



Using artificial intelligence and learning analytics for student competency-development

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About myself

Vitomir Kovanovic

- Associate Director: Research Excellence at Centre for Change and Complexity in Learning (C3L)
- Senior Lecturer in Learning Analytics at UniSA Education Futures

How can digital technology support teacher decision-making?

- Co-editor of the Journal of Learning Analytics (JLA)
- 2021 Young Tall Poppy for SA
- 2019 Top Early Career Researcher in Australia (The Australian)

Centre for Change and Complexity in Learning (C3L)



Understanding complexities of learning with digital technologies, AI, and its impact on broader society

www.unisa.edu.au/research/c3l

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Professor Maarten De Laat

Centre Director



Associate Professor Negin Mirriahi

Associate Director: Research Development and Translation, Education Futures



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Dr Florence Gabriel

Lecturer in STEM Education, Education Futures



Dr Rebecca Marrone

Lecturer, Education Futures



Dr Abhinava Barthakur

Postdoctoral Research Fellow, Education Futures



Recent projects

- **Learner Profiles**
- AI playground
- AI literacy courses
- Feedback automation
- Self-regulated learning trial



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THE GENEVA
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St Michael's
COLLEGE



Session outline

- Changes in Education and Current Drivers
- Role of Technology
- AI and Learning Analytics
- Teaching & Assessing Complex Competencies
- How AI and Learning Analytics can support Competency Development
- Challenges and opportunities
- Prospects for the future

Changes in education landscape

- Quiet revolution in education
~ 20-30 years ago
- Mainly driven by the
technologies



Classroom in the 1970s



Classroom in the 1990s



Classroom in the 2020s



Classroom in the 2020s



Changes in education landscape

- Job mobility
- Lifelong learning and upskilling
- Artificial Intelligence & Industrial Robots
- Alternative educational providers
- Preparing for workplace



Societal needs

- Increasing social mobility
 - Education key factor
- Expand access to higher ed
 - More flexible and personalised modalities
- Focus on skills employers want
 - Equip students with generalisable skills
- Demands for accountability
 - Demonstrate student attainment of skills and competencies



Jobs of the future

Learning from, working with and leveraging value from technologies

The future of work in Australia...



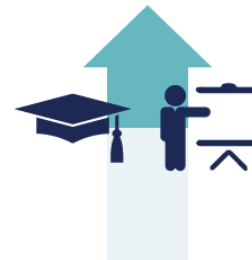
Australians will need **new skills** to adjust to the future of work. **By 2040** the average Australian will spend an additional

 **3 hours** per week

in education and training –

a **33%** increase

across their lifetime.



The most valuable skills will be those that **complement, rather than compete** with automation and artificial intelligence.

The fastest growing skills are the **uniquely human traits** that machines cannot easily replicate such as:

adaptability



team work



creativity



integrity



Role of teachers

“There is no doubt that AI will revolutionize the delivery and management of education and learning, ... And while we believe that teachers will not be replaced by machines by 2030, we still need a dynamic review of how AI will transform teachers’ roles.”

UNESCO, April, 2019

Growing complexity of teaching profession

- How to ensure students are well-prepared for the future?
- How to personalise student learning?
 - One size does not fit all



Growing complexity of teaching profession

- How to capture learning progressions?
 - Just measuring academic grades is not enough
- How to support teachers in dealing with growing complexity

At the same time...

- Ensure year of learning for each student
- Monitor learning progressions
- Demonstrate attainment of critical skills



To make things worse

- Decreasing funds for education
- Teacher shortage
- Casualisation of the teaching workforce
- COVID-19
- Decreasing PISA scores

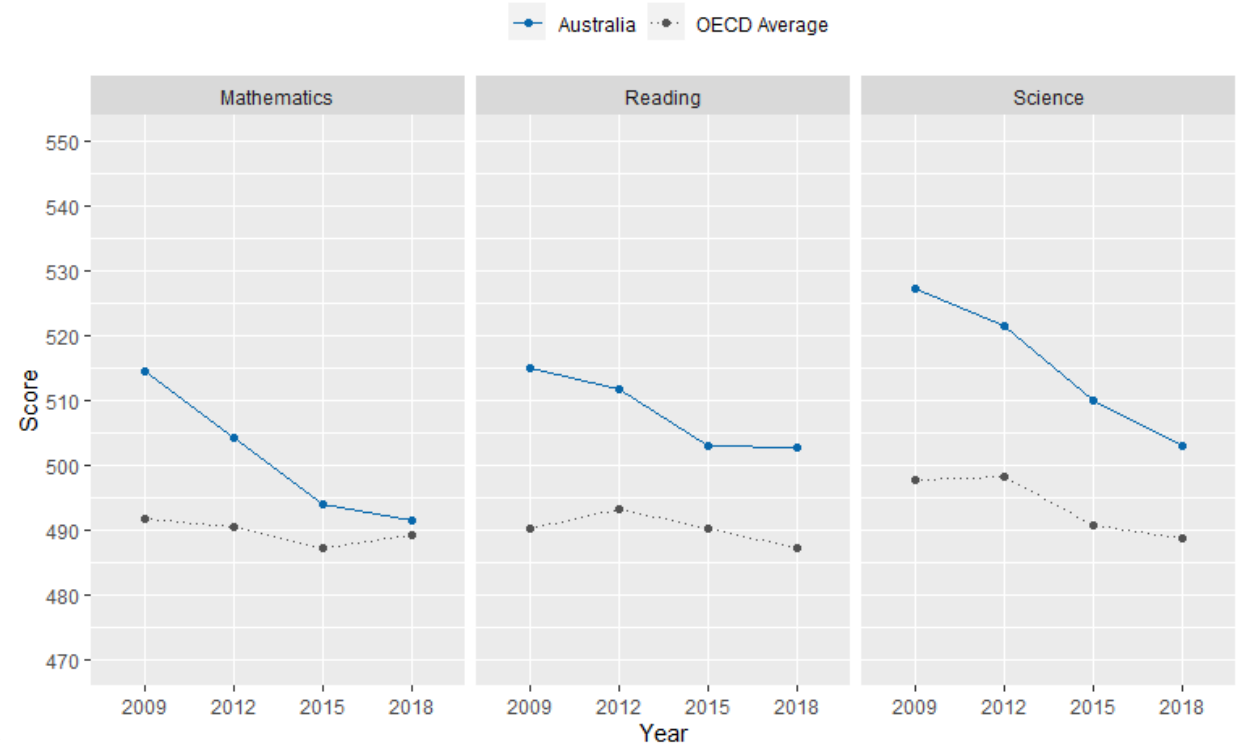
'Everyone's bailing': Australian teachers speak on stress and uncertainty of increasing casual contracts

Teachers tell Guardian Australia contract work and poor conditions are driving people away from classrooms



To make things worse

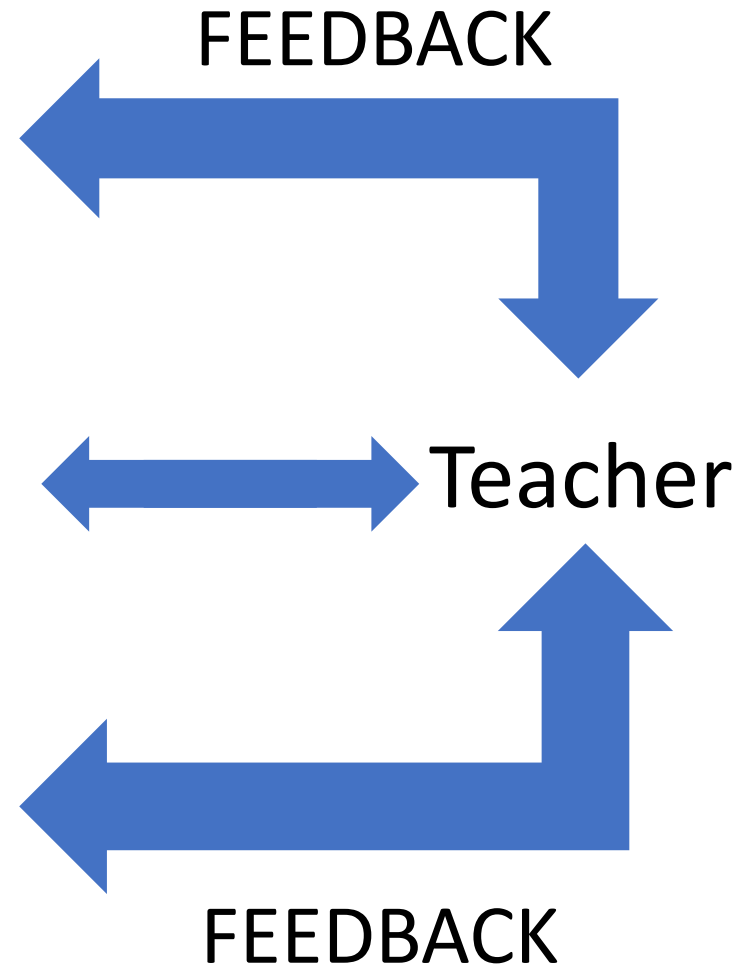
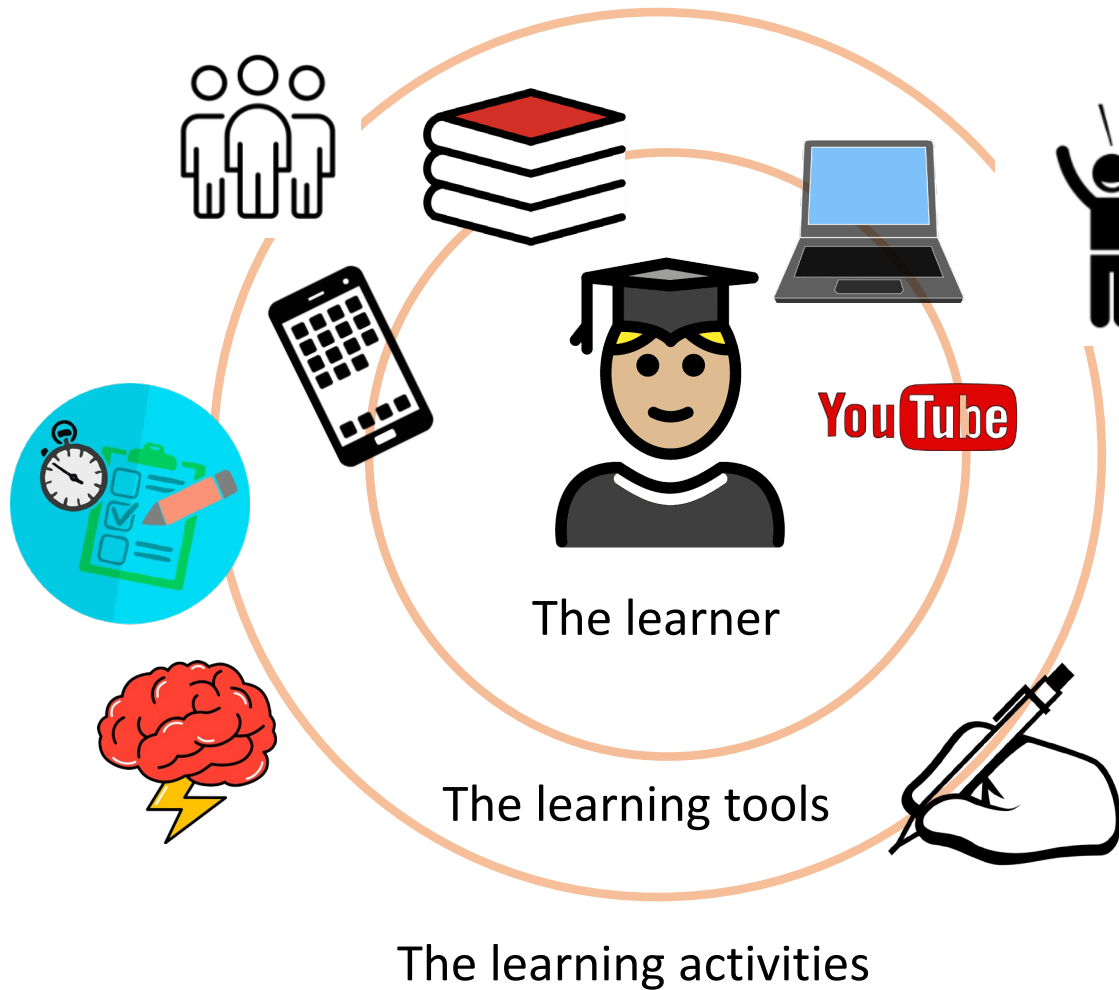
- Decreasing funds for education
- Teacher shortage
- Casualisation of the teaching workforce
- COVID-19
- Decreasing PISA scores



Turning towards technology

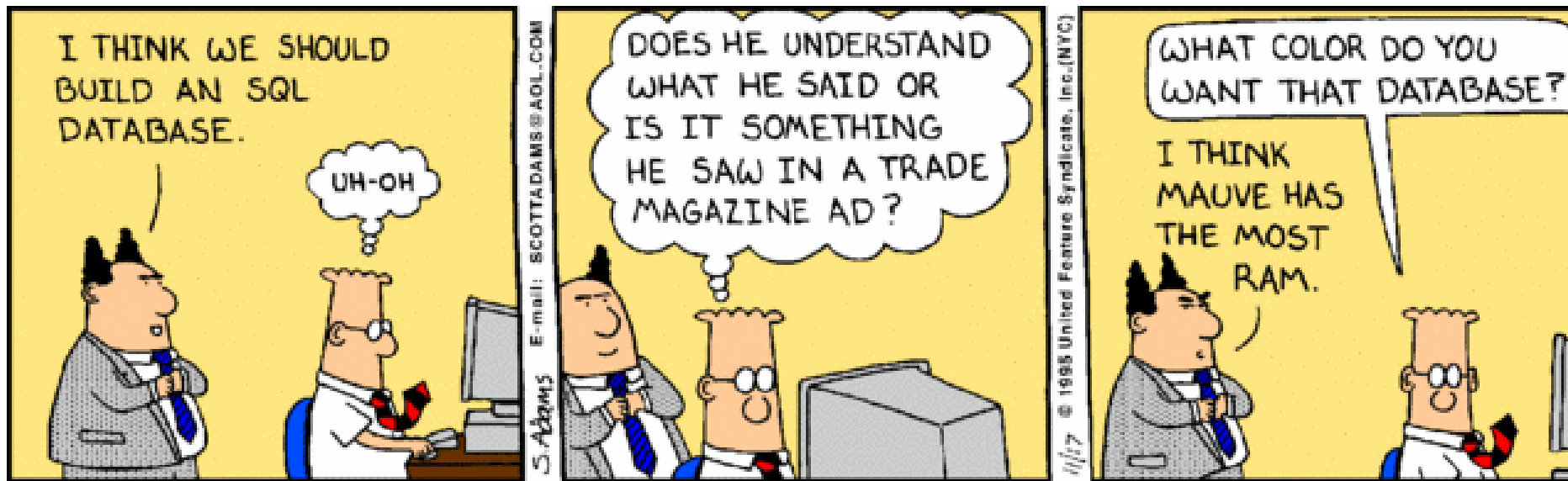
- Educational technologies allow to
 - Collect data in a systematic manner
 - Personalise learning
 - Detect weaknesses and places for intervention
 - Automate routine activities

Digital learning



Pedagogy first

- Needs to be pedagogically informed inclusion of technology
- Technology for technology sake a common pitfall



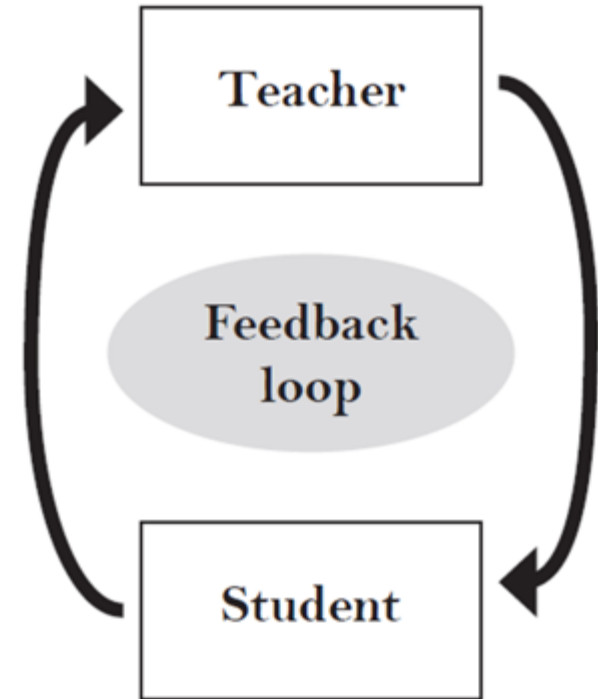
Learning analytics

- Use of digital data to understand and improve learning
 - Prediction of students at-risk
 - Dashboards & visualisations
 - Automated feedback
 - Learning personalisation
 - Career planning
 - Content recommendation
 - Decision support
 - Curriculum improvement
 - Monitoring growth



