From the Colloquial to the Scientific Story (And Back Again)

The Use of Classroom Dialogue in the Development of Conceptual Understanding of Physics

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From the Colloquial to the Scientific Story (and Back Again) – Goal and Challenges -
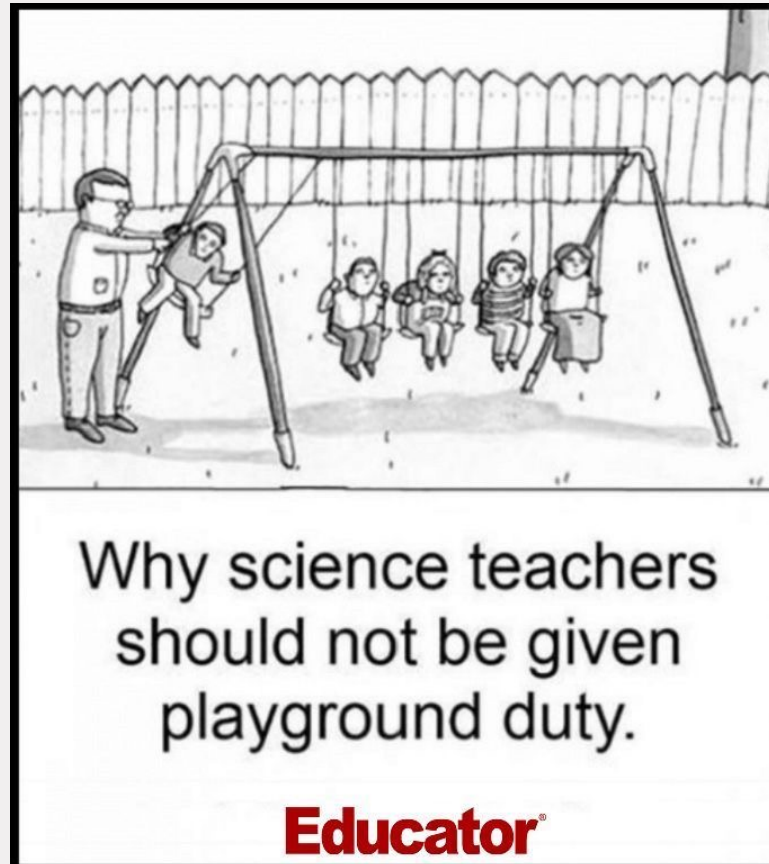
What I want to do today

1. Experience how my colleagues and I introduce velocity qualitatively ('hands-on intuition')

2. Introduce a tool to 'visualise the journey' from colloquial to scientific language

Two Perspectives

Why science teachers should not be given playground duty.

Educator

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One Perspective – The Student

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From Colloquial to Scientific Kinematics – A Warm-Up

