Queen Mary
University of London

# MTH6110

# Famous Research Studies in Education

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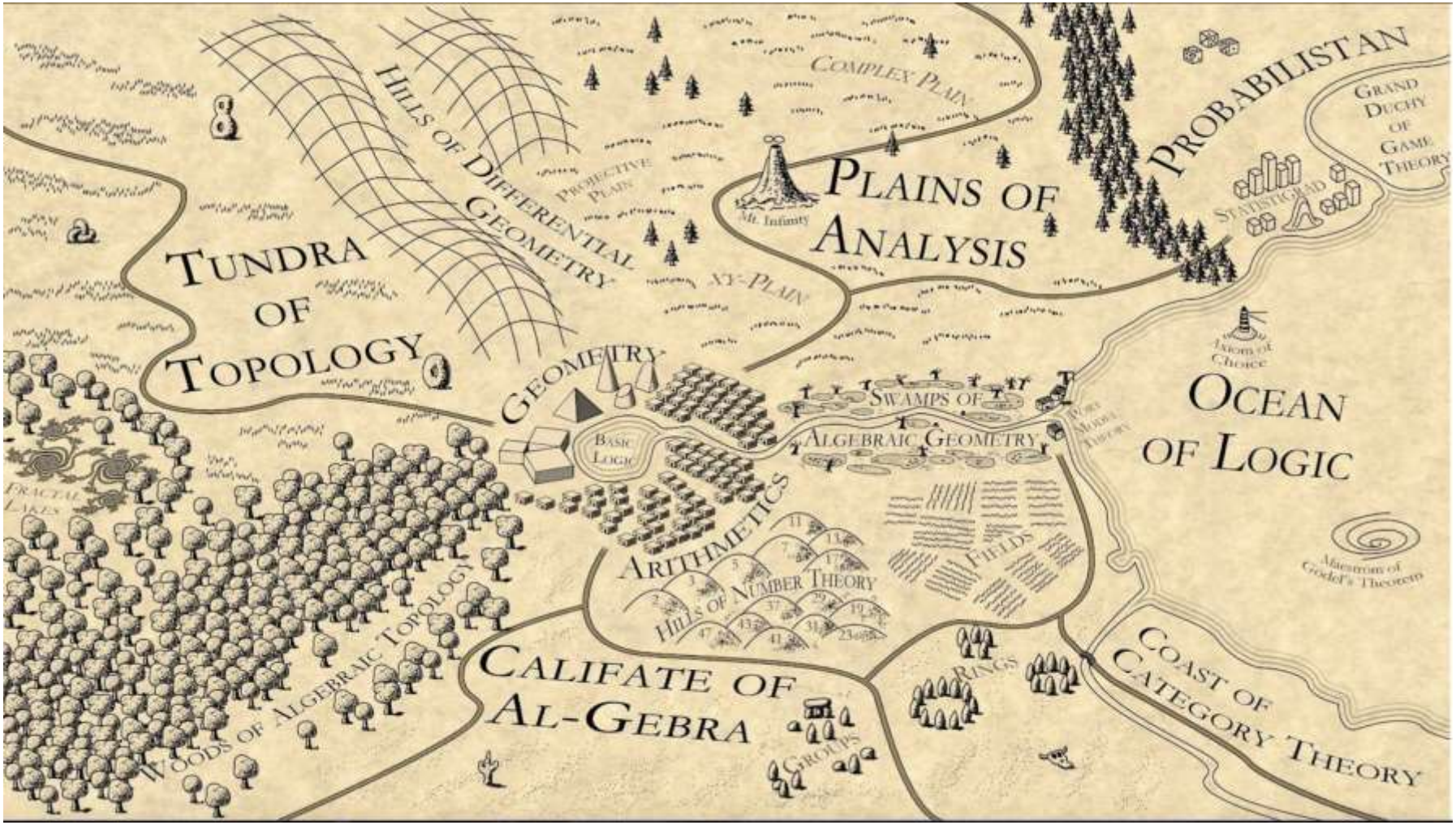
# Plan for Today

1. Warm-up discussion
2. Updates
3. Research Article Summary & Group Presentation
4. Individual and Group Activities

# Warmup Discussion

- What are the essential ingredients of a BSc in Mathematics?
- Provide a list of 5 modules that you think should be at the core of a BSc in Mathematics.
- What should be core attributes of a Maths graduate?