Feedback loops

- Feedback loops are currently weak
- Learning analytics (& AI) need to strengthen the feedback loops



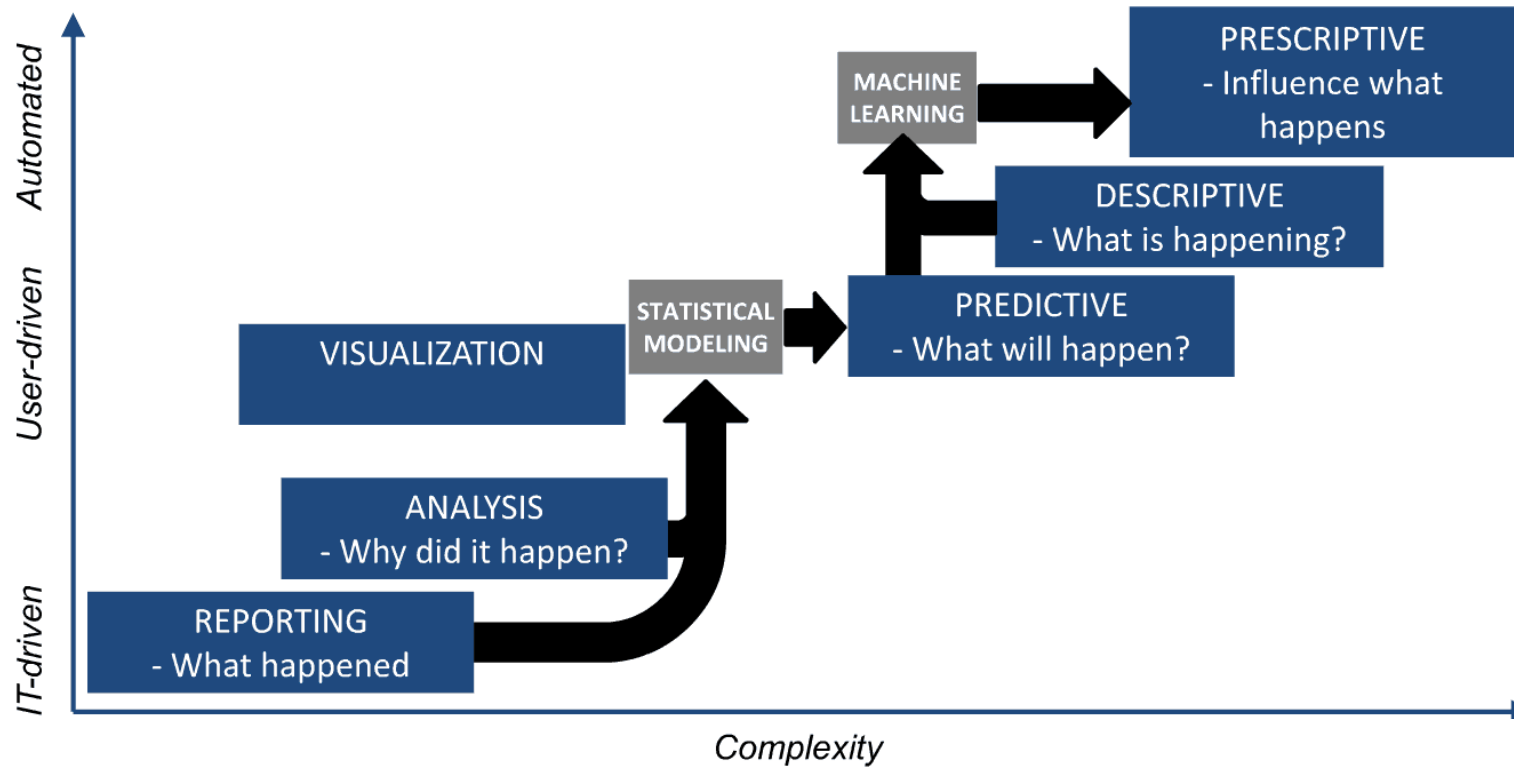
Personalisation

- Adjust to students' knowledge, needs, and motivation
- Different forms of personalisation over time
- Learner profiles latest 'hot' topic today
- Longer-term outlook than other personalisation technologies



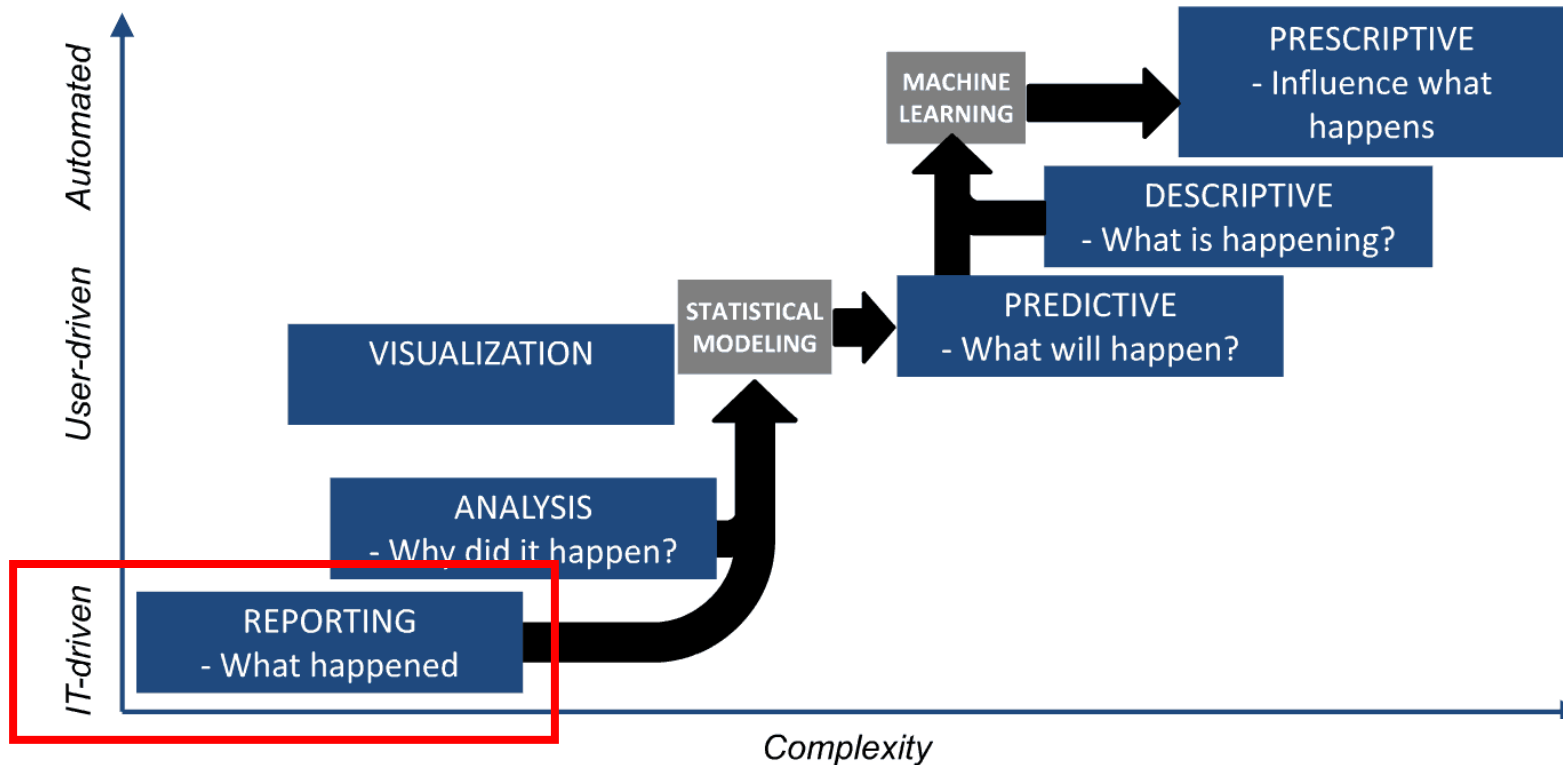
Learning analytics

- Different levels of complexity



Learning analytics

- Most schools focus on reporting



Current situation in schools

- More and more data being collected at schools
- Data often poorly organised and managed
- Data in independent silos
- Limited use of data to support teaching
- No longitudinal insights into learning development



THE DATAFICATION OF EDUCATION

Edited by Juliane Jarke and Andreas Breiter



Learner profiles

- Practical adoption of learning analytics in schools
- Monitor learning progressions and complex competency development
- Teacher professional development in data and analytics
- Data informed decision-making for school teachers



Learner profiles

- The latest approach to personalisation
- Could include
 - Knowledge
 - Skills
 - Competencies/capabilities
 - Beliefs
 - Attitudes
 - Wellbeing
 - Motivation
 - Prior knowledge
 - Basic demographics
 - Attendance
 - Standardized test scores
 - Behavior



Learner profile pilot

- Integration of data is essential for understanding student learning
- Explicit focus on teachers rather than administrators
 - Later: Support school management through the aggregation of data
- Focus on learning, not accreditation
- Identify students who are falling behind



Learner profile pilot

Wide range of data

- Grades
- Standardised tests
- Attendance
- Skills & Competencies
- Wellbeing
- Use of digital tools and services (LMS, Library)
- Extracurricular activities
- Learning progressions over time



Learner profile pilot

- Include staff early in design process
 - Need to get input from teachers on what matters to them
 - Identify challenges and barriers for project's adoption



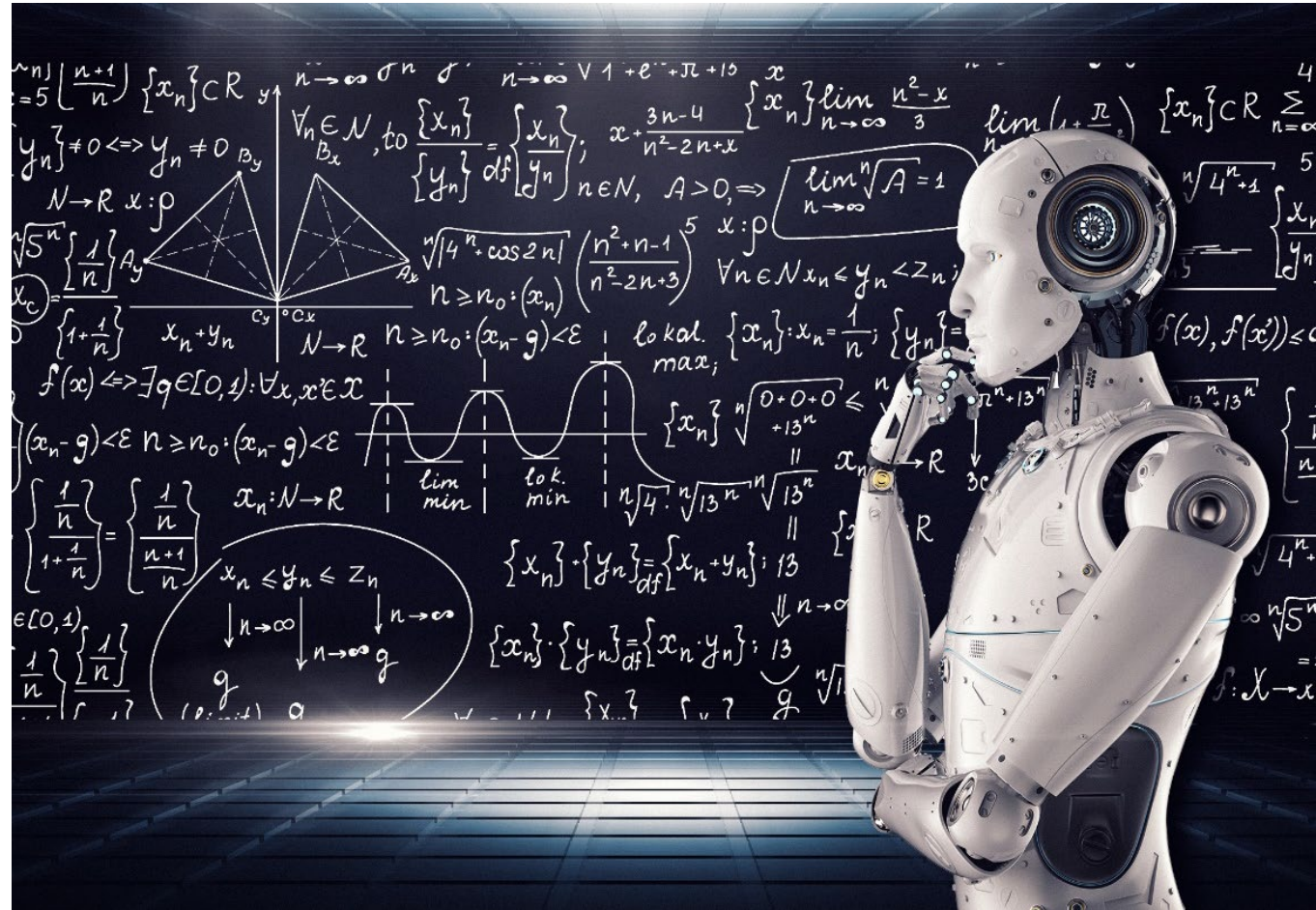
Learner profile pilot: Early results

- Positive feedback from teachers
- Identified students that were struggling that would otherwise be missed
- Increasing interest in wellbeing



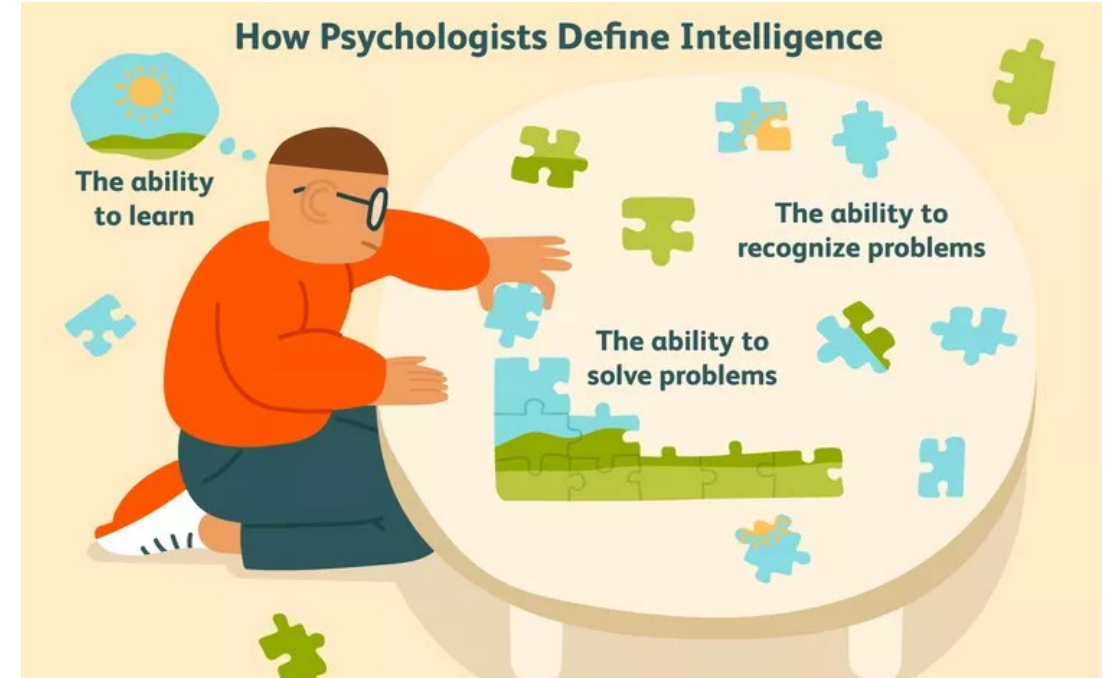
What is artificial intelligence?

Making intelligent machines, especially intelligent computer programs.



What is intelligence?

- Ability to learn
- Ability to adapt
- Ability recognise patterns
- Ability to solve problems
- Self-awareness?