The graph shows position as a function of time for two trains running on parallel tracks. Which is true?
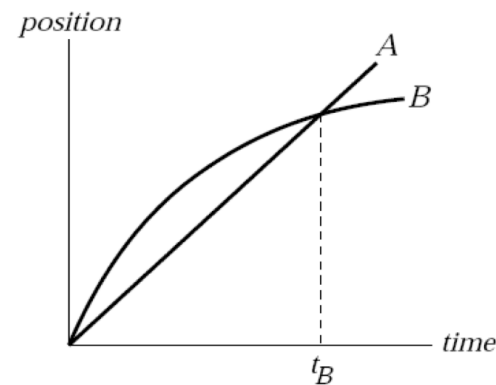
1. At time t_B, both trains have the same velocity.
2. Both trains speed up all the time.
3. Both trains have the same velocity at some time before t_B.
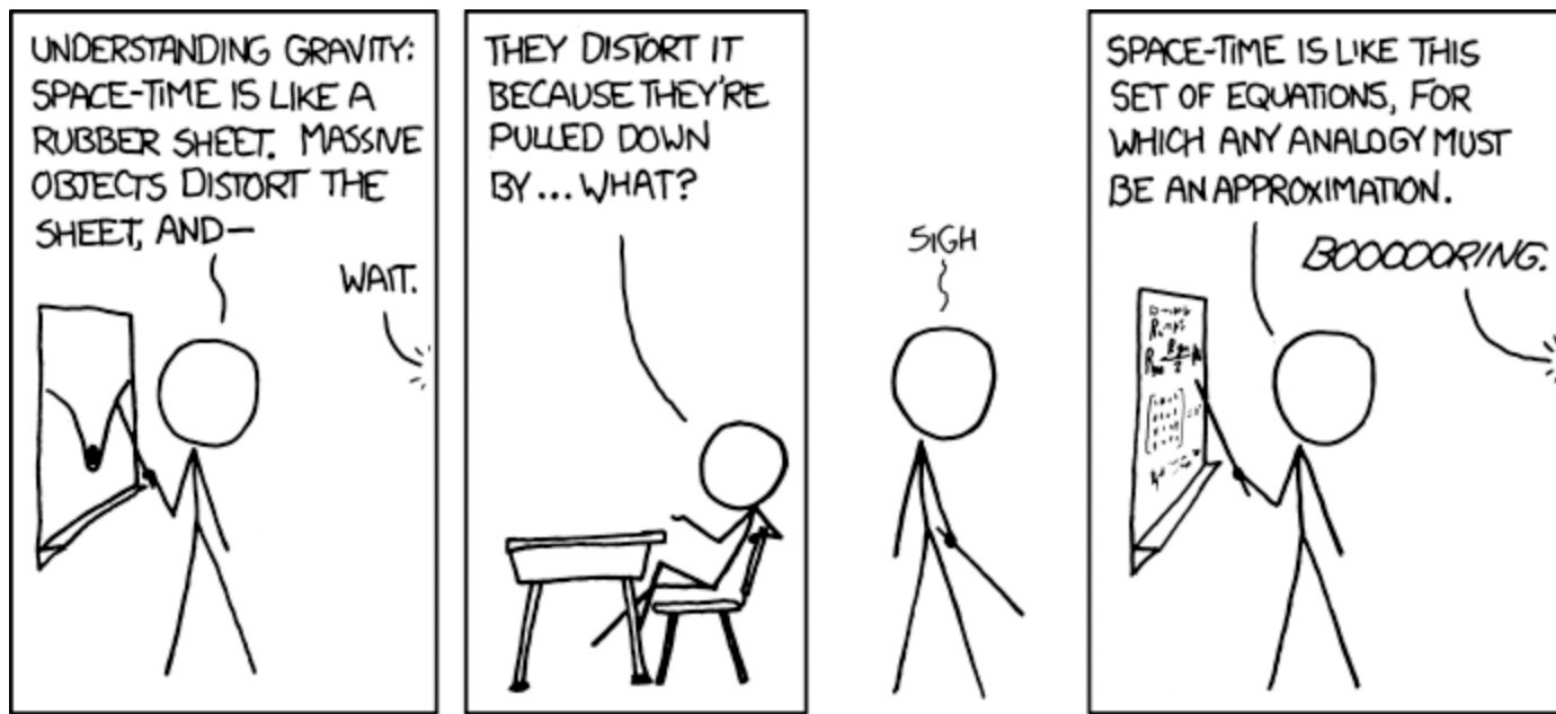4. Somewhere on the graph, both trains have the same acceleration.

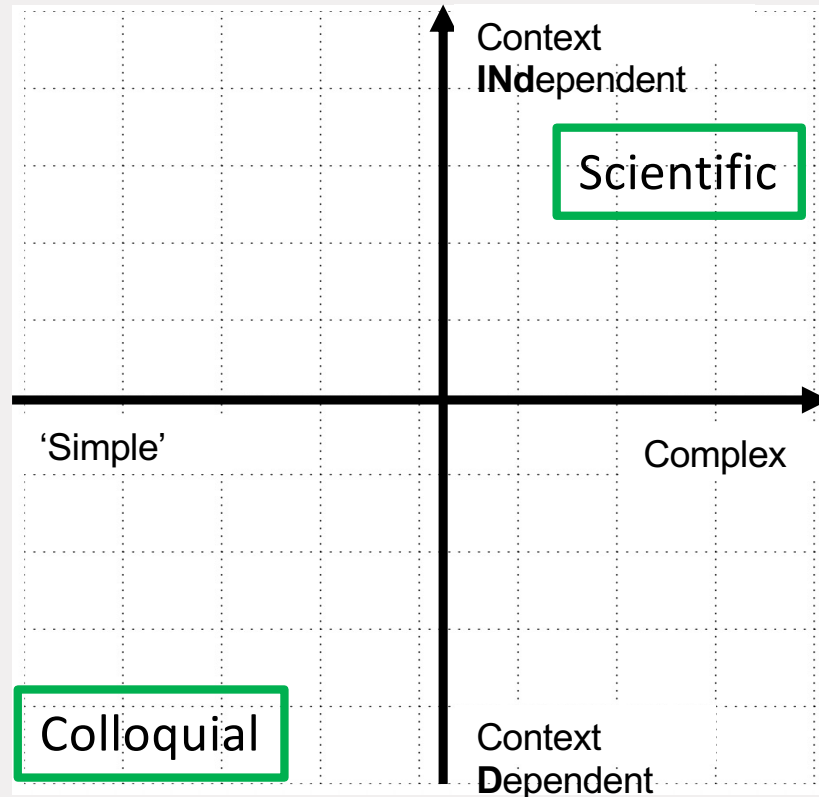# From Colloquial to Scientific Kinematics – Let's do this!

