Google DeepMind | Raspberry Pi Foundation

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Experience AI: lessons on AI for middle schools and localised for international use

Experience AI

Experience AI consists of six free, one-hour classroom lessons, developed with Google DeepMind, that introduce AI and Machine Learning (ML) to 11–14-year-olds [1]. There are no specific hardware or software requirements. The web app, Machine Learning For Kids [2], is used for activities. As well as key concept explanations, lesson plans, and teaching materials, teachers are provided with learning graphs that give learning progression.

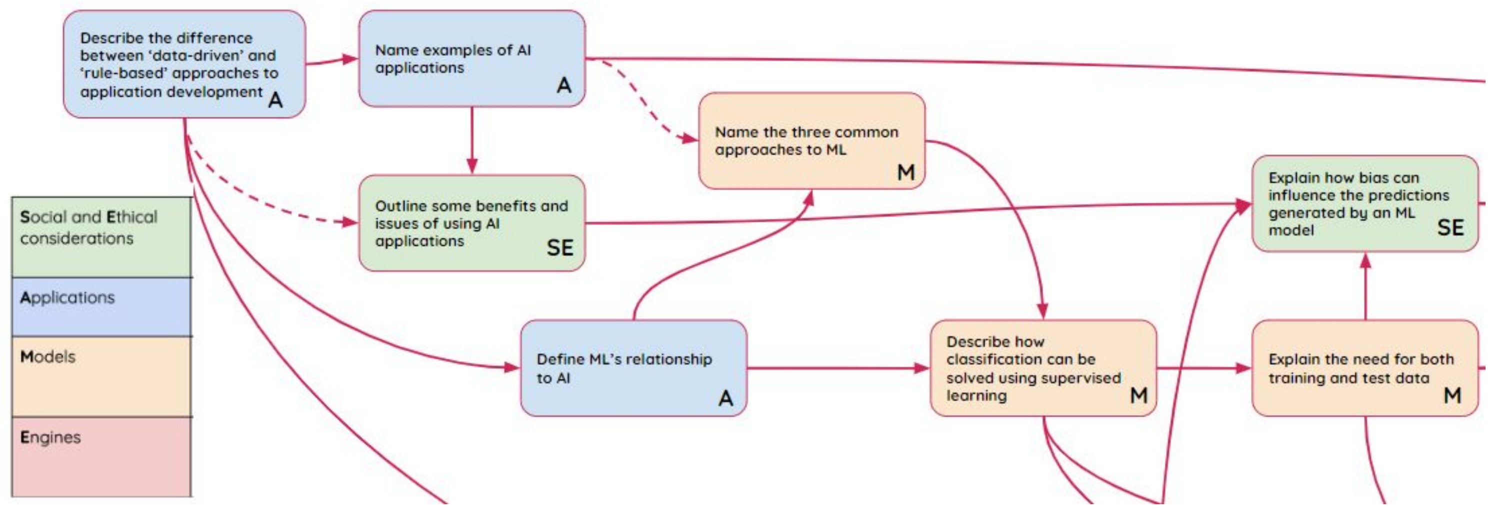

Figure 1: Part of the learning graph, categorised by SEAME levels [1].

Key concepts include: Data-driven (Figure 2) vs rule-based approaches to problem solving, AI applications, ML models, bias and ethics, decision trees, the AI data life cycle and careers in AI. Sub-concepts include (but not exhaustive), prediction, supervised learning, unsupervised learning, reinforcement learning, ML classification, ML training, ML explainability and ML model cards.

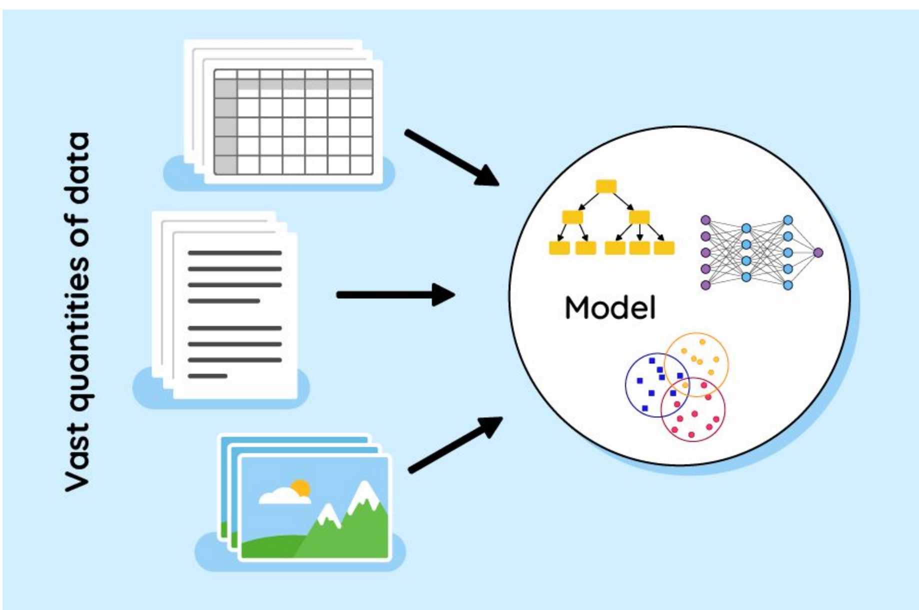

Figure 2: Explaining the data-driven rather than rule-based approach to problem solving is key [1].