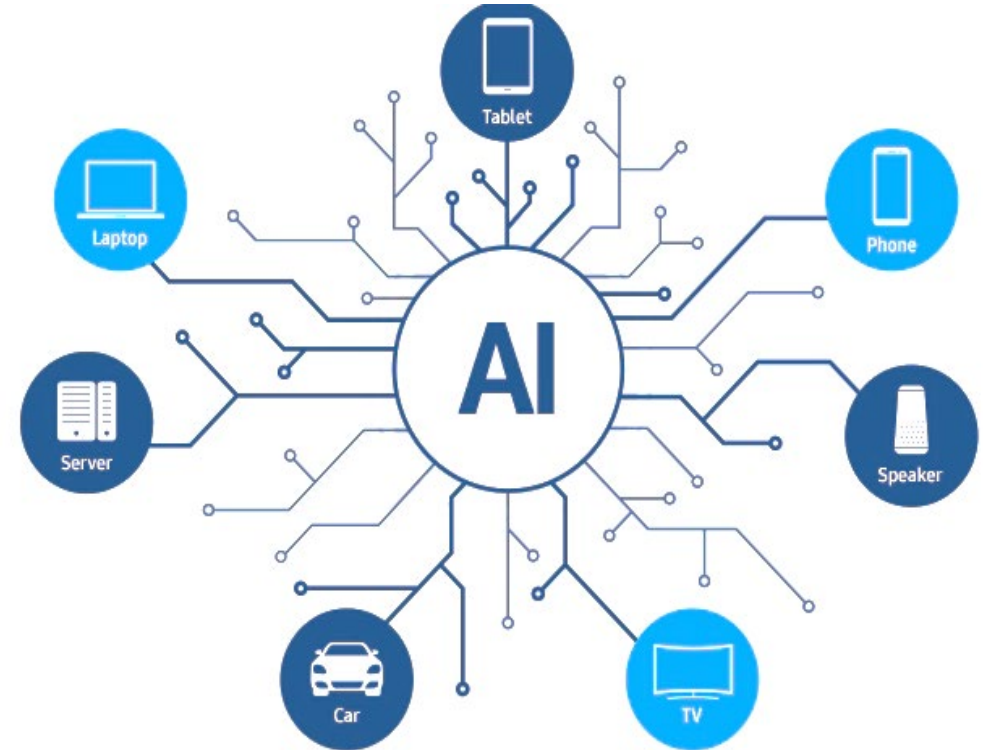
Two flavours of AI

Symbolic AI

- Based on logic
- Inductive and deductive reasoning
- Involves clever “searching” for a solution

Machine Learning

- Figuring rules from data
- Less formal
- Messy and inconsistent



History of AI part 1: 'Symbolic' AI

1940s–1950s

- Turing's "Computing Machinery and Intelligence" and Turing's test
- Early chess playing programs, checkers, geometry solving problems, theorem provers
- This will be easy: 10 years from now, AI will beat human in chess

1960s–1970s

- Dose of reality: Making AI is actually not so easy

1980s–1990s

- AI Winter. AI was not popular anymore
- Neural networks need a lot of data
- Focus on capturing knowledge manually
- Deep blue defeated Kasparov – a lot of buzz generated

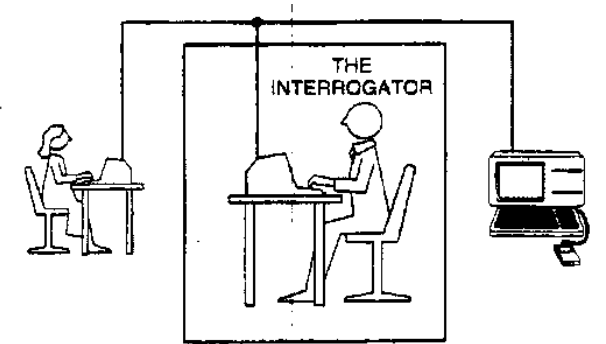


Figure 1.1 The Turing test.

History of AI part 2: 'Machine Learning' AI

2000s–2010s

- Let AI learn itself from data – no need to manually capture knowledge
- Internet and digitalisation brought a lot of data
- Cloud computing brought power
- Deep learning
 - Large neural networks with a lot of data

2020s and beyond

- Solving the problem of explainability
- How to best use these systems?

What is 'Learning' in Machine Learning

Suppose we want to estimate house value

Original idea: Talk to experts

It depends on

- Size of house
- Size of lot
- Location
- Type (House/Apartment/Townhouse)
- On a corner?
- Number of rooms
- Room layout
- How old
- # parking spots
- Pool?
- Proximity of good schools
- Public transport
-

What is 'Learning' in Machine Learning

We build a model of things that affect house price

Price = size (sqm) * ? + rooms * ? + pool (y/n) * ?

What is 'Learning' in Machine Learning

We build a model of things that affect house price

Price = size (sqm) * ? + rooms * ? + pool (y/n) * ?

Expert: each sqm increases the price by ~ \$3,000

What is 'Learning' in Machine Learning

We build a model of things that affect house price

$$\text{Price} = \text{size (sqm)} * ? + \text{rooms} * ? + \text{pool (y/n)} * ?$$

Expert: each sqm increases the price by ~ \$3,000

$$\text{Price} = \text{size (sqm)} * 3,000 + \text{rooms} * ? + \text{pool (y/n)} * ?$$

What is 'Learning' in Machine Learning

Get past sales data

| Price | Floor space | Rooms | Lot size | Appartment | Row house | Corner house | Detached |
|--------|-------------|-------|----------|------------|-----------|--------------|----------|
| 250000 | 71 | 4 | 92 | 0 | 1 | 0 | 0 |
| 209500 | 98 | 5 | 123 | 0 | 1 | 0 | 0 |
| 349500 | 128 | 6 | 114 | 0 | 1 | 0 | 0 |
| 250000 | 86 | 4 | 98 | 0 | 1 | 0 | 0 |
| 419000 | 173 | 6 | 99 | 0 | 1 | 0 | 0 |
| 225000 | 83 | 4 | 67 | 0 | 1 | 0 | 0 |
| 549500 | 165 | 6 | 110 | 0 | 1 | 0 | 0 |
| 240000 | 71 | 4 | 78 | 0 | 1 | 0 | 0 |
| 340000 | 116 | 6 | 115 | 0 | 1 | 0 | 0 |

What is 'Learning' in Machine Learning

Three question marks are three model parameters that we learn (estimate) from the data

$$\text{Price} = \text{size} * ? + \text{rooms} * ? + \text{pool} * ?$$

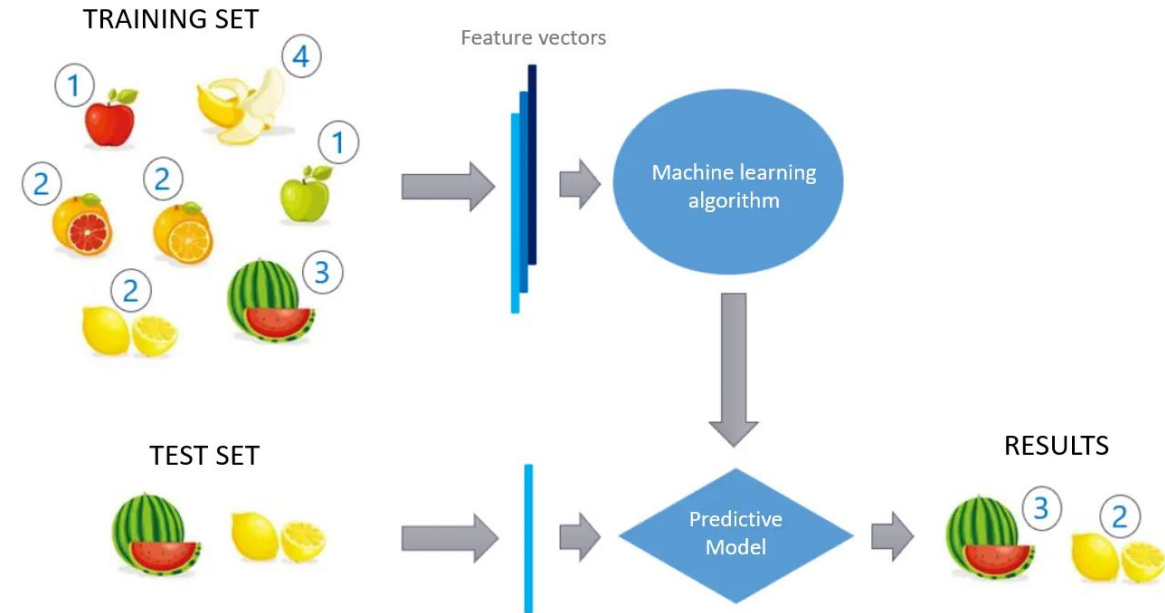
We learn three parameters from training data

Supervised learning

Needs training data with known “outcome” (labelled data)

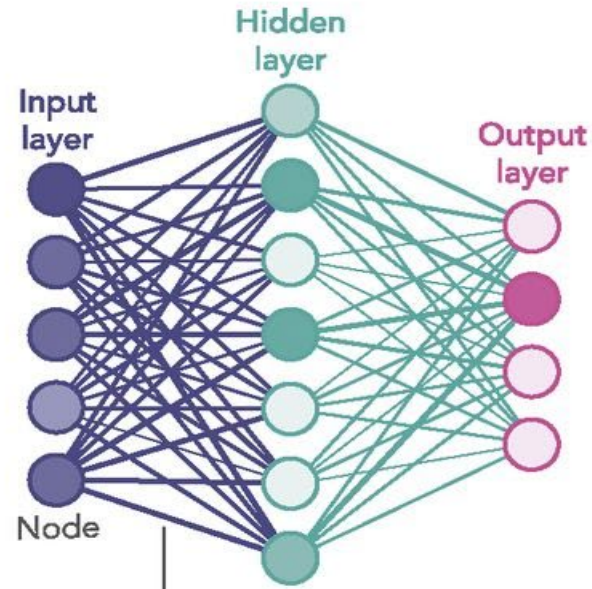
Steps:

- Specify model structure
- Finds parameters that best fit known inputs to outputs
- We apply the model on the new data



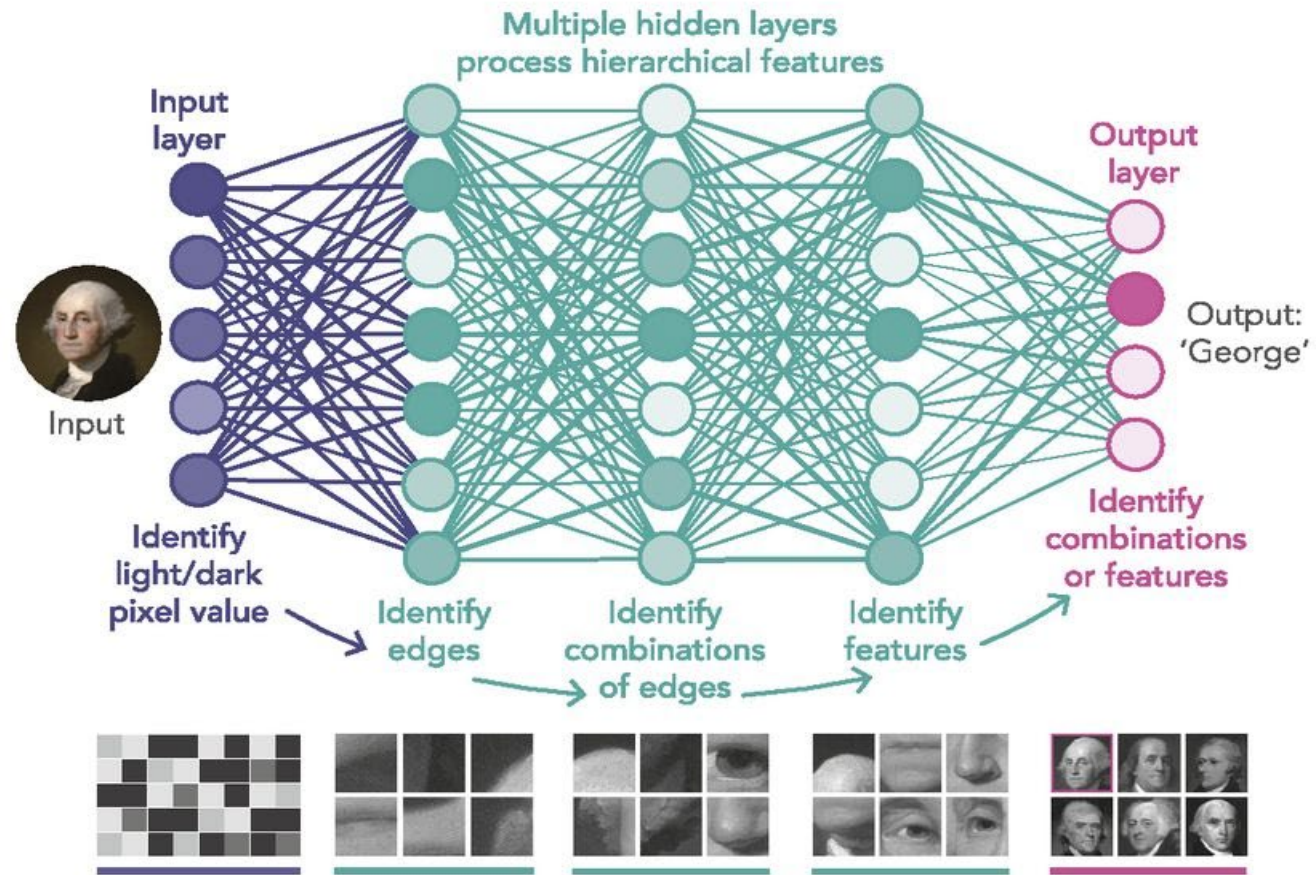
Neural networks

1980S-ERA NEURAL NETWORK



Links carry signals from one node to another, boosting or damping them according to each link's 'weight'.

DEEP LEARNING NEURAL NETWORK



Benefits of Machine Learning

- Build AI much faster – no need for so much expertise
- Capture previously unknown patterns
- Steps toward ‘Generalisable’ AI

Drawbacks of Machine Learning

- Hard to explain its reasoning
 - Can we be certain it will work correctly?
- Requires a lot of data
 - A LOT OF DATA
- Needs a lot of computing power and storage space

Transformers & Large Language models

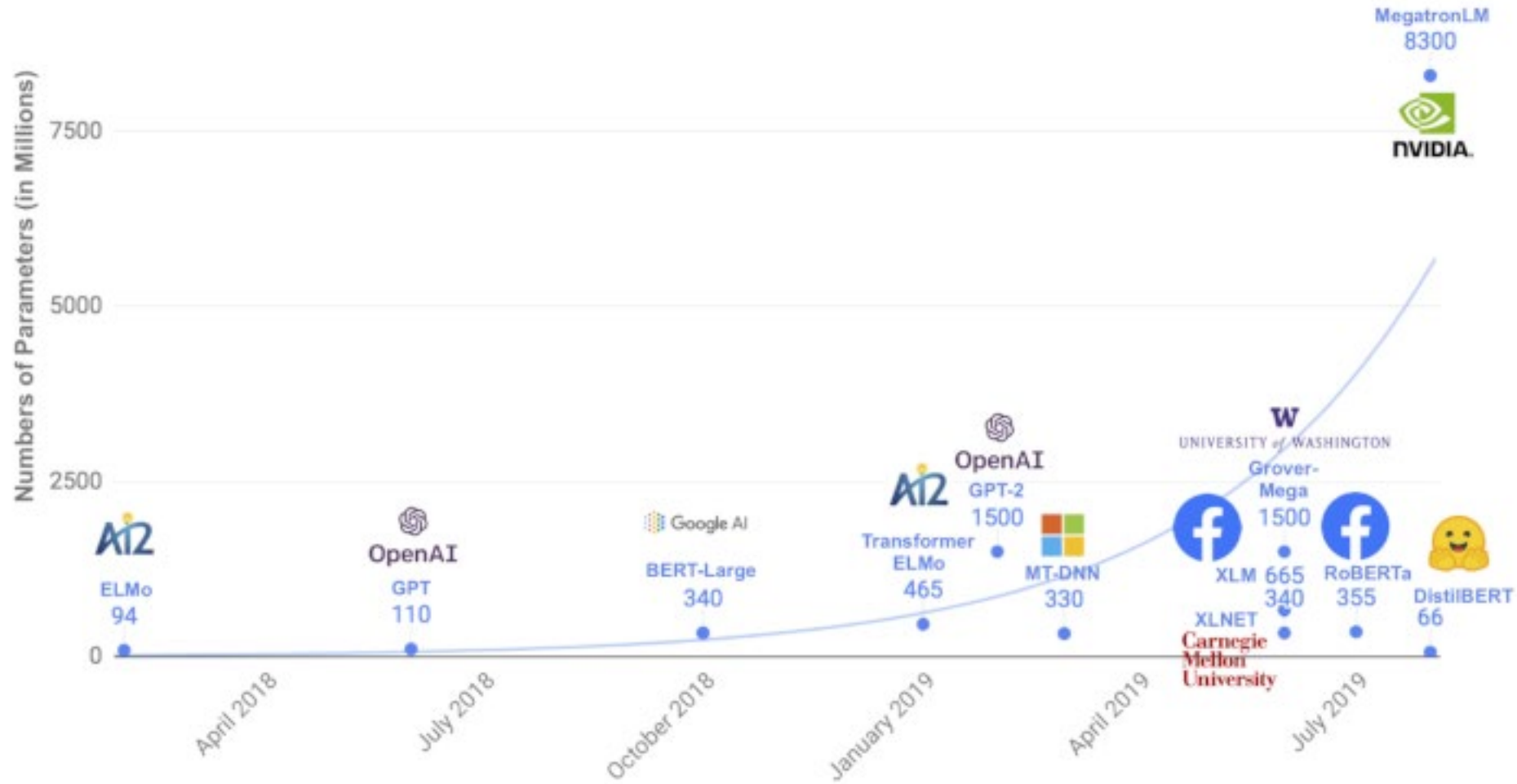
Significant technical advancements

- Can be run in parallel on multiple computers
- Can be trained with whole inputs rather than word-by-word