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Another Perspective – The Teacher

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From the Colloquial to the Scientific Story (and Back Again) – Does it work? -

The Semantic Plane – Visualising Colloquial and Scientific Language

Context Dependency:

"Do I need to have information about the environment to understand what is being said?"
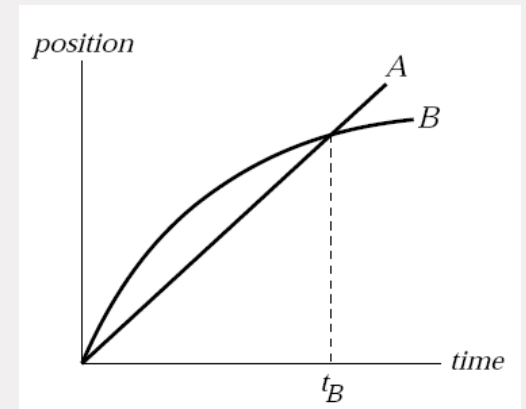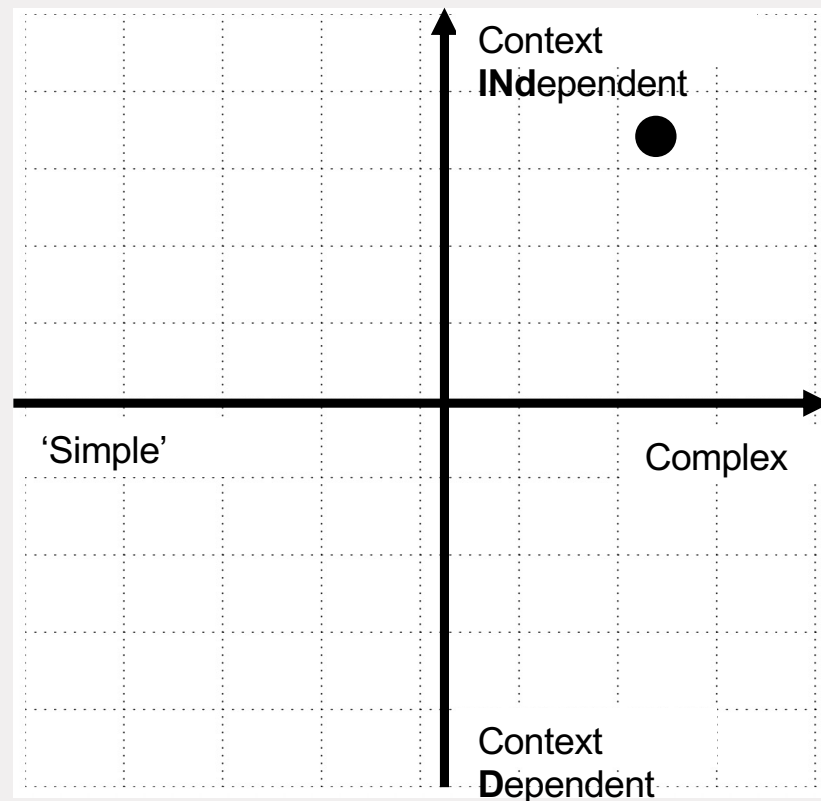
"Is it universally applicable?"

Complexity:

"What other pieces of theory/knowledge do I need to understand what is being said?"

(e.g. Barreto et al., 2021; Doran, 2021; Larsson, 2018; Maton, 2013, 2014;)

Visualising Colloquial and Scientific Language

Context
INdependent

'Simple'   Complex

Context
Dependent

Context Dependency: seconds? km?