# A Map of Mathematics




Source: https://www.youtube.com/watch?v=XqpvBaiJRHo

# Possible Thoughts…

## Modules:

Analysis
Geometry
Linear Algebra
Programming
Differential Equations

## Attributes:

Critical thinking
Numeracy
Analytical abilities
Presentation skills
Problem solving
Ambition

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# Updates

- Mathematics Presentations graded.
  Grades being uploaded today.

- Assigment 3 (Summary of Research Article)
  Deadline: 17:00, Wednesday 27th March

- Assigment 4 (Group Presentation)
  Deadline for Submission of Slides: 17:00, Monday 8th April

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# Assignments 3 & 4 – Research Article Summary & Group Presentations

- See Assessment Guide & Marking Criteria
- Give a 750-word summary of the Maths Education Research Article you have been assigned
- In Week 12, give a 10-minute **in-person** group presentation of the Maths Education Research Article you have been assigned.
- Your tasks, Weeks 8-12:

  Read → Write → **Interact**, Practice, Refine → PRESENT!

# Assignments 3/4 – Meet & Greet

- Check your emails to see which article you have been assigned
- Meet your group members
- Set a plan for the assignment.  Budget for
  - Individual time for reading + group discussion
  - Individual time for drafting summary
  - Group time for reflecting, giving feedback on summary
  - Group time for drafting presentation and practising

# Individual Activity

- Write down five factors that you think have the biggest impact on learning
- Pick one item from your list and write a brief summary of how you might test the effect this item has on learning

  (e.g. Time it takes to travel to school/university – survey all students taking *Vectors & Matrices* on the time it takes them to commute, compare this data with the end of module test scores)

# Group Activity

Rank the impact of the following influences on a child's learning outcome:

- Background music
- Lack of sleep
- Untreated ADHD
- ADHD treated with drugs
- Deliberate practice
- Deafness
- Depression
- Scaffolding
- Corporal punishment at home
- Holding students back a year
- Use of PowerPoint
- Teacher credibility
- Boredom
- Time spent on a task
- Rehearsal and memorization
- Diverse student body
- Television
- Peer tutoring
- Concept mapping
- Low birth weight
- Classroom discussion
- Effort

# Reflect

Look back at your list:

- Would you now change the order of any items on it?
- Did talking with your colleagues change your opinion at all?
- Was it useful to discuss your list with others?

# Effect Size

How do we quantify the impact of each of these factors?

*“Effect size is simply a way of quantifying the size of the difference between two groups… It allows us to move beyond the simplistic, 'Does it work or not?' to the far more sophisticated, 'How well does it work in a range of contexts?’*

*Moreover, by placing the emphasis on the most important aspect of an intervention - the size of the effect - rather than its statistical significance (which conflates effect size and sample size), it promotes a more scientific approach to the accumulation of knowledge.”*

# More specifically…

We could use Cohen's d:

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s}$$

Where:

- $\bar{\mathbf{x}}_1$ is the mean of the data taken from the experimental group (that is, the group exposed to some measurable influence)
- $\bar{\mathbf{x}}_2$ is the mean of the data taken from the control group (that is, the group not known to be exposed to this influence)
- **s** is the total standard deviation of all the data

# Hattie's *Visible Learning* (2008)

Luckily, we don't need to!  Someone beat us to it.