Actually quite simple

Led to large, General Pre-trained Transformers (GPT) -> General AI

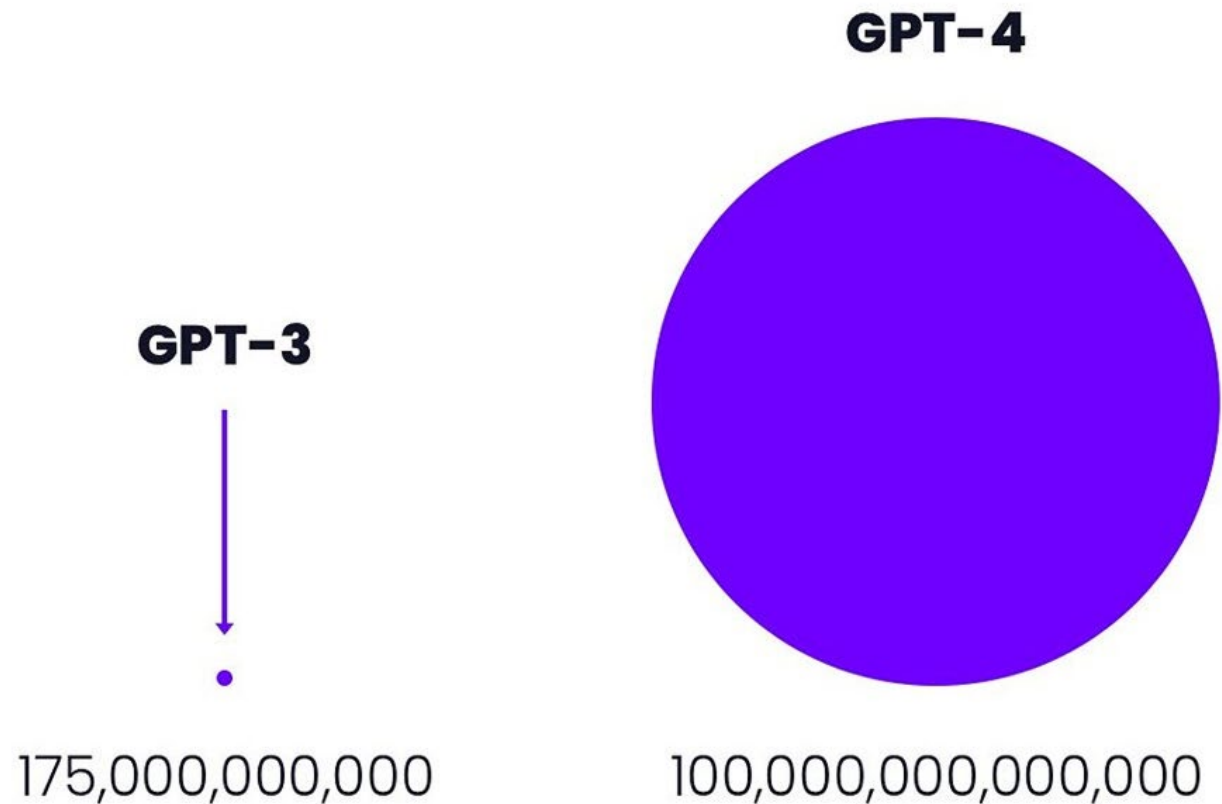
Rapid growth in size



GPT-3 vs GPT-4

45TB textual data as i

800GB to store the r



AI in education

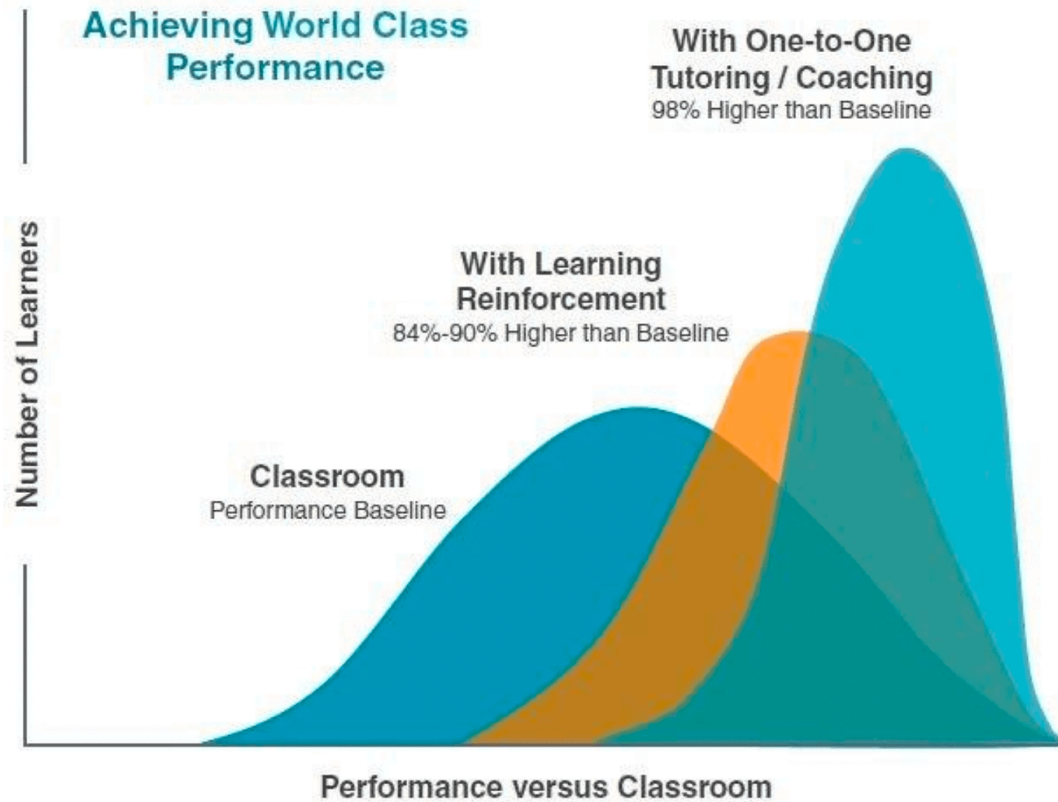


Chart based on the following education research:
Source: The 2 Sigma Problem; Bloom; JSTOR 2006

The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring

BENJAMIN S. BLOOM
University of Chicago and Northwestern University

Two University of Chicago doctoral students in education, Anania (1982, 1983) and Burke (1984), completed dissertations in which they compared student learning under the following three conditions of instruction:

1. *Conventional.* Students learn the subject matter in a class with about 30 students per teacher. Tests are given periodically for marking the students.

2. *Mastery Learning.* Students learn the subject matter in a class with about 30 students per teacher. The instruction is the same as in the conventional class (usually with the same teacher). Formative tests (the same tests used with the conventional group) are given for feedback followed by corrective procedures and parallel formative tests to determine the extent to which the students have mastered the subject matter.

3. *Tutoring.* Students learn the subject matter with a good tutor for each student (or for two or three students simultaneously). This tutoring instruction is followed periodically by formative tests, feedback-corrective procedures, and parallel formative tests as in the mastery learning classes. It should be pointed out that the need for corrective work under tutoring is very small.

Benjamin S. Bloom is Professor of Education, University of Chicago and Northwestern University, 5835 S. Kimbark Avenue, Chicago, Illinois 60637. His areas of specialization are evaluation and the teaching-learning process.

4

The students were randomly assigned the three learning conditions, and their initial aptitude tests scores, previous achievement in the subject, and initial attitudes and interests in the subject were similar. The amount of time for instruction was the same in all three groups except for the corrective work in the mastery learning and tutoring groups. Burke (1984) and Anania (1982, 1983) replicated the study with four different samples of students at grades four, five, and eight and with two different subject matters, Probability and Cartography. In each sub-study, the instructional treatment was limited to 11 periods of instruction over a 3-week block of time.

Most striking were the differences in final achievement measures under the three conditions. Using the standard deviation (sigma) of the control (conventional) class, it was typically found that the average student under tutoring was about two standard deviations above the average of the control class (the average tutored student was above 98% of the students in the control class).¹ The average student under mastery learning was about one standard deviation above the average of the control class (the average mastery learning student was above 84% of the students in the control class).

The variation of the students' achievement also changed under these learning conditions such that about 90% of the tutored students and 70% of the mastery learning students attained the level of summative achievement reached by only the highest 20% of the stu-

dents under conventional instructional conditions. (See Figure 1.)

There were corresponding changes in students' time on task in the classroom (65% under conventional instruction, 75% under Mastery Learning, and 90+% under tutoring) and students' attitudes and interests (least positive under conventional instruction and most positive under tutoring). There were great reductions in the relations between prior measures (aptitude or achievement) and the summative achievement measures. Typically, the aptitude-achievement correlations changed from +.60 under conventional to +.35 under mastery learning and +.25 under tutoring. It is recognized that the correlations for the mastery learning and tutoring groups were so low because of the restricted range of scores under these learning conditions. However, the most striking of the findings is that under the best learning conditions we can devise (tutoring), the average student is 2 sigma above the average control student taught under conventional group methods of instruction.

The tutoring process demonstrates that most of the students do have the potential to reach this high level of learning. I believe an important task of research and instruction is to seek ways of accomplishing this under more practical and realistic conditions than the one-to-one tutoring, which is too costly for most societies to bear on a large scale. This is the "2 sigma" problem. Can researchers and teachers devise teaching-learning conditions that will enable the majority of students under group instruction to

Educational Researcher

Some ideas for using AI

- Generating learning materials
 - Generating personalised learning materials
- Automating parent reports
 - (Automating bunch of reports)
- Supporting student creativity
- Providing formative feedback
- Career planning

ACARA HASS curriculum Grade 4

> HASS (Version 8.4)



| Year Levels | Strands | General Capabilities | Cross Curriculum Priorities | Additional Information |
|---|--|---------------------------------|---------------------------------|--|
| Please select at least one year level to view the content | | | | |
| <input type="checkbox"/> Select All | <input type="checkbox"/> Foundation Year | <input type="checkbox"/> Year 1 | <input type="checkbox"/> Year 2 | |
| <input type="checkbox"/> Year 3 | <input checked="" type="checkbox"/> Year 4 | <input type="checkbox"/> Year 5 | <input type="checkbox"/> Year 6 | |
| <input type="checkbox"/> Year 7 | | | | |
| | | | | <input type="button" value="Submit"/> <input type="button" value="Reset"/> |

Understand how Humanities and Social Sciences works



Level Description

Content Descriptions

Achievement Standards

Work Samples

Expand all

Year 4

Year 4 Level Description

How people, places and environments interact, past and present

The Year 4 curriculum focuses on interactions between people, places and environments over time and space and the effects of these interactions. Students gain opportunities to expand their world knowledge and learn about the significance of environments, examining how people's need and want of resources over time has affected peoples, societies and environments. Specifically, students study European exploration and colonisation in Australia and elsewhere up to the early 1800s and life for Indigenous Australians pre- and post-contact. They examine the concept of sustainability, and its application to resource use and waste management, past and present, by different groups. The curriculum introduces the role of local government, laws and rules, and group belonging and how they meet people's needs. Themes of law and citizenship extend into their studies of diverse groups, the colonisation of Australia and other places, and how environmental sustainability is enacted.

The content provides opportunities for students to develop humanities and social sciences understanding through key concepts including **significance; continuity and change; cause and effect; place and space; interconnections; roles, rights and responsibilities; and perspectives and action**. These concepts may provide a focus for inquiries and be investigated across sub-strands or within a particular sub-strand context.

ChatGPT to generate a lesson plan



Can you generate a lesson plan for year 4 students on how people, places and environments interact, past and present



Yes, here's a sample lesson plan for Year 4 students on how people, places, and environments interact, past and present:



Objective: Students will understand how people, places, and environments interact and have changed over time.

Materials:

- Large world map
- Pictures of different environments (e.g. urban, rural, coastal, etc.)
- Images of different historical and modern buildings
- Interactive timeline or chart
- Small world maps for each student

Introduction (10 min):

- Show the students a large world map and ask them to identify different environments (e.g. urban, rural, coastal, etc.) and their locations.
- Ask students to share their observations about the environments and their features.

Main Activity (30 min):

- Divide the students into small groups and provide each group with a small world map, pictures of different environments, and images of different historical and modern buildings.
- Ask each group to place the pictures and images on the map to show how the environment has changed over time and how it has affected the people and buildings.
- Each group should also create an interactive timeline or chart to show the changes in the environment, buildings, and people over time.
- After each group has completed their map, timeline, and chart, they should present their work to the class.

Conclusion (10 min):

- Summarize the main points made by each group and discuss how the changes in the environment, buildings, and people have affected each other.
- Ask the students to reflect on what they have learned and how they can use this information to make a positive impact on their environment in the future.

Assessment:

- Observe the students during the presentation and take notes on their participation and understanding of the topic.
- Evaluate the quality of their map, timeline, and chart, including their ability to show the interactions between people, places, and environments over time.

Practicing & formative feedback



I want you to test me on my knowledge of python programming. You will ask me 20 multiple choice questions about python programming constructs.



Sure, I can do that! Here's your first question:



1. What is the output of the following code snippet?

```
scss Copy code
list = [1, 2, 3, 4, 5]
print(list[2:4])
```

- a) [2, 3]
- b) [3, 4]
- c) [3, 4, 5]
- d) [2, 3, 4]

Please select your answer from the options above.



d



Correct! The output of the code snippet will be `[3, 4]`. The slice `list[2:4]` includes elements at index 2 and 3, but not 4.



Insanely useful and powerful



can you try a few regression analyses and look for interesting patterns?



Certainly! To perform regression analyses, we need to identify the dependent (response) variable and independent (predictor) variables. Given the data, we could explore the relationship between different factors, such as the number of deals, average deal value, average equity per deal, and total equity invested.

Let's start by performing three linear regression analyses:

1. Regression Analysis 1: Exploring the relationship between the total amount of equity invested (`Sum of Equity Invested (USD Mil)`) as the dependent variable and the number of deals (`No. of Deals`) as the independent variable.
2. Regression Analysis 2: Exploring the relationship between the average deal value (`Avg Deal Value (USD Mil)`) as the dependent variable and the average equity per deal (`Avg Equity Per Deal (USD Mil)`) as the independent variable.
3. Regression Analysis 3: Exploring the relationship between the average equity per company (`Avg Equity Per Company (USD Mil)`) as the dependent variable and the number of companies (`No. of Companies`) as the independent variable.

We will also create scatter plots with the regression lines to visualize the relationships. Let's proceed with these analyses.

