefully considered progression for this unit and how students might progress through the AI concepts included in the lessons. We have produced learning graphs to outline this progression. To learn some of the concepts and skills, students need prior knowledge of others, so the learning graphs show how the concepts and skills are related. The learning graphs are designed for use by teachers.



The learning graphs are provided in three formats to outline how learning progresses against three measures:

- Concepts and skills
- [The SEAME framework](https://rpf.io/blog-seame-framework) (rpf.io/blog-seame-framework)
- [Bloom's Taxonomy](https://rpf.io/blooms) (rpf.io/blooms)

Assessment

Formative assessment

Every lesson includes formative assessment opportunities for you to use, and these are listed in the lesson plan. We include these in every lesson to ensure that you can recognize and address learners' alternate conceptions if they occur. You can use the assessments to decide whether and how to adapt your teaching to suit the needs of the learners you are working with. Formative assessments include the following:

- Activities include questioning, for example:
 - Video clips have questions next to them for students to consider and discuss after the clip
 - Think, pair, share is used in activities throughout the unit
 - Recap questions are used to ensure core concepts from previous lessons are firmly established
- Activities include opportunities for whole-class engagement, for example, thumbs up for true and down for false or multiple choice questions where students can hold up a number of fingers to give their answer
- Worksheets are provided so you can collect responses from students to identify alternate conceptions
- An Activity 1 and Exit ticket are used in each lesson to allow you to check learning and identify whether lesson objectives have been met

Summative assessment

For summative assessment, optional end-of-module multiple choice questions are provided. These can be adapted easily for digital formats such as Google Forms, and they enable quick data capture, allowing you to identify areas of weakness and offer personalized feedback, support, and praise. This assessment data can be included in your school's existing assessment processes. The questions are provided in an assessment document, and the questions and answers are both provided in a separate answers document. The summative assessment has been carefully designed to measure learners' understanding of AI literacy concepts – we have deliberately chosen the wording and appropriate cultural references so that the questions are accessible for learners without relying on their reading and writing skills.

Diagnostic assessment

The summative assessment includes questions that have been designed to represent the learning objectives within the unit. In writing the questions, we have followed the diagnostic assessment approach to ensure that the assessment of the unit is useful to determine both how well your learners have understood the content, and what learners may have misunderstood, if they have not given the correct answers. For each question, the assessment answers document includes feedback that highlights misconceptions that learners may have if they have chosen a wrong answer. This ensures that you know which areas to return to in later units.

Adapting for your setting

As there are no universally agreed levels of assessment, the assessment materials provided are designed to be used and adapted by schools in a way that best suits their needs.

Core principles

Inclusive and ambitious

The resources have been designed to be both **inclusive** and **ambitious**. The content has been created for an international audience, ensuring that young learners from diverse backgrounds find the materials engaging, relatable, and accessible. The resources are aimed to empower all learners, regardless of their social or cultural context, to engage meaningfully with the topics and be inspired to become critical and effective users of AI technologies.

The resources are also designed for non-specialist educators, with all the necessary materials provided, including videos, lesson walkthroughs, various activities, and discussion points, ensuring that no technical background is required.

Time-saving for educators

The resources are designed to save educators time by providing detailed lesson plans, slide decks, worksheets, and more, all of which you could easily adapt to suit the needs of your learners. In line with the current Experience AI offering, these resources are accessible to non-specialist educators and are versatile enough to be used in various settings, including youth clubs and even at home.

Adaptable

The lessons are designed to be adapted to suit your context, the timing of your lessons, and the confidence of your students. The materials are designed to allow you to extend or shrink the activities to suit your needs and give your students more space to explore new concepts and hands-on activities. You can also tailor how the resources are used by your learners, including adapting the type of group work, sharing materials digitally, or printing them for offline use.

Pedagogy

The Foundations of AI resources have been created with research-informed design choices and deliberate pedagogies in mind, which are a result of the ongoing work between learning designers at the Raspberry Pi Foundation, industry experts at Google DeepMind, and researchers at the University of Cambridge and the Raspberry Pi Computing Education Research Centre.

Avoiding anthropomorphism

To support learners in forming accurate mental models of AI and ML technologies, the resources avoid anthropomorphism (rpf.io/anthro-qr) and don't use words that may lead students to misunderstand machines as being human-like in their abilities. For example, rather than saying "AI understands" or "it listens", it is more accurate to describe AI tools as receiving inputs, processing data, and producing outputs. Using this sort of language will support learners to become responsible users and creators of AI technologies.