Complexity: Slopes, $v = \dfrac{\Delta x}{\Delta t}$, comparison

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Visualising Colloquial and Scientific Language

Context
INdependent

'Simple'   Complex
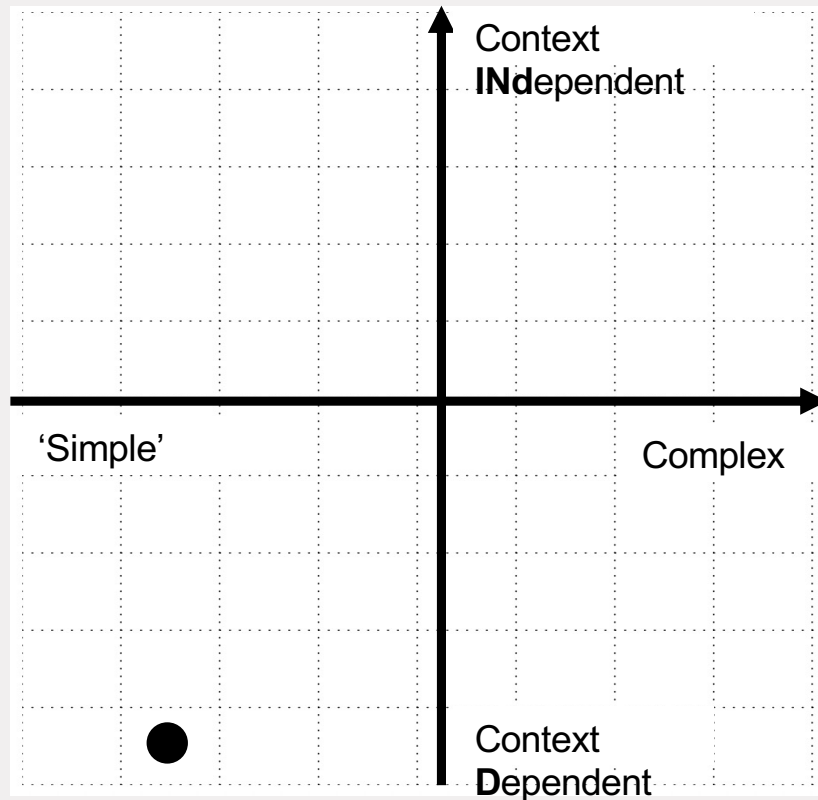
Context
Dependent

"Walk the *x-t* graph"