References

[1] Raspberry Pi Foundation. 2023. Experience AI website. http://experience-ai.org

[2] Lane, D. 2021. Machine Learning for Kids: A Project-Based Introduction to Artificial Intelligence. San Francisco, US: No Starch Press.

[3] Salles, A., Evers, K., Farisco, M. 2020. Anthropomorphism in AI. AJOB Neuroscience, 11(2): 88–95.

[4] Tedre, M., Denning, P., Toivonen, T. 2021. CT 2.0. In: 21st Koli Calling International Conference on Computing Education Research. ACM, NY, USA. https://doi.org/10.1145/3488042.3488053

[5] Waite, J., Tshukudu, E., Cucuiat, V., Whyte, R., Sentance, S. 2023. Towards a framework for learning content analysis in k-12 ai/ml education. In: 2023 IEEE Frontiers in Education Conference (FIE). pp. 1–5. IEEE Computer Society, CA, USA. https://doi.org/10.1109/FIE58773.2023.10343368

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Design principles

A set of design principles underpin the resources, including developing a core vocabulary, **avoiding anthropomorphism** [3], **Computational Thinking 2.0** [4], using the **SEAME** framework [5], and threading real world examples throughout, with the aim of increasing underrepresented student participation in technology.

Anthropomorphisation may 1) lead to incorrect mental models about AI systems, 2) lead to relationship-forming and unintended influence or purposeful manipulation, exacerbating racism and sexism in society, 3) lead to overestimating AI system capability, and 4) distract responsibility away from the people who create AI systems and delegate responsibility to an imagined "AI agent" [6].

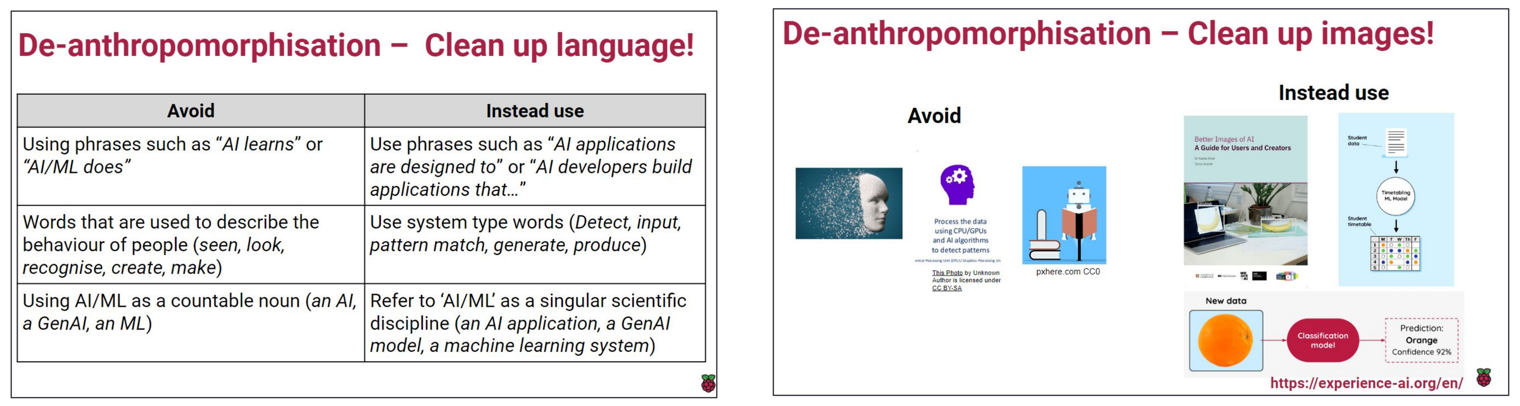

Figure 3: Avoiding anthropomorphisation for language and images.

Computational Thinking 2.0 (CT2.0) has been suggested by Tedre, Denning & Toivonen [4] as an important way of framing how we think about data-driven problem solving (Table 1) that students and teachers must understand alongside current CT views.

CT 1.0 (rule-driven)	CT 2.0 (data-driven)
Problem-solving workflows	
Formalise the problem	Describe the job and collect data from the intended context
Design an algorithmic solution	Filter and clean the data. Label the data
Implement a solution in a stepwise program	Train a model from the available data
Compile and execute the program	Evaluate and use the model

CT 1.0 (rule-driven)	CT 2.0 (data-driven)
Conceptual changes in computing education	
Correctness can be formally proven	Models may display higher or lower confidence, efficiency
Debugging: Tracking and tracing	Evaluate the model wrt predictions
Deductive problem-solving	Inductive problem-solving
Transparent structure	Black-boxed
Stepwise, deterministic, discrete flow of program through states	Parallel, possibly nondeterministic passing data through a network
Structured data	Unstructured data

Table 1: Comparison of CT 1.0 and CT2.0 [4]

SEAME is a simple framework that we use to frame learning objectives, activities and teacher training (Figure 4). The levels are not intended to control the order that one learns about concepts, they simply help situate learning [5].