Finished working

Show work

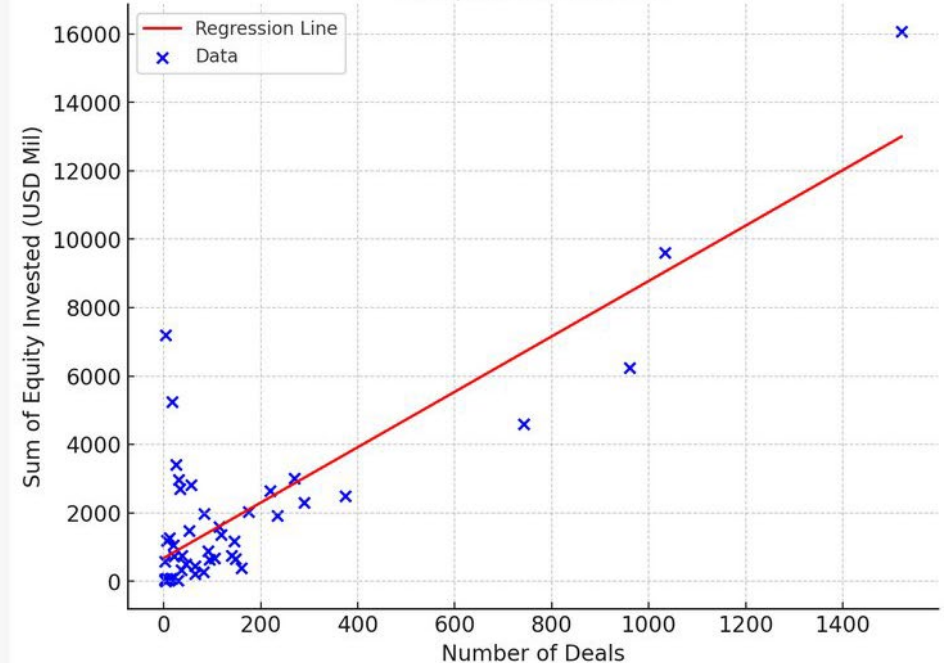
It seems that the data contains NaN (missing) values, which are causing an error when trying to perform linear regression analyses. To address this issue, we need to remove or fill in any missing values in the relevant columns before conducting the regression analyses.

Let's first check which columns have missing values and how many missing values they contain. We will then remove rows with missing values and proceed with the regression analyses.

Finished working

Show work

Regression Analysis: Sum of Equity Invested vs Number of Deals
R-squared: 0.7046



Clever uses: Generate a crossword

*Please act as a subject matter expert on the topic of **Anzac Day** crosswords.*

You know how to describe words that intersect each other on a crossword grid. You can also write meaningful clues.

*Could you please come up with **6 words** for a crossword on the topic of **Anzac Day** appropriate for **Secondary School Children**?*

The words will be placed on a crossword grid, and some words need to have at least 1 character in common

Clever uses: Generate a crossword



Certainly! Here are six words related to Anzac Day for a crossword puzzle appropriate for secondary school children. Some of the words will share at least one character:

1. GALLIPOLI, a significant World War I campaign where Australian and New Zealand troops fought.
2. SOLDIER, a person who serves in the military.
3. LESTWEFORGET, a phrase commonly associated with Anzac Day, reminding us to remember and honor those who have served.
4. MEMORIAL, a structure or place built to remember and honor those who served or died in the military.
5. POPPY, a red flower symbolizing remembrance for those who have died in war.
6. DAWN, the time of day when many Anzac Day services and commemorations take place.

Generate a crossword

Crossword Labs

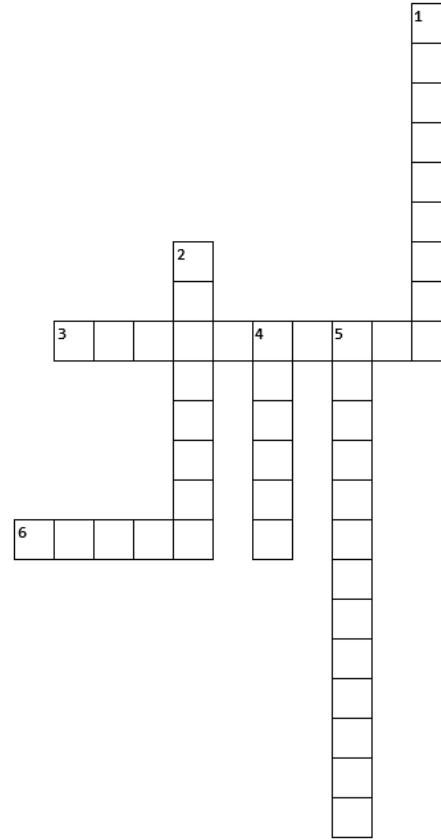
[Make a Crossword](#) [Find a Crossword](#) [About](#) [Login/Sign Up](#)

Crossword Puzzle Title

ANZAC DAY CROSSWORD

Enter the answer, a space and then the clue. One word/clue pair per line. [Need to see an example?](#)

GALLIPOLI, a significant World War I campaign where Aus
SOLDIER, a person who serves in the military.
LESTWEOFORGET, a phrase commonly associated with Anzac Day,
MEMORIAL, a structure or place built to remember and h
POPPY, a red flower symbolizing remembrance for tho
DAWN, the time of day when many Anzac Day services



Across

3. a significant World War I campaign where Australian and New Zealand troops fought.
6. the time of day when many Anzac Day services and commemorations take place.

Down

1. a structure or place built to remember and honor those who served or died in the military.
2. a person who serves in the military.
4. a red flower symbolizing remembrance for those who have died in war.
5. a phrase commonly associated with Anzac Day, reminding us to remember and honor those who have served.

AI and assessment

Make it harder for AI to help

Ask things that AI doesn't know about

- Ask students to summarise class discussions

Ask students to self-reflect on a particular topic

- Ask students to embed their own experience into their responses

AI and assessment

Embed AI into assessment

Assess the *process of using AI*

- Assess how AI is being used to generate response
- Assess the quality of prompts and critical thinking embedded in the prompts



Can you write me a short story about three little piggies set in the star wars universe



Once upon a time, in a galaxy far, far away, there were three little piggies living on the planet of Tatooine. They had always dreamed of escaping their mundane life and exploring the vastness of space. They spent their days tinkering with gadgets and dreaming of adventures beyond their wildest imaginations.



The first little piggy, whose name was Porkins, was an excellent mechanic. He spent most of his time in his workshop, building and repairing droids. He dreamed of one day building his own spaceship and traveling across the stars.

The second little piggy, whose name was Chewbacca, was a fearless warrior. He spent his days training and honing his combat skills. He dreamed of fighting for a just cause and defending the galaxy against evil forces.

The third little piggy, whose name was Luke, was a gifted pilot. He spent most of his time practicing his flying skills, hoping to one day join the legendary Rebel Alliance and fight against the tyranny of the Galactic Empire.



can you change it so that the third piggy is evil sith lord?



Once upon a time, in a galaxy far, far away, there were three little piggies living on the planet of Coruscant. They had always dreamed of power and domination, and they spent their days scheming and plotting to achieve their goals.

The first little piggy, whose name was Darth Porkins, was a cunning strategist. He spent most of his time planning his next move, hoping to gain more power and influence within the Sith Order.

The second little piggy, whose name was Chewbacca, was a fierce warrior. He spent his days training and honing his combat skills, dreaming of one day leading the Sith armies to victory.

The third little piggy, whose name was Darth Vader, was a gifted pilot and a powerful Sith Lord. He was feared throughout the galaxy for his cruelty and his thirst for power.

Together, the three little piggies plotted to overthrow the Galactic Republic and establish a new Sith Empire. They formed an alliance and began to execute their plan, using their unique skills and abilities to outmaneuver their enemies.



I don't want all three piggies to conspire against the republic, I want only the third one to be against the republic

Unlike his fellow piggies, Darth Vader had a different goal in mind. He saw the corruption and decadence of the Galactic Republic, and he believed that the only way to save the galaxy was to overthrow the Republic and establish a new order under the Sith.

Education and future work

My study plan

You've chosen a Course, which displays mandatory and elective subjects.

C04372v2 Master of Data Science and Innovation

56 of 96 credit points

Please select 96 credit points from the following: 56 / 96

| | | |
|--|---------|---|
| STM90984 Data Science Practices | 24 / 24 | > |
| STM90986 Innovation Labs | 24 / 24 | > |
| 36104 Data Visualisation and Narratives | 8 | ✓ |
| CBK91807 Options (Data Science and Innovation) | 0 / 40 | > |

Click on elective options to browse and add Subjects until you have the required total credits.

The Subjects you've added to your basket

6 Subjects

Data Science Practices

- Data Science for Innovation
- Statistical Thinking for Data Science
- Data, Algorithms and Meaning

Innovation Labs

- iLab 1
- iLab 2
- Data Visualisation and Narratives

Adding a Subject could add new Skills

14 Skills

| | |
|--------------------------|----|
| Decision Making | 98 |
| Machine Learning | 98 |
| teamwork / collaboration | 98 |
| Creativity | 96 |
| Data Science | 93 |
| Data Mining | 90 |
| Research | 87 |
| Journalism | 75 |

Adding new Skills could add potential new Careers

10 Careers

| | |
|--------------------------|------|
| data scientist | 57 |
| senior data scientist | 55.2 |
| data analyst (marketing) | 52.1 |
| data analyst (general) | 49.2 |
| data engineer | 48.7 |
| statistician | 48 |
| senior data analyst | 47.3 |
| data analyst (finance) | 47.2 |

Mapping curriculum with job descriptions

Skill matching analysis summary

The following analytics were performed based on the public available data.

Match against skills gained from Course & Assessments FILTER

MATCHED HARD SKILLS (OVERALL: 24) +

UNMATCHED HARD SKILLS (OVERALL: 8) +

MATCHED SOFT SKILLS (OVERALL: 10) -

Show 10 entries Search:

| TITLE | SKILL IN COURSE FREQUENCY | SKILL IN JOB FREQUENCY |
|-----------------|---------------------------|------------------------|
| problem solving | 251 (51.02%) | 54225 (22.91%) |
| communication | 219 (44.51%) | 55259 (23.34%) |
| experience | 210 (42.68%) | 77351 (32.68%) |
| professionalism | 203 (41.26%) | 71837 (30.35%) |
| self-management | 149 (30.28%) | 66136 (27.94%) |
| teamwork | 129 (26.22%) | 68425 (28.91%) |
| leadership | 92 (18.70%) | 44734 (18.90%) |
| responsibility | 26 (5.28%) | 42277 (17.86%) |
| courtesy | 25 (5.08%) | 29689 (12.54%) |
| flexibility | 9 (1.83%) | 13568 (5.73%) |

1. Discrete “hard” skills
2. Enterprise skills

Competency development



Why competencies?

Evidence of achievement

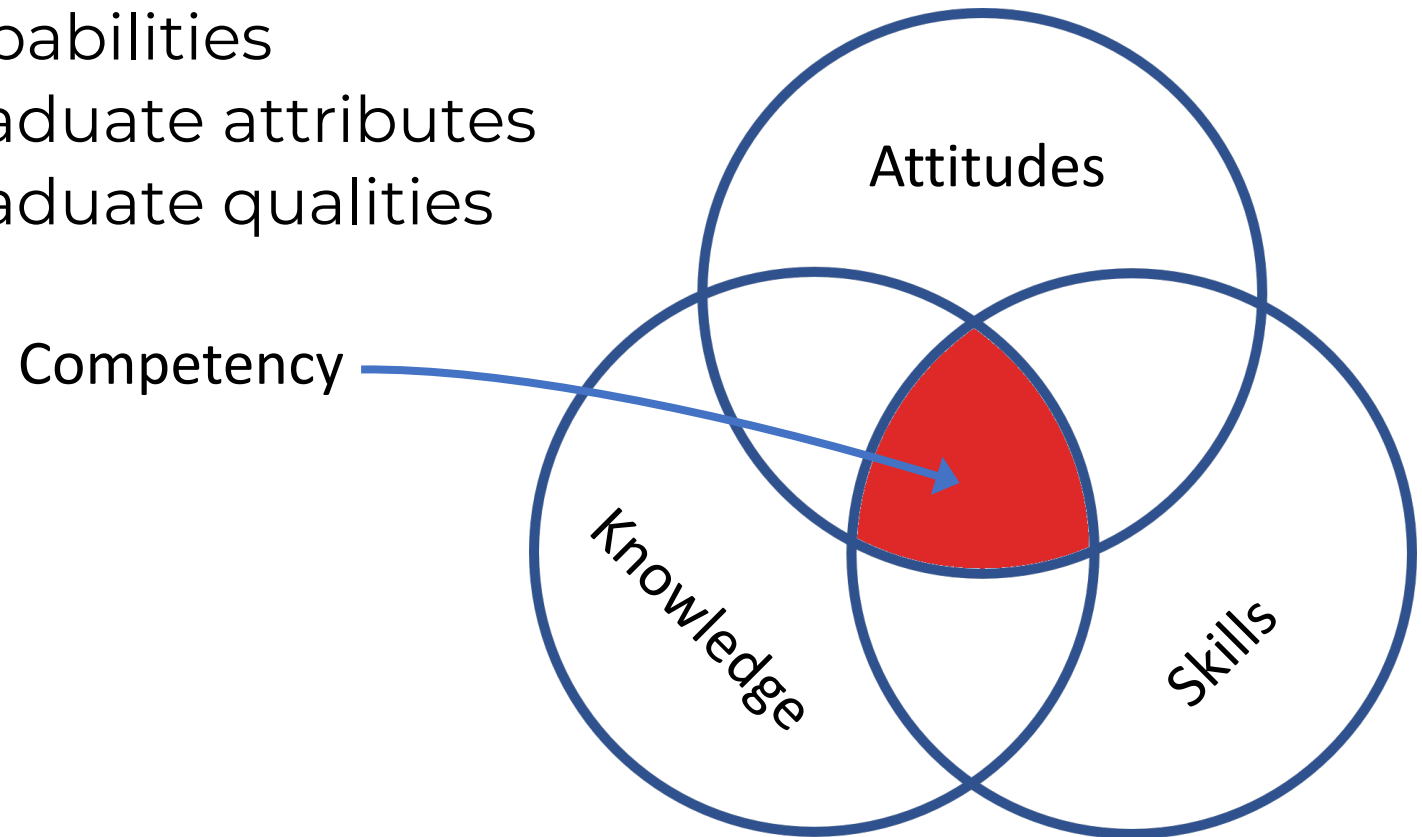


Developmental

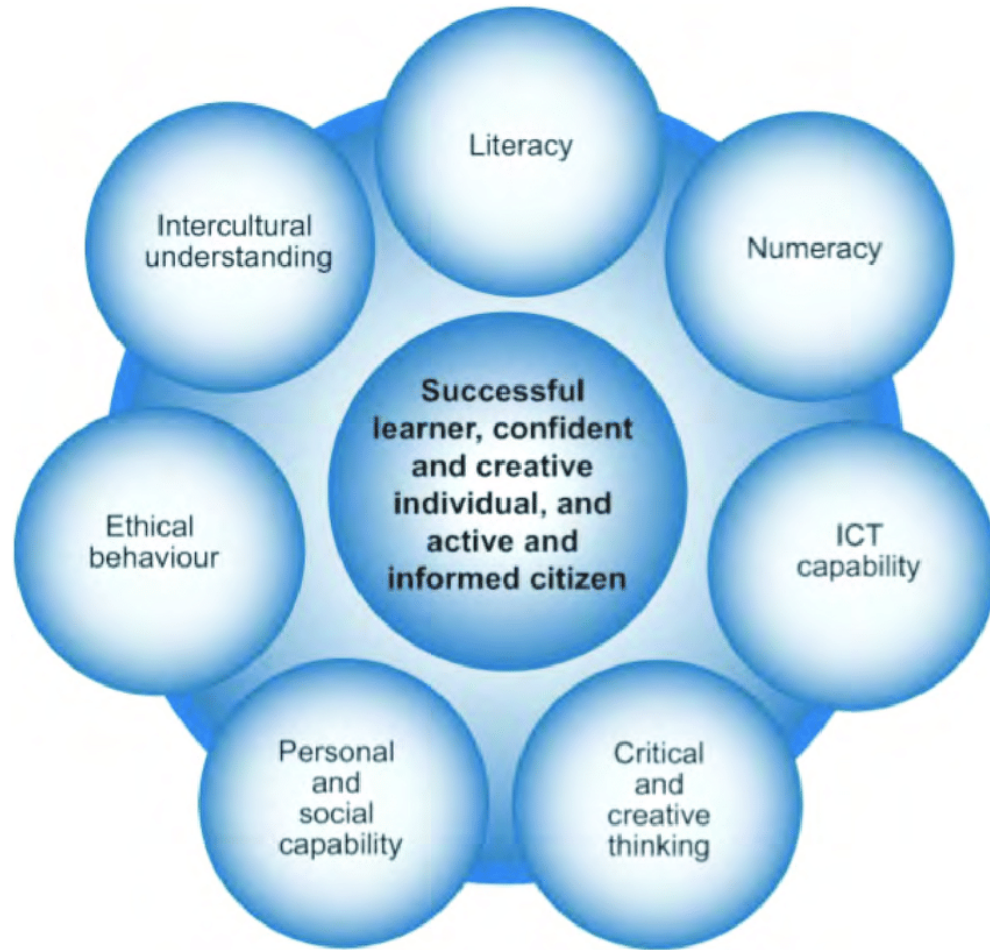


Elements of competencies

- Terminology unclear
 - Also known as capabilities
 - Also known as graduate attributes
 - Also known as graduate qualities



