Raspberry Pi Foundation

Module 2: Solving problems with AI

Unit overview

Unit introduction

The Foundations of AI unit is part of the Experience AI educational programme, 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 5 lessons in Module 2, learners understand the difference between generative and predictive AI, and follow the AI project lifecycle to design, build, and evaluate their own machine learning model. They will also consider ethical issues, apply user-focused design principles, and discover career pathways in AI.

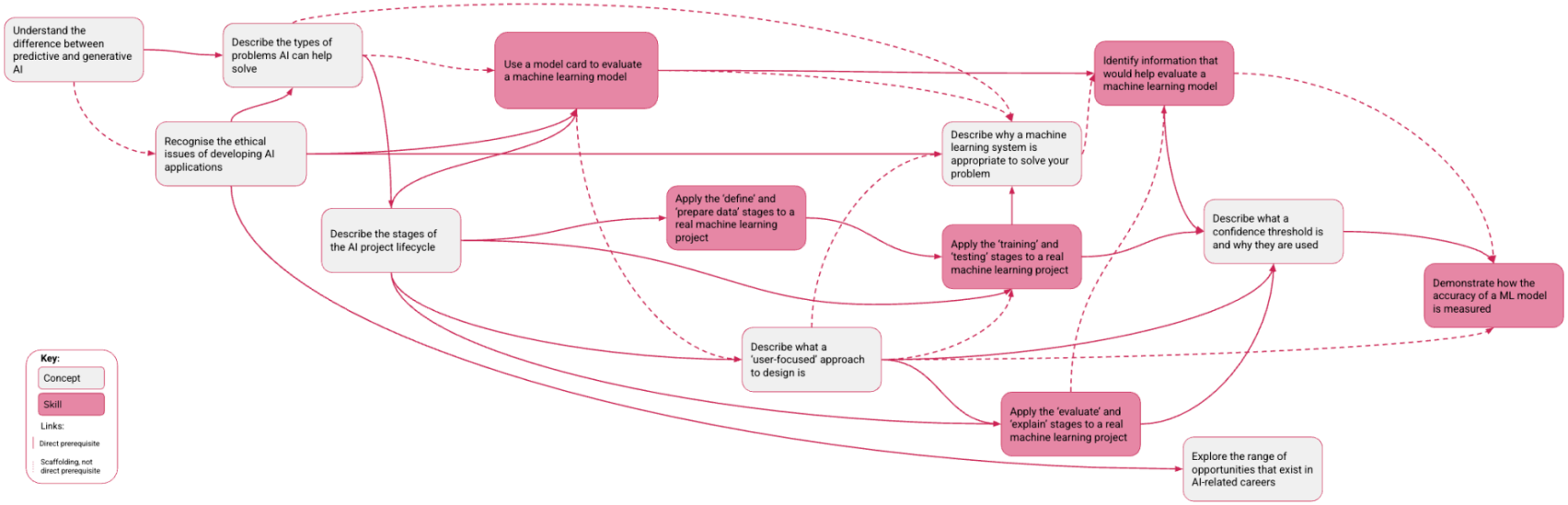
Lesson-by-lesson overview

Lesson	Brief overview	Learning objectives
1: AI around you	Learners will explore the difference between predictive and generative AI and explore how AI is used in everyday life. They will investigate problems they can solve using AI, and reflect on when AI tools are an appropriate solution to a problem.	• Understand the differences between predictive and generative AI • Describe the types of problems AI can help solve • Recognise the ethical issues of developing AI applications
2: Creating AI projects	By the end of this lesson, learners will be able to describe the stages of an AI project lifecycle — from the initial idea to the end use of a model. They will see how real research projects that use AI technologies have used these stages to help people all over the world.	• Describe the stages of the AI project lifecycle • Use a model card to evaluate a machine learning model
3: Solving problems with ML models (part 1)	In this lesson, learners will use the AI project lifecycle to begin creating their own machine learning model to solve a problem of their choice. They will choose a problem and persona from two options. They will be introduced to a 'user-focused' design approach and then prepare their data by splitting it into classes.	• Apply the 'define' and 'prepare data' stages to a real machine learning (ML) project • Describe what a 'user-focused' approach to design is • Describe why a machine learning system is appropriate to solve your problem
4: Solving problems with ML models (part 2)	In this lesson, learners will continue to apply the AI project lifecycle. They will begin to train a machine learning model to solve a problem of their choice and test it. They will learn how accuracy is measured when testing AI models using confidence thresholds.	• Apply the 'training' and 'testing' stages to a real machine learning project • Describe what a confidence threshold is and why they are used

		• Demonstrate how the accuracy of an ML model is measured
5: Model cards and careers	In this lesson, learners will evaluate and explain their AI model using model cards, which document its purpose, test results, and limits. They then explore the range of career opportunities in AI and fields using AI applications, including roles at Google DeepMind and areas of personal interest.	• Apply the 'evaluate' and 'explain' stages to a real machine learning project • Identify information that would help evaluate a machine learning model • Explore the range of opportunities that exist in AI-related careers

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 (rpf.io/blog-seame-framework)
- Bloom's Taxonomy (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 recognise 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 personalised 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 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.

Resource		**Lesson**	**URL**
Other student activity websites	AI Quests	6	rpf.io/quests
	Machine Learning for Kids	8	machinelearningforkids.co.uk
A series of Raspberry Pi Foundation videos, hosted on YouTube	How do AI applications get made?	6	rpf.io/xai-5-v1
	Choosing the right model for your AI application	6	rpf.io/xai-6-v1
	What's it like to work in AI?	9	rpf.io/xai-6-v2

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

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.