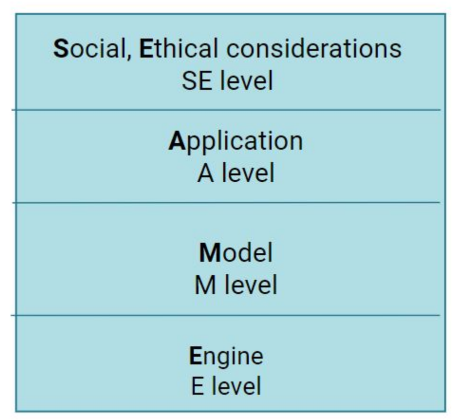

Figure 4: The SEAME framework [5].

Localisation: More than translation

As Experience AI is now international, local partners are key to localisation, training and dissemination (Figure 5).

Figure 5: Current international partners for Experience AI [1].

Converting materials for use in another country is more than language translation. Key adaptation challenges have been a) finding local culturally appropriate contexts that resonate with students' everyday lives and that meet the learning objective, and b) dealing with vocabulary that does not easily translate, e.g. bias. To ensure design decisions are maintained in country rollouts, partners have been trained in the resource design principles.

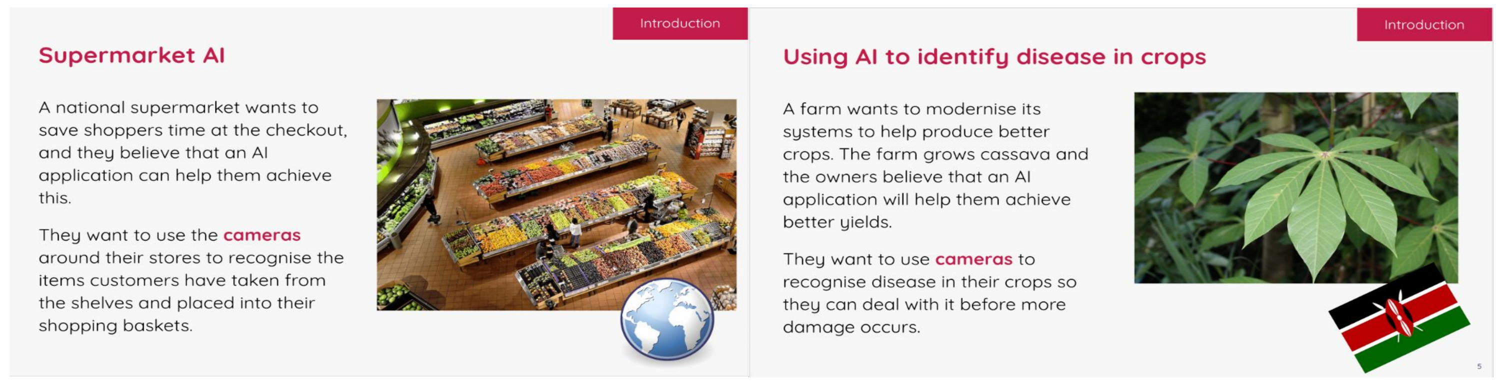

Figure 6: Contexts must be localised, e.g. from UK supermarket AI to using AI to identify crop disease in Kenya [1].

AI & Biology: It's all about the biology

With the UK's Royal Society of Biology Association's Biology Education Research Group, a supplemental stand-alone lesson has been designed and taught in schools. Learning objectives are: 1) Recall the importance of maintaining biodiversity, 2) Describe why AI is a useful tool in helping to maintain biodiversity, 3) Discuss some of the benefits and drawbacks of using AI.

The activities are: 1) Classify images of animals in the Serengeti, 2) Discuss the challenges of this, 3) Discuss the impact AI has on supporting conservationists and maintaining biodiversity.

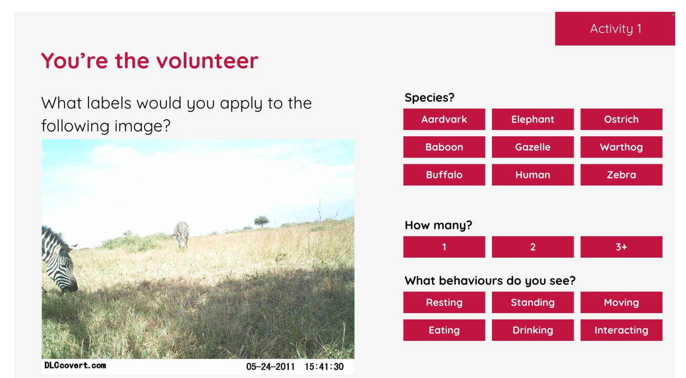

Figure 7: Biology activity [1].

Critical lessons learned were: 1) It is key to work with discipline experts, 2) Use vocabulary precisely, 3) Be led by the curriculum requirements of the lead subject (in this case, biology).