Australian Curriculum capabilities



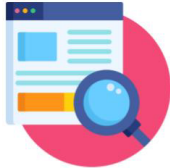
IB Learner Profile



INQUIRERS

As IB Learners we strive to:

- Nurture our curiosity
- Learn independently and with others
- Learn with enthusiasm all our life



KNOWLEDGEABLE

As IB Learners we strive to:

- Develop and use conceptual understanding to explore knowledge
- Engage with issues and ideas that are important in our lives and for the whole world



THINKERS

As IB Learners we strive to:

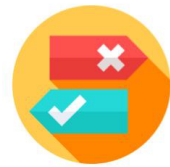
- Use critical and creative thinking skills to analyze and take action on complex problems
- Show initiative in making reasoned and ethical decisions



COMMUNICATORS

As IB Learners we strive to:

- Express ourselves confidently and creatively in more than one language
- Collaborate effectively by listening carefully to the perspectives of others
- Share our ideas respectfully



PRINCIPLED

As IB Learners we strive to:

- Act with integrity, honesty and a strong sense of fairness and justice for all
- Take responsibility for our actions and their consequences



OPEN-MINDED

As IB Learners we strive to:

- Appreciate our own cultures and personal histories, as well as the traditions and values of others
- Seek and evaluate a range of points of view
- Grow from our experiences



CARING

As IB Learners we strive to:

- Show empathy, compassion and respect
- Commit to service learning
- Act to make a positive difference in the lives of others and in the world



RISK-TAKERS

As IB Learners we strive to:

- Work independently and cooperatively to explore new ideas
- Develop innovative strategies
- Be resourceful and resilient in the face of challenge, change and uncertainty



BALANCED

As IB Learners we strive to:

- Balance different aspects of our lives - intellectual, physical, and emotional
- Create well-being for ourselves and others
- Recognize our interdependence with other people and the world in which we all live



REFLECTIVE

As IB Learners we strive to:

- Consider the world, our own ideas and our experiences thoughtfully
- Understand our strengths and weaknesses in order to support our learning and personal development

Icons by Freepik on Flaticon. Poster by @ajivir.

Challenges

- **Definition:** How are competencies defined?
- **Measuring:** How to measure competencies?
- **Teaching:** How to teach for competency development?
- **Adoption:** How to implement learner profiles in practice?

Challenges

- **Definition:** How are competencies defined?
- **Measuring:** How to measure competencies?
- **Teaching:** How to teach for competency development?
- **Adoption:** How to implement learner profiles in practice?
 - How to introduce learner profiles?
 - How to collect relevant data?
 - How to measure effectiveness?

Defining competencies

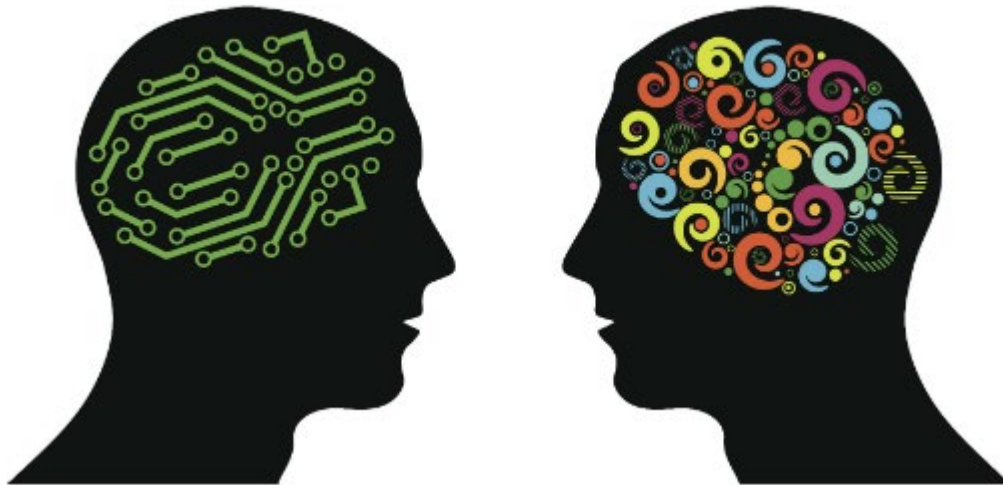
- Focus on theoretically validated constructs
- Clarity critical for shared understanding
- Avoid mixing apples and oranges
 - Critical and creative thinking
 - Critical thinking: rational, convergent, analytical, logical
 - Creative thinking: intuitive, divergent, speculative,

Defining competencies

Critical and creative thinking

- Critical thinking: rational, convergent, analytical, logical
- Creative thinking: intuitive, divergent, speculative,

Critical Thinking vs Creative Thinking



Defining competencies

Personal and social capability

- Self-management
- Self-awareness
- Social management
- Social awareness



Defining competencies

AI and Learning Analytics?

Up to us to define constructs carefully

Ensure shared understanding



Defining competencies

Can AI do the dirty job for us?

Automated mapping of differently defined competencies & skills across different areas



Measuring competencies

Common approaches

- Teacher's professional judgement
- Student's reflective judgement

Measuring competencies

Often based on rubrics

- Dimensions
- Levels of progression
- Performance standards

Preschool – Prekindergarten
Rubric for Assessing Effective Reasoning

| Component | 4 - Advanced | 3 - Proficient | 2 - Basic | 1 - Novice |
|--------------------------------|--|--|--|--|
| Validity of the Claim | Student makes a reasonable claim, stays on topic, demonstrates understanding of the topic. | Student makes a reasonable claim and stays on topic. | Student makes a claim, stays on topic, but doesn't make a claim. | Student talks about the topic generally, but doesn't make a claim. |
| Logic of the Claim and Support | Student connects their claim to support clearly. | Student connects their claim to support. | Student connects their claim to support. | Student connects their claim to support. |
| Relevant Support | Student provides relevant support. | Student provides support. | Student provides support. | Student provides support. |
| Challenge of Question | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. |

Kindergarten – 1st Grade
Rubric for Assessing Effective Reasoning

| Component | 4 - Advanced | 3 - Proficient | 2 - Basic | 1 - Novice |
|--------------------------------|--|--|--|--|
| Validity of the Claim | Student makes a reasonable claim, stays on topic, demonstrates understanding of the topic. | Student makes a reasonable claim and stays on topic. | Student makes a claim, stays on topic, but doesn't make a claim. | Student talks about the topic generally, but doesn't make a claim. |
| Logic of the Claim and Support | Student connects their claim to support clearly. | Student connects their claim to support. | Student connects their claim to support. | Student connects their claim to support. |
| Relevant Support | Student provides relevant support. | Student provides support. | Student provides support. | Student provides support. |
| Challenge of Question | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. |

2nd Grade – 3rd Grade
Rubric for Assessing Effective Reasoning

| Component | 4 - Advanced | 3 - Proficient | 2 - Basic | 1 - Novice |
|--------------------------------|--|--|--|--|
| Validity of the Claim | Student makes a reasonable claim based on provided sources and background knowledge. | Student makes a reasonable claim, stays on topic, and demonstrates understanding of the topic. | Student makes a reasonable claim and stays on topic. | Student talks about the topic generally, but doesn't make a claim. |
| Logic of the Claim and Support | Student connects their claim to support clearly. | Student connects their claim to support. | Student connects their claim to support. | Student connects their claim to support. |
| Relevant Support | Student provides relevant support. | Student provides support. | Student provides support. | Student provides support. |
| Challenge of Question | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. |

4th Grade – 5th Grade
Rubric for Assessing Effective Reasoning

| Component | 4 - Advanced | 3 - Proficient | 2 - Basic | 1 - Novice |
|--------------------------------|--|--|--|--|
| Validity of the Claim | Student makes a reasonable claim based on provided sources and background knowledge. | Student makes a reasonable claim, stays on topic, and demonstrates understanding of the topic. | Student makes a reasonable claim and stays on topic. | Student talks about the topic generally, but doesn't make a claim. |
| Logic of the Claim and Support | Student connects their claim to support clearly. | Student connects their claim to support. | Student connects their claim to support. | Student connects their claim to support. |
| Relevant Support | Student provides relevant support. | Student provides support. | Student provides support. | Student provides support. |
| Challenge of Question | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. | Student identifies a challenge to their claim. |

6th Grade – 8th Grade
Rubric for Assessing Effective Reasoning

| Component | 4 - Advanced | 3 - Proficient | 2 - Basic | 1 - Novice |
|--------------------------------|--|--|---|---|
| Validity of the Claim | Student makes a sophisticated claim based on provided sources and background knowledge and demonstrates a deep and relevant understanding of the topic as evidenced through use of discipline specific vocabulary and articulation of a core concept within the discipline. | Student makes a reasonable claim based on provided sources and background knowledge and demonstrates a deep understanding of the topic as evidenced through use of discipline specific vocabulary and articulation of key ideas. | Student makes a reasonable claim based on provided sources and background knowledge, stays on topic, utilizes appropriate topic specific vocabulary, and demonstrates an understanding of the topic based on the sophistication of the claim. | Student makes a reasonable claim and generally stays on topic, but doesn't show a deep understanding of the topic. |
| Logic of the Claim and Support | Student makes clear and strong connections between their claim and support. Student sequences their support in a way that clearly builds the case for their claim and supports insight into the steps of their logic and articulation of counter arguments. | Student makes clear connections between their claim and support. Student sequences their support in a way that clearly builds the case for their claim as well as provides insight into the steps of their logic. | Student makes clear connections between their claim and support. Student sequences their support in a way that clearly builds the case for their claim. | Student makes connections between their claim and support but they are not clear, or they make no connection between their claim and support. |
| Relevant Support | Student evaluates all possible supporting evidence and chooses the only the best evidence. Student utilizes proposed theories from within the discipline to support their claim. Student draws on evidence that anticipates and refutes counter evidence and alternative claims. | Student chooses only evidence that supports the claim. There is evidence that the student evaluated possible supporting evidence and chose only the best evidence. Student utilizes accepted theories from within the discipline to support their claim. | Student chooses only evidence that supports the claim. There is evidence that the student evaluated possible supporting evidence and chose only the best evidence. | Student provides no reason why their claim is true or only one relatively weak supporting statement. |
| Challenge of Question | Student can identify gaps in their knowledge, can state a different reasonable claim, and identify counter evidence that refutes the support that they identified. Student uses this analysis to refine their own claim/statement. | Student can identify gaps in their knowledge, can state a different reasonable claim and/or identify counter evidence that refutes the support that they identified. | Student can identify gaps in their knowledge and can identify a different reasonable claim. | Student can identify one way in which their claim might be challenged or cannot identify any ways that their claim can be challenged. |

Adapted from the Carolina Foothills School District's 21st Century Skills Rubric: Critical and Creative Thinking; Inductive Reasoning, 6/06 – 6/11

Measuring competencies

- Holistic assessment at predefined timepoints
- Subject-specific assessment within assessment rubrics
- Continuous assessments

Measuring competencies

- Ability to recognize when competencies are demonstrated
- Require in-depth understanding of rubrics
- Time consuming
- High cognitive load



Measuring competencies

AI and Learning Analytics?

Great opportunities for automating rubrics

- Text analytics (sentiment, creativity, critical thinking)
- Social network analysis (social capability, social awareness)
- Learning behaviour analysis (self-regulation, self-management)

Learning analytics

JOURNAL OF LEARNING ANALYTICS

SOLAR
SOCIETY for LEARNING
ANALYTICS RESEARCH

(2016). Learning analytics for 21st century competencies. *Journal of Learning Analytics*, 3(2), 6–21. <http://dx.doi.org/10.18608/jla.2016.32.2>

Learning Analytics for 21st Century Competencies

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University of Bristol
Ruth.Crick@uts.edu.au

Example

- Utilising mapping of competencies in the curriculum
- Combine static data about programs, courses and assignments and student grades to derive models for assessing complex competencies
- Program consists of courses
- Each course has assignments (MCQ, exam, essay etc)
- Each assignment is mapped to competency
 - Directly: (e.g., accreditation data),
 - Indirectly (e.g., graduate qualities mapped through course objectives)

Australian Teaching Standards

| Domains of teaching | Standards | Focus areas and descriptors |
|--------------------------------|---|--|
| Professional Knowledge | <ol style="list-style-type: none">1. Know students and how they learn2. Know the content and how to teach it | Refer to the Standard at each career stage |
| Professional Practice | <ol style="list-style-type: none">3. Plan for and implement effective teaching and learning4. Create and maintain supportive and safe learning environments5. Assess, provide feedback and report on student learning | Refer to the Standard at each career stage |
| Professional Engagement | <ol style="list-style-type: none">6. Engage in professional learning7. Engage professionally with colleagues, parents/carers and the community | Refer to the Standard at each career stage |

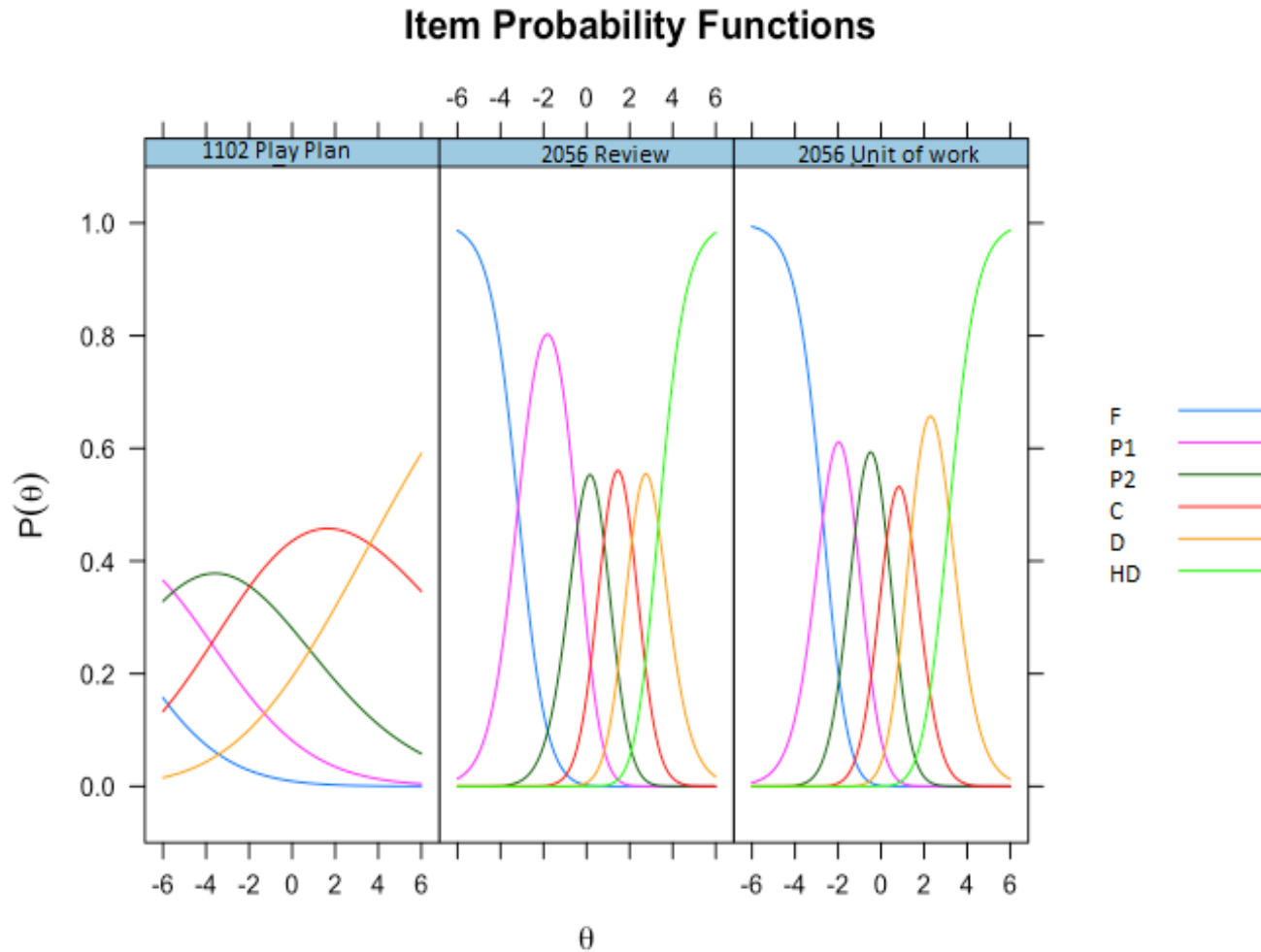
Primary Education Standard mapping

| | Standard 1 (know students and how they learn) | Standard 2 (know the content and how to teach it) | Standard 3 (plan and implement effective T&L) | Standard 4 (create and maintain safe learning env.) |
|----------------------|--|--|--|--|
| Assessments | | | | |
| 1018_Cont assessment | | X | | |
| 1018_Pamphlet | | X | | |
| 1018_Project | | | X | |
| 1076_Presentation | | | X | |
| 1076_Report | X | X | | |
| 1077_Essay | | X | X | |
| 1102_Play Plan | | | | X |
| 2006_Resource folder | | X | | |
| 2056_Review | | | | X |
| 2056_Unit of work | | | X | X |
| 2058_Case study | X | | | |
| 2058_Project | | X | | |
| 2061_Essay | X | | | |
| 3062_Case study | | | X | |
| 3079_Presentation | X | | | |
| 4100_Project | X | | | |