John Hattie in 2014
(Source: Wikipedia)

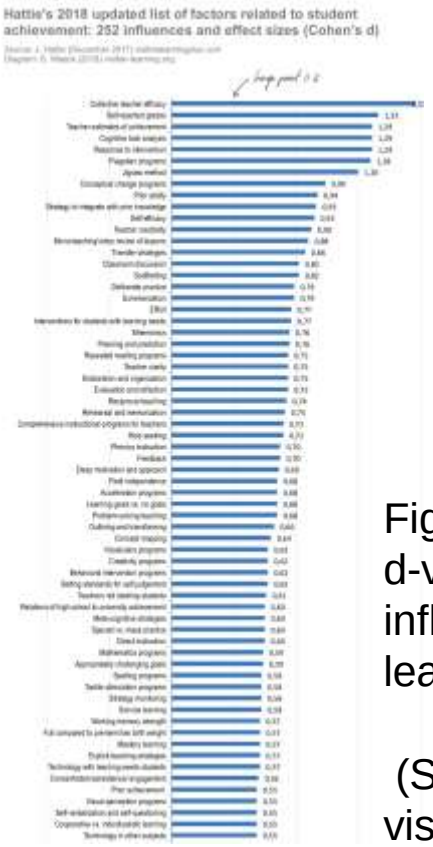
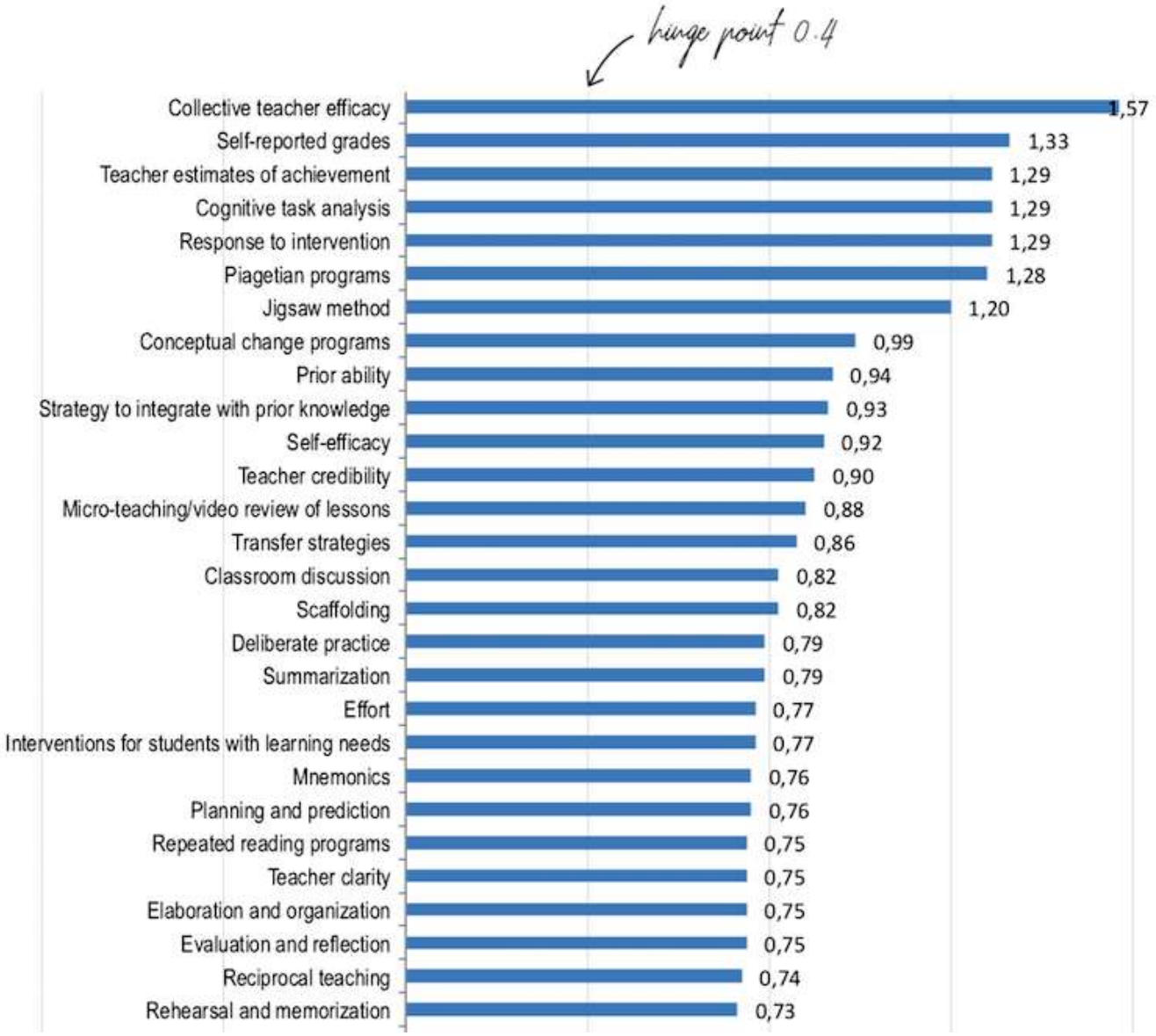