Computational Thinking 1.0 and 2.0

The resources use the Computational Thinking (CT) 1.0 and 2.0 frameworks (rpf.io/ct2-qr) when teaching learners about AI and ML technologies. While classical programming (CT 1.0) can be described as being rule-based and characterised by strict syntax and step-wise ordered code, ML introduces a data-driven approach (CT 2.0) that leverages vast amounts of data to identify patterns and make predictions. By regularly highlighting the difference between these two frameworks, learners can gain a deeper understanding of how AI systems operate and the impact of different problem-solving approaches.

Lead with concepts

Support learners to gain knowledge through the use of key concepts, terms, and vocabulary, providing opportunities to build a shared and consistent understanding. Glossaries and concept maps, along with regular recap and revision, can support this approach.

Work together

Throughout the lessons, there are multiple chances to encourage learners to work together, in particular using structured paired tasks and discussions. Working together stimulates classroom dialogue, articulation of concepts, and development of shared understanding.

Think, pair, share

Another pedagogy to encourage pair work is to ask a question to the class, and have learners **think** about their opinions and thoughts on the question, then **pair** up and discuss their thoughts before **sharing** their combined ideas with the class.

Unpack, unplug, repack

The resources are designed to support the teaching of new concepts by first unpacking complex terms and ideas, exploring these ideas in unplugged and familiar contexts, then repacking this new understanding into the original concept. This approach, called ‘semantic waves’ (the-cc.io/qr06), can help learners develop a secure understanding of complex concepts.

Challenge misconceptions

Use formative questioning to uncover misconceptions and adapt teaching to address them as they occur.

Make concrete

Bring abstract concepts to life with real-world, contextual examples. This can be achieved through the use of unplugged activities and using carefully crafted real-world examples. Building their own machine learning model, for example, will help to strengthen understanding of the concepts covered.

Websites used in this module


Below you will find a list of websites used in the delivery of the lessons in this module. We recommend that you check the links work in your classroom setting for both teachers and students before delivering the lessons, and confirm that each site is approved for student use by your school or district, before delivering the lessons.

Resource		Lesson	URL
Raspberry Pi Foundation AI activity data	Computer vision	1	ai-activities.raspberrypi.org/computer-vision
	Machine learning model project files	4	ai-activities.raspberrypi.org/project-files
Other student activity websites	Artguru	1	artguru.ai/ai-text-to-image-generator
	Quick, Draw!	3	quickdraw.withgoogle.com
	Machine Learning for Kids	4	machinelearningforkids.co.uk

A series of Raspberry Pi Foundation videos, hosted on YouTube	What is artificial intelligence?	1	rpf.io/xai-1-v1
	What is machine learning?	2	rpf.io/xai-2-v1
	How do machines learn?	2	rpf.io/xai-2-v2
	Machine learning: bias in, bias out	4	rpf.io/xai-3-v1

In addition, these websites are suggested to support teacher subject knowledge:

Resource		URL
Raspberry Pi Foundation pedagogy articles	Pedagogy Quick Read: The effects of anthropomorphisation on students' mental models of AI	rpf.io/anthro-qr
	Pedagogy Quick Read: Computational Thinking 2.0	rpf.io/ct2-qr
	SEAME framework	rpf.io/blog-seame-framework
	Pedagogy Quick Read: Addressing learners' alternate conceptions in computing	the-cc.io/qr19
	Pedagogy Quick Read: Improving explanations and learning activities in computing using semantic waves	the-cc.io/qr06
Further reading	Bloom's Taxonomy	rpf.io/blooms

	Wikipedia article on Deep Blue versus Garry Kasparov	wikipedia.org/wiki/Deep_Blue_versus_Garry_Kasparov
	The intelligent piece of paper from Teaching London Computing	teachinglondoncomputing.org/resources/inspiring-unplugged-classroom-activities/the-intelligent-piece-of-paper-activity

Please give us your feedback!

We'd love to hear how you have used the Experience AI Lessons and what you thought about them.

After using the lessons, please take a few minutes to:

- Share your feedback in our user survey: rpf.io/exai-brf

Your feedback supports us to make Experience AI accessible to everyone, and we really appreciate you giving your time to share what you think.