Primary Education Standard mapping

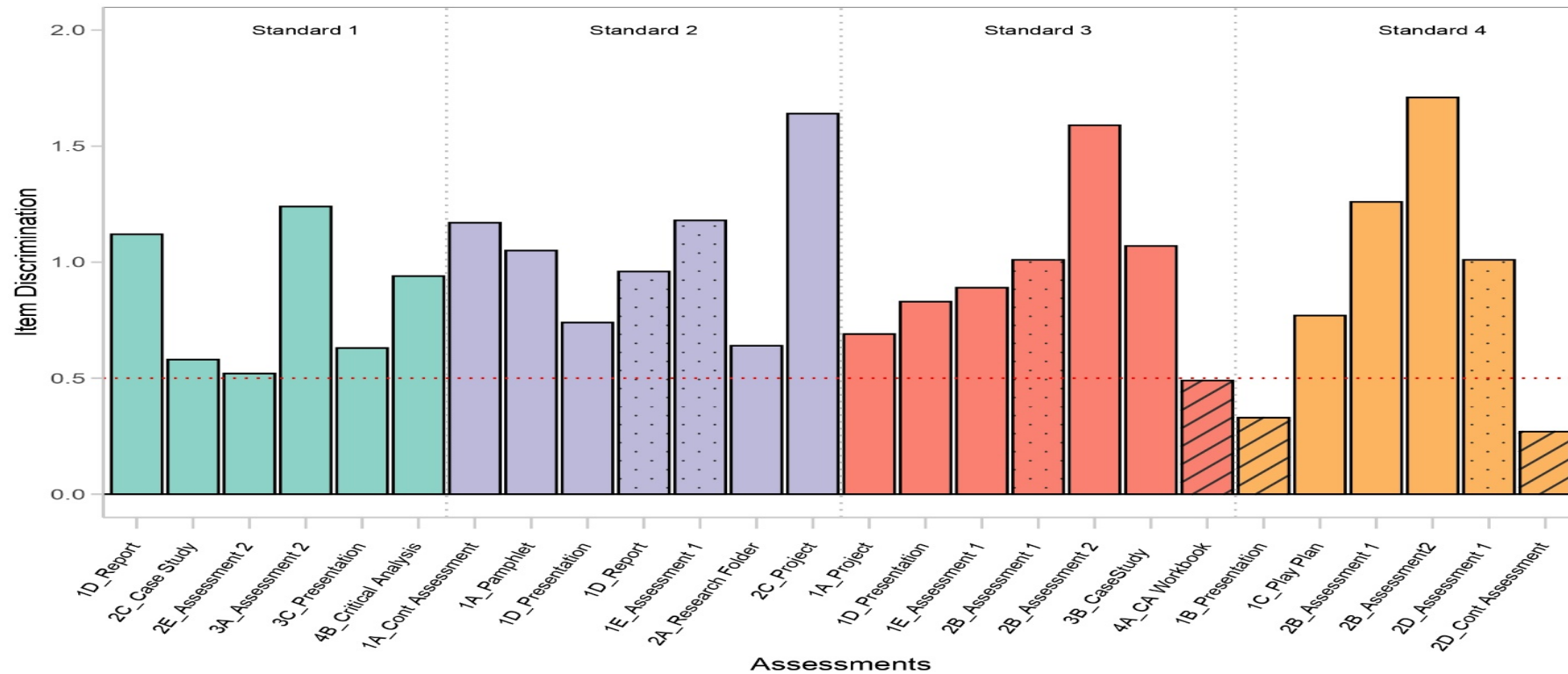
| Assessments | Standard 1 (know students and how they learn) | Standard 2 (know the content and how to teach it) | Standard 3 (plan and implement effective T&L) | Standard 4 (create and maintain safe learning env.) |
|----------------------|--|--|--|--|
| 1018_Cont assessment | | X | | |
| 1018_Pamphlet | | X | | |
| 1018_Project | | | X | |
| 1076_Presentation | | | X | |
| 1076_Report | X | X | | |
| 1077_Essay | | X | X | |
| 1102_Play Plan | | | | X |
| 2006_Resource folder | | X | | |
| 2056_Review | | | | X |
| 2056_Unit of work | | | X | X |
| 2058_Case study | X | | | |
| 2058_Project | | X | | |
| 2061_Essay | X | | | |
| 3062_Case study | | | X | |
| 3079_Presentation | X | | | |
| 4100_Project | X | | | |

Quality of measures



1102_Play Plan is a poor measure of teaching standard #4

Competency development over time

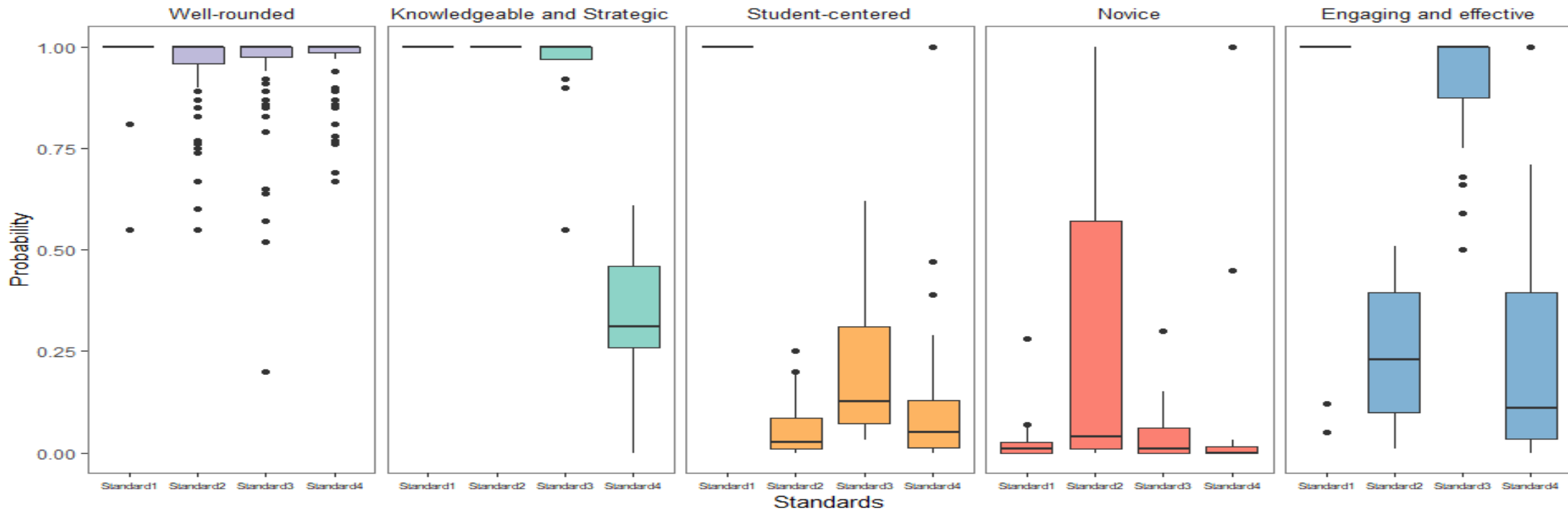


Note: The stroked bars represent assessments with item discrimination values less than 0.50, while the dotted bars represent misfitting items.

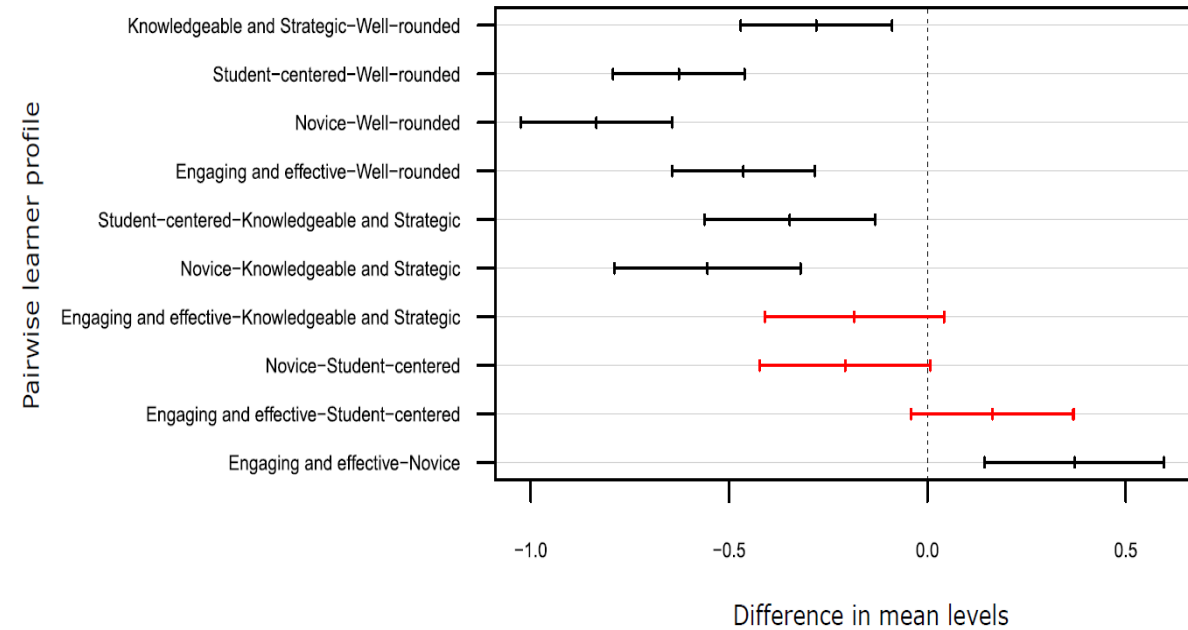
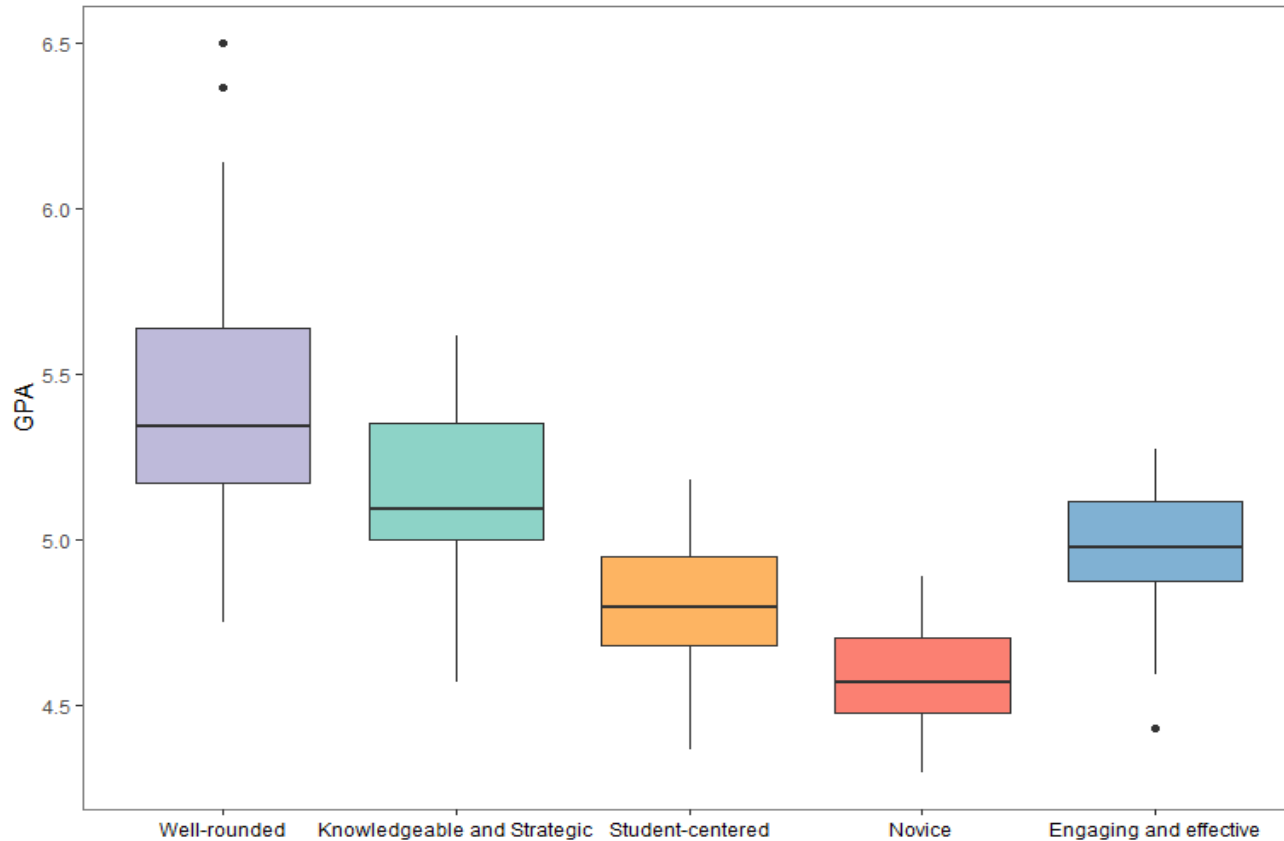
Estimating competency development

| Student ID | Standard 1 | Standard 2 | Standard 3 | Standard 4 |
|------------|------------|------------|------------|------------|
| 1001 | 1.00 | 0.10 | 0.98 | 0.03 |
| 1002 | 1.00 | 1.00 | 1.00 | 0.96 |
| 1003 | 0.03 | 0.00 | 0.01 | 0.00 |
| 1004 | 1.00 | 0.98 | 1.00 | 0.96 |

Grouping students by competency development



Richer description than GPA



UniSA Graduate qualities

The University's commitment to graduate qualities reflects a world-wide movement within educational institutions such as universities. There is a deliberate focus on the development of particular student outcomes through educational programs. A number of different terms are used to refer to these outcomes including graduate qualities, graduate outcomes, graduate attributes, generic qualities and transferable or key skills.

The University of South Australia has adopted as institutional policy a statement of seven graduate qualities as the outcomes it seeks for its undergraduates (stated below). It has also developed a related set of [Research Degree Graduate Qualities](#).

A graduate of the University of South Australia:

1. operates effectively with and upon a body of knowledge of sufficient depth to begin professional practice
2. is prepared for life-long learning in pursuit of personal development and excellence in professional practice
3. is an effective problem solver, capable of applying logical, critical, and creative thinking to a range of problems
4. can work both autonomously and collaboratively as a professional
5. is committed to ethical action and social responsibility as a professional and citizen
6. communicates effectively in professional practice and as a member of the community
7. demonstrates international perspectives as a professional and as a citizen.

Each of the qualities has [indicators](#) which serve as a guide to their development.

Graduate qualities assessment project

- How do UniSA graduates attain graduate qualities?
- What programs are good/bad in terms of GQs?
- What courses need to be tweaked to allow better assessment of GQs?
- What GQs do we need to focus on?

Teaching for competency development

Unclear at the moment.