Figure showing d-values of effect of influences on childhood learning

(Source: visiblelearning.org/)


hinge point 0.4
Collective teacher efficacy 1,57
Self-reported grades 1,33
Teacher estimates of achievement 1,29
Cognitive task analysis 1,29
Response to intervention 1,29
Piagetian programs 1,28
Jigsaw method 1,20
Conceptual change programs 0,99
Prior ability 0,94
Strategy to integrate with prior knowledge 0,93
Self-efficacy 0,92
Teacher credibility 0,90
Micro-teaching/video review of lessons 0,88
Transfer strategies 0,86
Classroom discussion 0,82
Scaffolding 0,82
Deliberate practice 0,79
Summarization 0,79
Effort 0,77
Interventions for students with learning needs 0,77
Mnemonics 0,76
Planning and prediction 0,76
Repeated reading programs 0,75
Teacher clarity 0,75
Elaboration and organization 0,75
Evaluation and reflection 0,75
Reciprocal teaching 0,74
Rehearsal and memorization 0,73

# Reflect

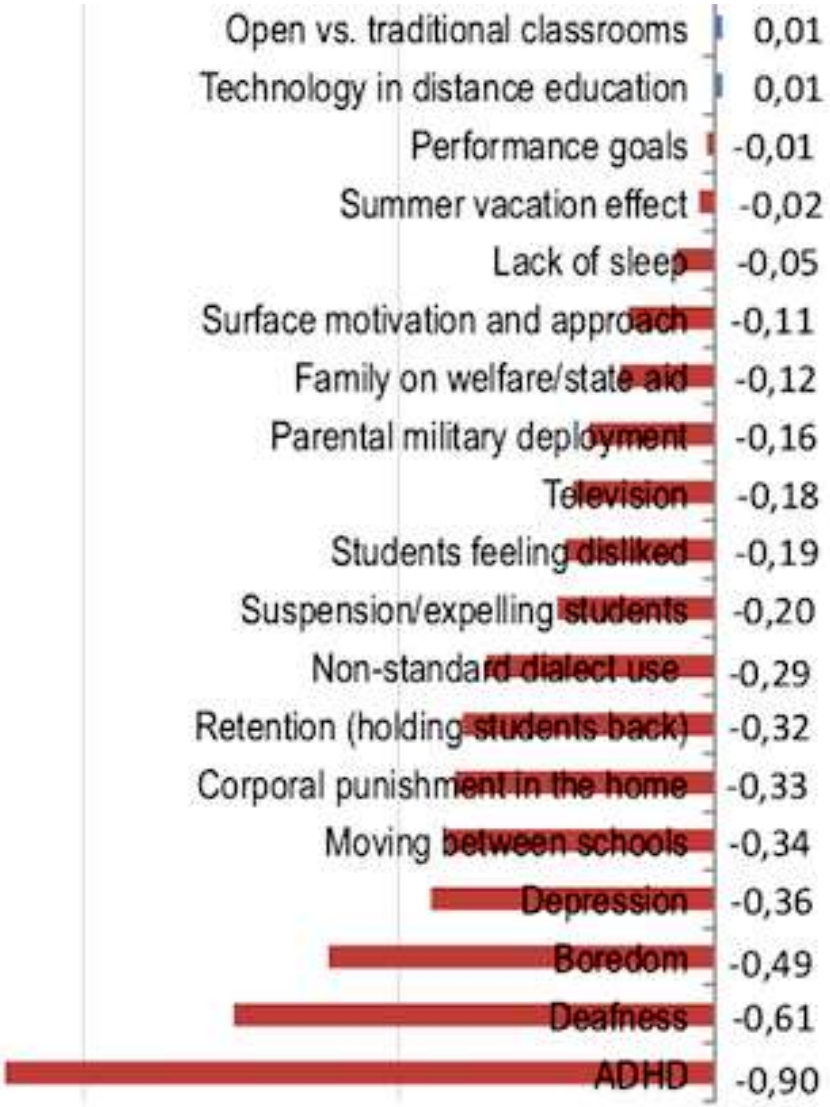
- The average effect size of these influences is 0.4
- The average effect size of teacher-led influences is 0.32
- What do you think produced the largest negative effect?

