Becoming the machine: An experiential guide to algorithmic thinking

MAV 2024

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What is algorithmic thinking?

What do you think students think algorithmic thinking is?

Student responses



"I have no idea"

"Is it something like....forget about it I have no clue"

"Something I'll never be capable of"

"Thinking in a pattern...it's just a guess though"

What do you think society thinks algorithmic thinking is?

Who really cares anyway?

VCAA definition

Algorithms

A sequence of instructions that can be performed.

So what area of the curriculum do algorithms or algorithmic thinking sit?

Filter by

"algorithmic"

Curriculum areas

Reset all

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Chinese

Civics and Citizenship

Critical and Creative Thinking

Dance

Design and Technologies

Digital and Technologies

Drama

Economics and Business

English

Ethical Capability

Apply filters

Band description in Digital Technologies, Levels 7 and 8

Digital Technologies | Levels 7 and 8

3 results found for "algorithmic".

Students represent and communicate their **algorithmic** solutions using flowcharts and pseudocode.

Learning in Digital Technologies

Digital Technologies

This begins with the description of tasks and concludes in the accurate definition of problems and their **algorithmic** solutions.

Learning in Mathematics

Mathematics

Mathematical problem-solving and investigation draws on the processes of mathematical modelling, computational and **algorithmic** thinking, statistical investigation, probability experiments and simulations.

Q

Curriculum areas

173 results found for 'algorithmic thinking'.

Chinese

- Civics and Citizenship
- Critical and Creative Thinking
- Dance
- Design and Technologies
- Digital and Technologies

🗌 Drama

- Economics and Business
- English
- Ethical Capability

Apply filters

VC2CC4M02

Critical and Creative Thinking | Metacognition | Levels 3 and 4

the use of **thinking** processes to facilitate **thinking**, including for problem-solving, and verbal and non-verbal strategies for representing **thinking** processes

VC2CC8M02

Critical and Creative Thinking | Metacognition | Levels 7 and 8

broad strengths and limitations of thinking processes in different contexts, including problem-solving

VC2CC2M02

Critical and Creative Thinking | Metacognition | Foundation to Level 2

verbal and non-verbal strategies to express and describe thinking processes, including for problem-solving

SO WHAT???

"<u>Integrated learning</u> combines the subject matter of two or more subjects into a joint learning experience.

For example, teaching Science using an Engineering process (design-based learning). This approach recognises that each STEM subject has overlapping, shared skills to offer. For example, each STEM subject supports systematic problem-solving and critical analysis skills."

At its base, **algorithmic thinking** involves the integration of many subject areas – For example, most STEM projects involve at least 2 subject areas that have been integrated.

Many involve all 4 areas, depending on the complexity of the investigation. Some STEM projects may involve more. It is all about making the connections to other areas of the curriculum.

BUT THIS IS HARD

OR IS IT???

Note to self: Pause for dramatic effect

What we hear from teachers in our schools...

Teachers often mention how **difficult** and **time consuming** it is to plan units of work in the way the Victorian Curriculum intended:

Connected across learning areas and repeated knowledge and skills within a variety of appropriate contexts.

"This curriculum design assumes that knowledge and skills are transferable across the curriculum and therefore are not duplicated."

What we hear from teachers in our schools...

Teachers often talk about rigorous assessment and data collection requirements that are leading to curriculum content being taught in isolation and restricting their ability to observe achievement standards within lessons or units of work.

The Victorian Curriculum F–10 is structured as a continuum across levels of learning achievement not years of schooling. This enables the development of targeted learning programs for all students, where the curriculum is used to plan in relation to the actual learning level of each student rather than their assumed level of learning based on age.

Standards and levels http://victoriancurriculum.vcaa.vic.edu.au/overview/curriculum-design/standards-and-levels

What we hear from teachers in our schools...

Teachers talk of planning in a siloed way. Where they often spend facilitated planning sessions with a focus on one curriculum area, then a separate planning session on another curriculum area.

Secondary teachers often talk of limited opportunities to work across curriculum areas and duplication of the intended curriculum often results.

What Policy tells us...

The intentional design of the Victorian Curriculum "assumes knowledge and skills are transferable across the curriculum and therefore not duplicated"

(Victorian Curriculum F-10, 2018)

For example, where skills and knowledge such as asking questions, evaluating evidence and drawing conclusions are defined in Critical and Creative Thinking, these are not duplicated in other learning areas such as History or Health and Physical Education. It is expected that the skills and knowledge defined in the capabilities will be developed, practised, deployed and demonstrated by students in and through their learning across the curriculum. (Victorian Curriculum F-10, 2018).

Furthermore, the Victorian Curriculum emphasises the need for Literacy, Numeracy and ICT capabilities to be **embedded throughout** the other curriculum areas and not taught in isolation.

There is considerable research that identifies the importance of the teaching of literacy and numeracy and ICT in the context of the different curriculum areas. It is both appropriate and necessary that the literacy, numeracy and ICT requirements be embedded in the curriculum areas

Curriculum Design http://victoriancurriculum.vcaa.vic.edu.au/overview/curriculum-design/learning-areas-and-capabilities

Necessity is the mother of invention

Plato



Unplugged learning

Now for something completely different



https://www.csunplugged.org/en/topics/sorting-networks/reinforcing-numeracy-through-a-sorting-network/

Enabling and extending....





https://www.csunplugged.org/en/topics/sorting-networks/reinforcing-numeracy-through-a-sorting-network/

Distance from sun

Here are the planets listed by their average distance from the Sun, with Earth's distance represented as **1.00** (Astronomical Unit - AU):

- 1. Mercury: 0.39 AU
- 2. Venus: 0.72 AU
- 3. Earth: 1.00 AU
- 4. Mars: 1.52 AU
- 5. Jupiter: 5.20 AU
- 6. Saturn: 9.58 AU
- 7. Uranus: 19.22 AU
- 8. Neptune: 30.05 AU

Temperature

Here are the average surface or atmospheric temperatures of the planets in the solar system (according to NASA)

- **Venus**: 464°C
- Mercury: 167°C
- **Earth**: 15°C
- **Mars**: -65°C
- Jupiter: -110°C
- **Saturn**: -140°C
- **Uranus**: -195°C
- Neptune: -200°C



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Here are the planets listed in order of size (diameter) relative to Earth:

- **1. Jupiter**: 11.21
- 2. Saturn: 9.45
- 3. Uranus: 4.01
- 4. Neptune: 3.88
- 5. Earth: 1.00
- 6. Venus: 0.95
- 7. Mars: 0.53
- 8. Mercury: 0.38

Number of moons

Here are the planets listed by the number of moons they have (as of the most recent counts):

- 1. Saturn: 145 moons
- 2. Jupiter: 95 moons
- 3. Uranus: 27 moons
- 4. Neptune: 14 moons
- 5. Mars: 2 moons
- 6. Earth: 1 moon
- 7. Mercury: 0 moons
- 8. Venus: 0 moons



What opportunities for mathematical reasoning are evident in this task?

How might you modify it for your learners?

Your Turn!



On your tables are a selection of stimulus prompts to consider different 'inputs' you may present to the students.

Give the prompts a test run on the A3 sheets provided.

Be prepared to share an idea and with with the main group.

In random groups of three discuss:



How has your understanding of algorithmic thinking changed?

What is one thing you might do in your maths classroom next week about algorithmic thinking?

Q & A

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Don't forget to fill in your feedback for this workshop via the conference app:





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