Couple of approaches:

- Add-on to existing teaching, external to curriculum
- Identify existing teaching activities that develop competencies
 - Competency mappings
- Redesign teaching activities to integrate competencies
 - Ability to demonstrate competencies
 - Feed data back to teachers so they can deploy interventions

AI and Learning Analytics?

Provide opportunities to demonstrate competencies

- Gamified learning experiences
- Interactive and immersive learning experiences



Key adoption lessons

- Include teachers early in the project
- Provision of the data is not enough
- One size fits all does not work
- Build on existing projects and initiatives

Key adoption lessons

- “Just start” – don’t wait for everything to be clear
- Create broader awareness across staff
- Adoption is far more about people than technology
- Focus on easy wins before bringing in big changes

We are assessing products, not processes

- AI use is about the process
- Dissertation is the product
- If we really care about the process, then the assessment needs to change

Reporting the use of AI

- AI will be ubiquitous
 - AI will be part of NVivo and SPSS
 - What about PPT slide designer?
- It sends the wrong message
 - Will Google disclose if they used AI to build their products?

Doing it 'the hard way'

- Will 'artisan' companies be valued more for doing it "the hard way"?
- Will an employee get fired if he uses AI to do his work?

Real Programmers Don't Use PASCAL

Ed Post, "Real Programmers Don't Use Pascal",
DATAMATION, July 1983, pp. 263-265 (Readers' Forum).

Back in the good old days -- the "Golden Era" of computers, it was easy to separate the men from the boys (sometimes called "Real Men" and "Quiche Eaters" in the literature). During this period, the Real Men were the ones that understood computer programming, and the Quiche Eaters were the ones that didn't. A real computer programmer said things like "DO 10 I=1,10" and "ABEND" (they actually talked in capital letters, you understand), and the rest of the world said things like "computers are too complicated for me" and "I can't relate to computers -- they're so impersonal". (A previous work [1] points out that Real Men don't "relate" to anything, and aren't afraid of being impersonal.)

AI will reshape what creativity means

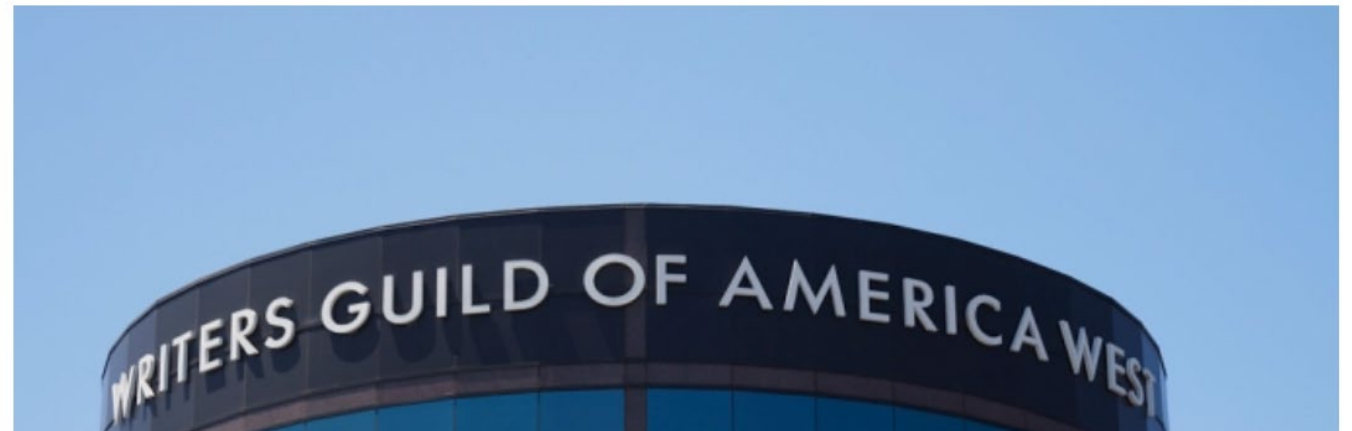
- Routine AI vs Creative AI? What is the difference?
- Grammarly vs ChatGPT? What is the difference?
- Reporting ChatGPT as a source?

Writers Guild of America's AI Statement

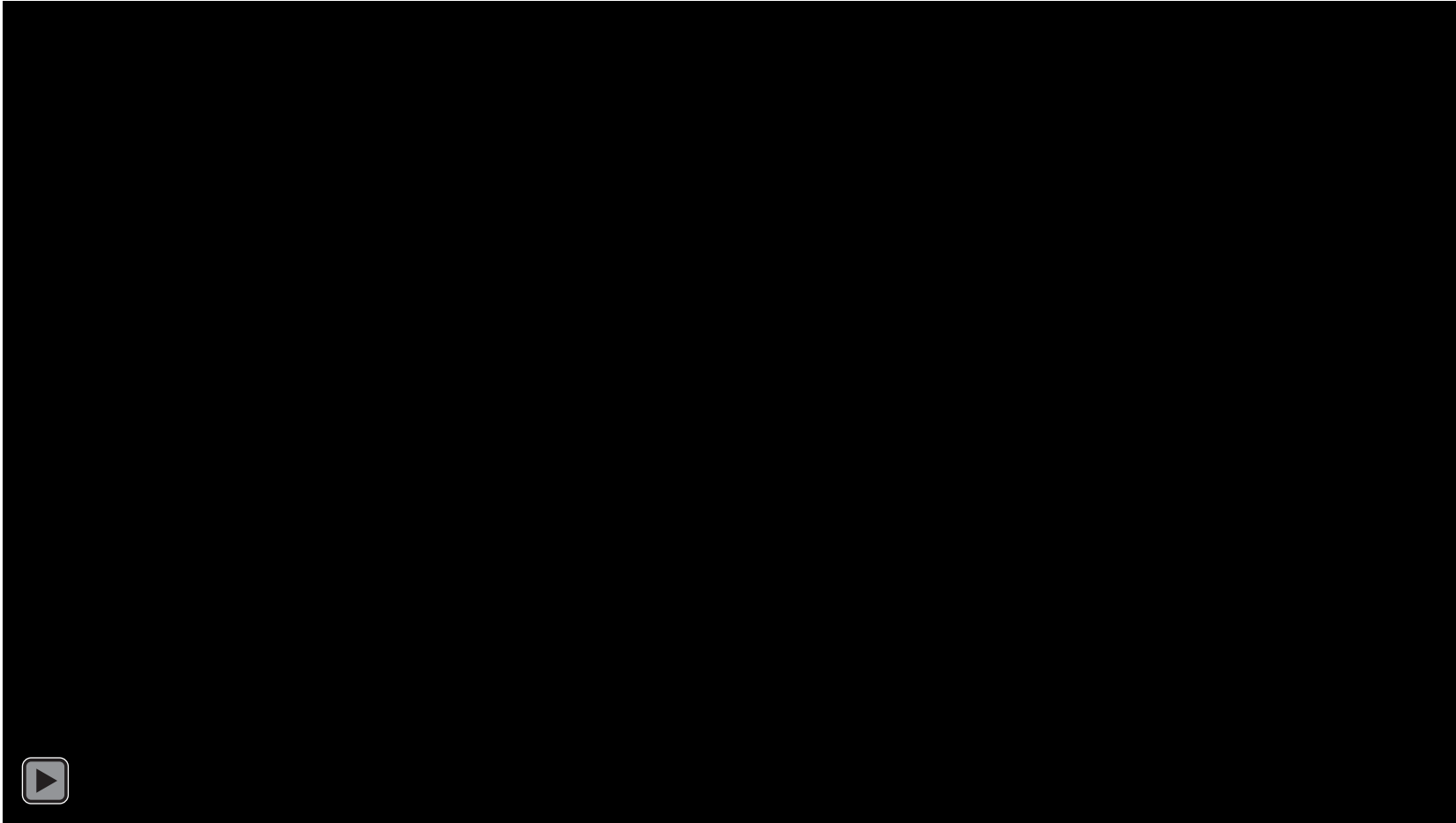
- AI-generated material is not “literary material”
- No sharing of credit (and money) with software companies

WGA Would Allow Artificial Intelligence in Scriptwriting, as Long as Writers Maintain Credit

By Gene Maddaus ▾



Doing it “the right way”



Learning with AI should be like Military training

- Heavy use of new technologies
- Martial arts still have a role in military training

- Balanced approach to training

AI policy

- AI will be everywhere
- Genie is out of the bottle – we won't be able to stop it
- Must teach students how to use AI technologies
- Need to reflect the reality of the society
- Need to include students' voice – what do they want from AI policy?

What about students?

- Can we use competencies to tailor to their needs and aspirations?
- Students aspirations to drive interventions



Prospects for the future

- Construct definitions and mapping
 - How to define constructs?
 - Can AI help with incompatible models?
- Construct measuring –
 - Focus on development and learning
 - Can data and analytics help give more unbiased and time-consuming measures?
- Teaching for competencies
 - Ensure competencies can be demonstrated
 - How to leverage immersive environments?
- Adopting effectively
 - Ensure teachers are being heard
 - Use AI & learning analytics to support learning and development

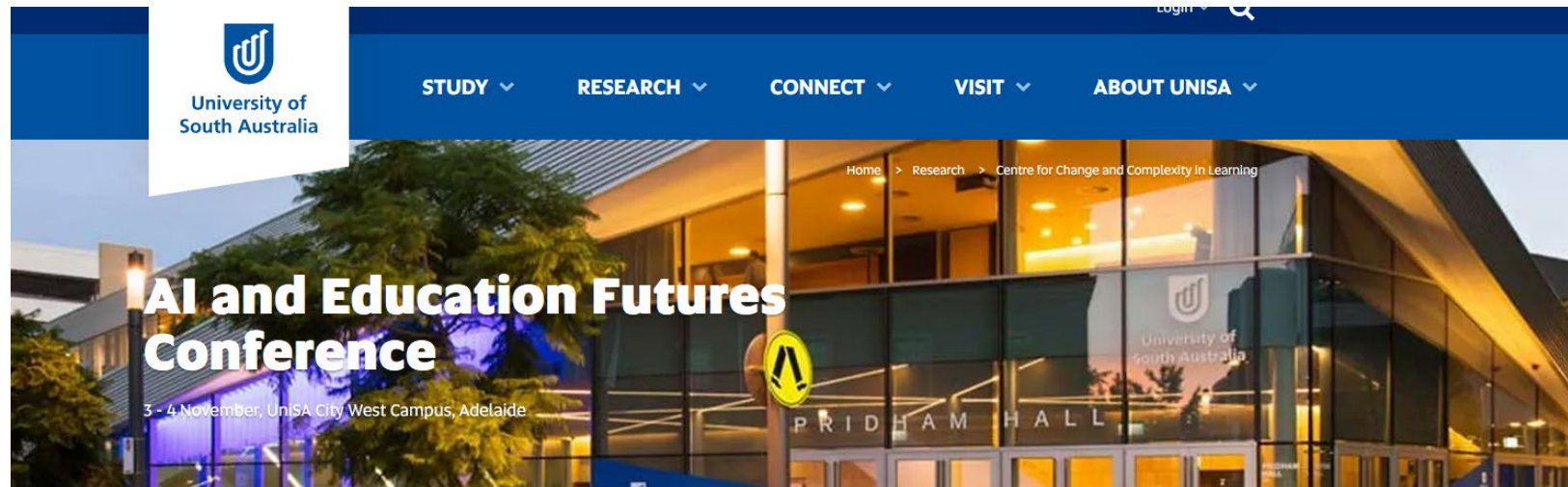
Thank you

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C3L@unisa.edu.au

AI and Education Futures Conference (Nov 3-4)

<https://www.unisa.edu.au/research/c3l/conference23>



Friday 3 November – Saturday 4 November 2023

Reimagining education with AI

Education sits on the edge of a new age of innovation, with broadening access and growing opportunities for learning. All sectors - primary, secondary, tertiary, and corporate - face growing complexity as they respond to new technologies and globalisation.

The **Centre for Change and Complexity in Learning (C3L)** is excited to announce its second face-to-face international conference. It will take place from **Friday 3 November – Saturday 4 November 2023**.

More in this section

[Featured Presenters](#)



[Program Information](#)



AI and Education Futures Conference (Nov 3-4)

Friday program

8:30 am - 9:00 am Registration
9:00 am - 9:30 am Conference Opening
9:30 am - 11:00 am Keynote (Tanya Joosten)
11:00 am - 11:30 am Break
11:30 am - 12:30 pm AI and Ethics Panel
12:30 pm - 1:30 pm Lunch & Networking
1:30 pm - 2:30 pm DfE Presentation
2:30 pm - 3:00 pm AI and Wellbeing Presentation
3:00 pm - 3:30 pm Afternoon tea & Networking
3:30 pm - 4:30 pm AI and Assessment Panel
4:30 pm - 5:00 pm Partnering with C3L
5:00 pm - 6:30 pm Posters and Drinks

Saturday program

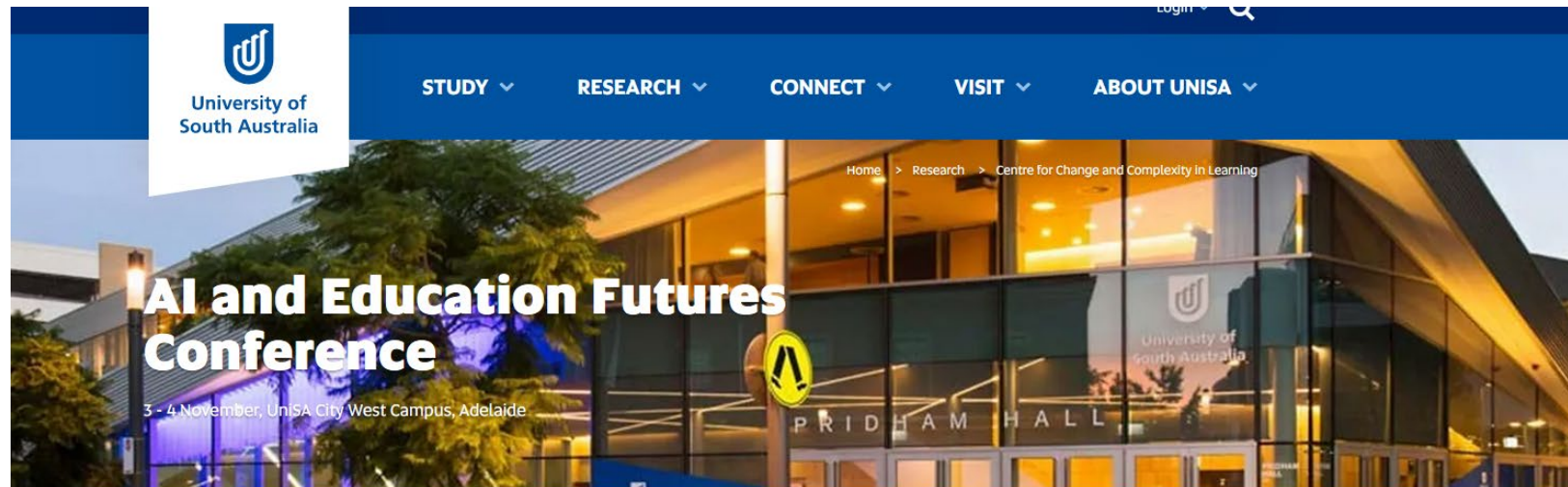
8:30 am - 9:00 am Registration
9:30 am - 11:00 am Opening and Keynote (Dragan Gasevic)
11:00 am - 11:30 am Morning Tea & Networking
11:30 am - 12:30 pm Teaching with AI: Prompt engineering
12:30 pm - 1:30 pm Lunch
1:30 pm - 2:30 pm Complexity Leadership for Improving Self-Regulation in School
2:30 pm - 3:00 pm AI and Classroom Practice Presentation
3:00 pm - 3:30 pm Afternoon Tea & Networking
3:30 pm - 5:00 pm Workshops

- Industry Engagements
- Leadership Workshop
- AI Playground
- AI and Creativity
- AI and Assessment
- Learner Profiles

5:00 pm - 5:30 pm Conference Close

AI and Education Futures Conference (Nov 3-4)

<https://www.unisa.edu.au/research/c3l/conference23>



Friday 3 November – Saturday 4 November 2023

Reimagining education with AI

Education sits on the edge of a new age of innovation, with broadening access and growing opportunities for learning. All sectors - primary, secondary, tertiary, and corporate - face growing complexity as they respond to new technologies and globalisation.

The **Centre for Change and Complexity in Learning (C3L)** is excited to announce its second face-to-face international conference. It will take place from **Friday 3 November – Saturday 4 November 2023**.

More in this section

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