a) Boredom

b) Corporal Punishment at Home

c) Untreated ADHD

d) Lack of Sleep


Open vs. traditional classrooms 0,01
Technology in distance education 0,01
Performance goals -0,01
Summer vacation effect -0,02
Lack of sleep -0,05
Surface motivation and approach -0,11
Family on welfare/state aid -0,12
Parental military deployment -0,16
Television -0,18
Students feeling disliked -0,19
Suspension/expelling students -0,20
Non-standard dialect use -0,29
Retention (holding students back) -0,32
Corporal punishment in the home -0,33
Moving between schools -0,34
Depression -0,36
Boredom -0,49
Deafness -0,61
ADHD -0,90

# Reflect

- Which of these do you find most surprising? Why?
- If you know who you are teaching, can you use these effect sizes to inform your planning? How?
- What do the numbers alone not tell us?

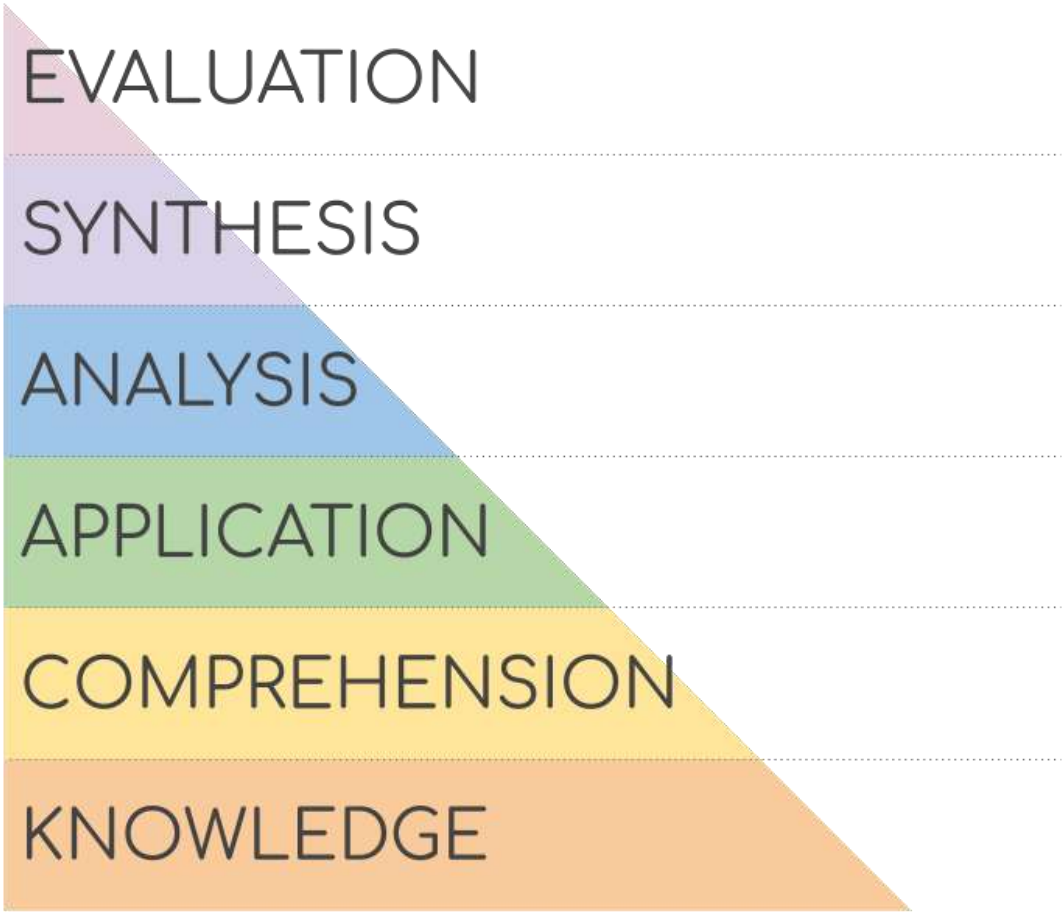
# Bloom's *Taxonomy* (1956)

Benjamin Bloom
(Source: thoughtco.com)

*"Bloom's taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity*

*The three lists cover the learning objectives in cognitive, affective and sensory domains. The cognitive domain list has been the primary focus of most traditional education and is frequently used to structure curriculum learning objectives, assessments and activities."*

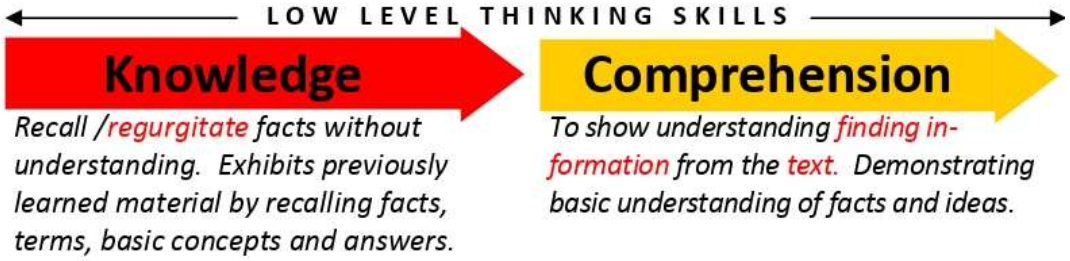
# Bloom's *Taxonomy* (1956)




Bloom's Taxonomy of the Cognitive Domain

(Source: Wikipedia)

# Bloom's *Taxonomy* (1956)




**Questions:**

Can you list three ...?
Can you recall ...?
Can you select ...?
How did _____ happen?
How is ...?
How would you describe ...?
How would you explain ...?
How would you show ...?
What is ...?
When did ...?
When did _____ happen?
Where is . . . ?
Which one ...?
Who was ...?
Who were the main . . . ?
Why did ...?

**Questions:**

Can you explain what is happening . . . what is meant . . .?
How would you classify the type of ...?
How would you compare ...?contrast ...?
How would you rephrase the meaning ...?
How would you summarise ...?
What can you say about ...?
What facts or ideas show ...?
What is the main idea of ...?
Which is the best answer ...?
Which statements support ...?
Will you state or interpret in your own words ...?

# Bloom's *Taxonomy* (1956)

HIGH LEVEL THINKING SKILLS

## Application

To use in a new situation. Solving problems by applying acquired knowledge, facts, techniques and rules in a different way.

### Questions:

How would you use...?
What examples can you find to ...?
How would you solve _____ using what you have learned ...?
How would you organise _____ to show ...?
How would you show your understanding of ...?
What approach would you use to...?
How would you apply what you learned to develop ...?
What other way would you plan to ...?
What would result if ...?
Can you make use of the facts to ...?
What elements would you choose to change ...?
What facts would you select to show ...?
What questions would you ask in an interview with ...?

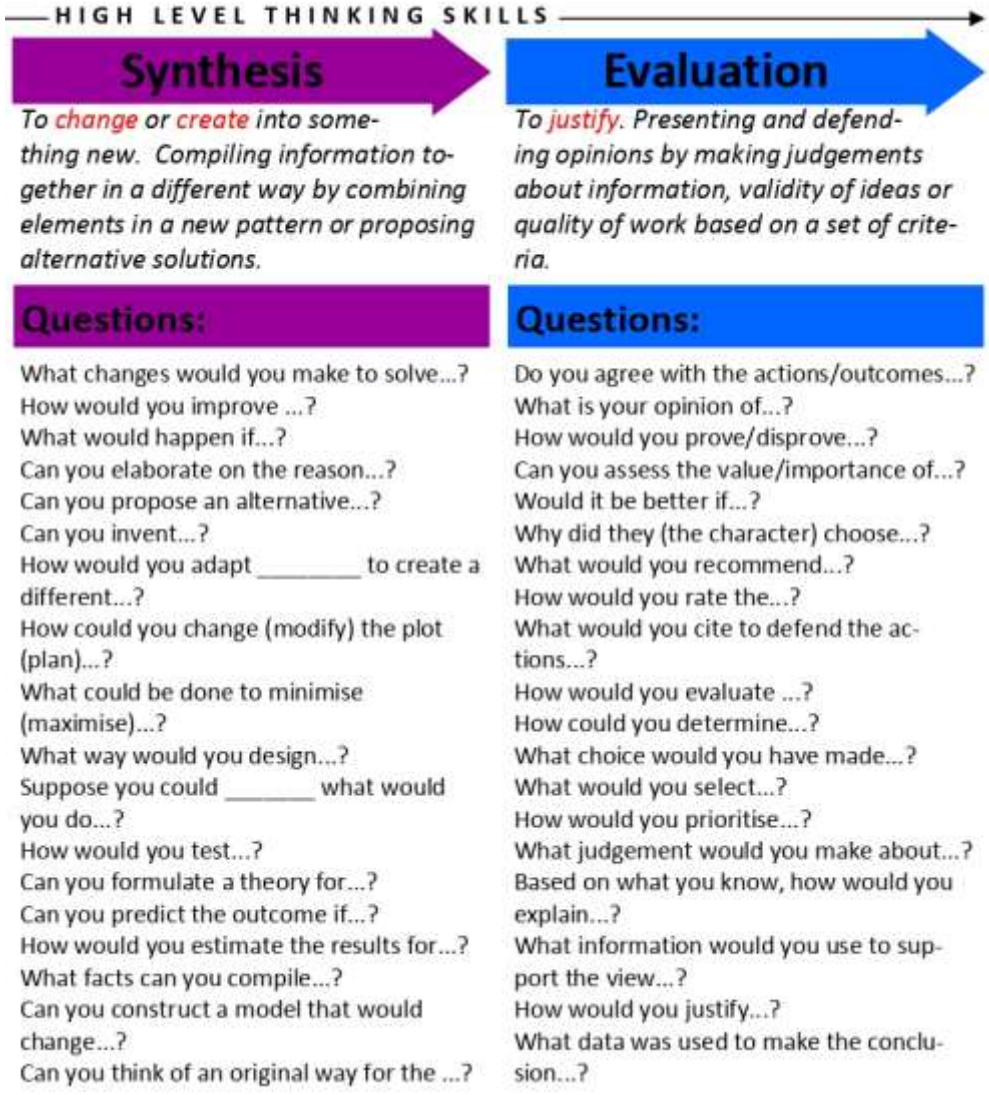
## Analysis

*To examine in detail. Examining and breaking information into parts by identifying motives or causes; making inferences and finding evidence to support generalisations.*

### Questions:

What are the parts or features of ...?
How is _____ related to ...?
Why do you think ...?
What is the theme ...?
What motive is there ...?
Can you list the parts ...?
What inference can you make ...?
What conclusions can you draw ...?
How would you classify ...?
How would you categorise ...?
Can you identify the difference parts ...?
What evidence can you find ...?
What is the relationship between ...?
Can you make a distinction between ...?
What is the function of ...?
What ideas justify ...?

# Bloom's *Taxonomy* (1956)



# Bloom's *Taxonomy* (1956)

- As well as a classification Bloom's is often used to inform planning or assessment in various contexts
- Is your activity encouraging the use of the higher level thinking skills?
- How can you take an activity from "recall" to "application"?

How well does Bloom's work when applied to mathematics as a subject?

For each level, can you think of an appropriate task?

# Reflect

How might you use effect sizes or Bloom's taxonomy in the following situations?

- You're planning to teach a classroom activity to a group of 10 students
- You're studying for your *Random Processes* module
- You are planning the first lecture to be given to 100 first year maths undergrads on the fundamentals of Set Theory

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**Questions?**

**Thank you for your participation!**