Context Dependency: Right here, right now

Complexity: Walk it

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Visualising Colloquial and Scientific Language
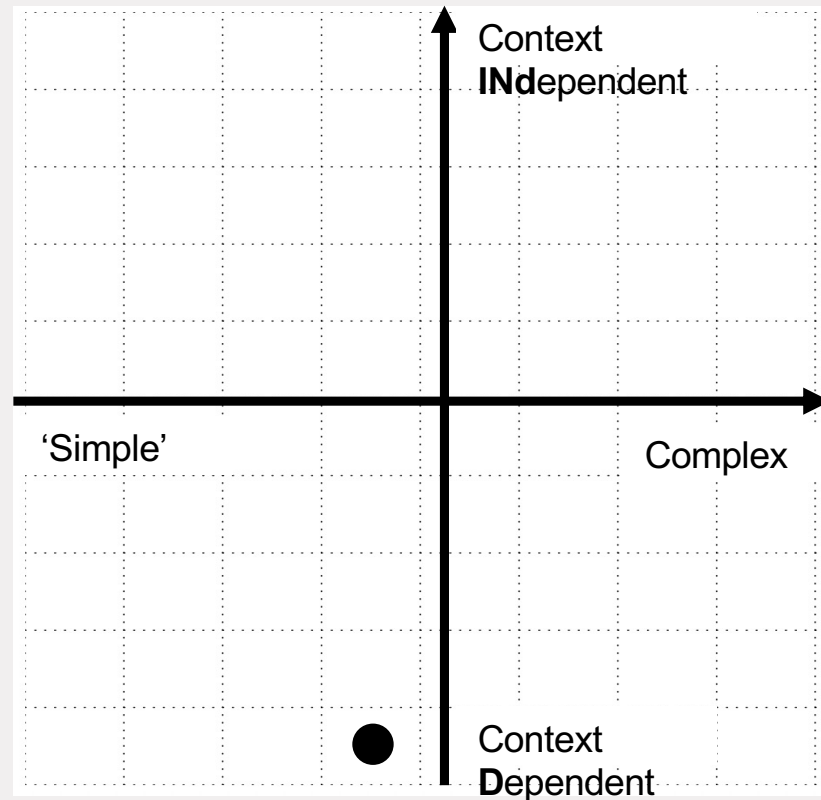
"He/she (blue) walked faster "
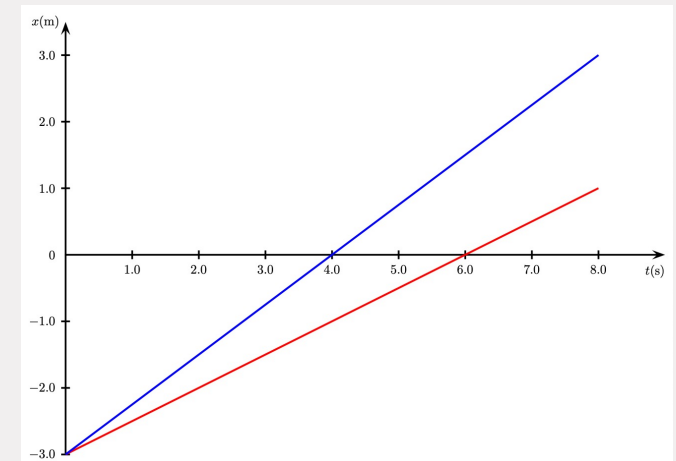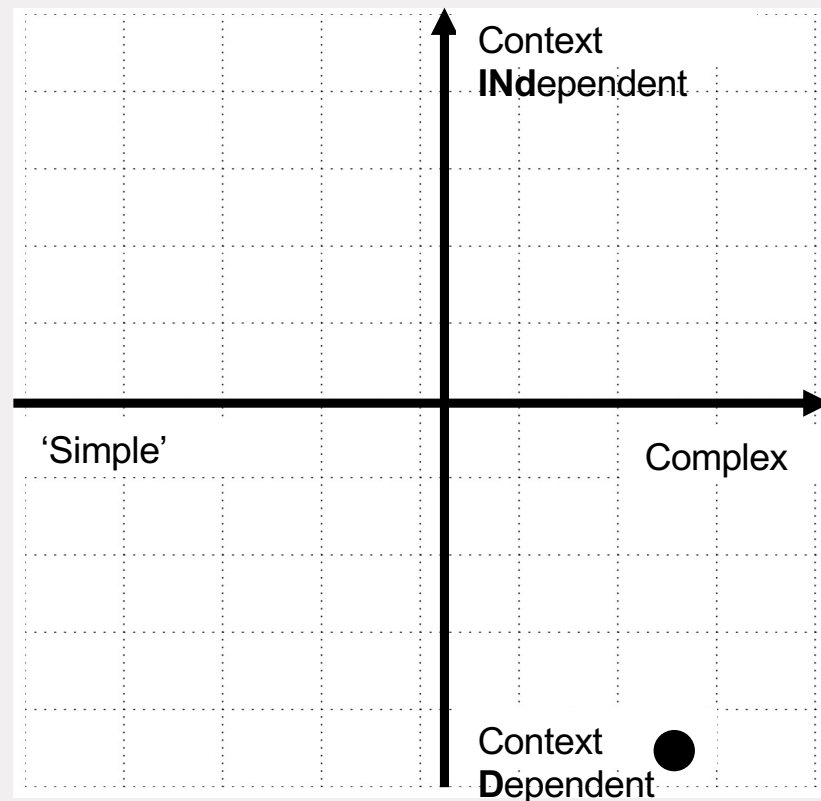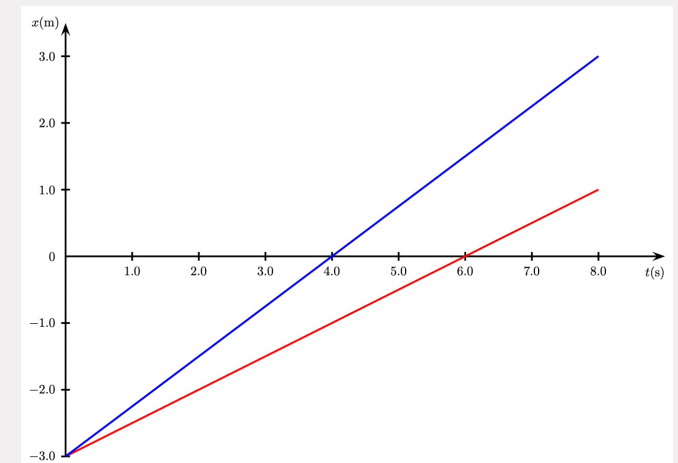

Context Dependency: Right here, right now

Complexity: "walk faster"

Visualising Colloquial and Scientific Language

"steepness of *x-t* graph = velocity"

Context Dependency: Right here, right now

Complexity: Definition, combining things

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Visualising Colloquial and Scientific Language

Context
INdependent

'Simple'   Complex
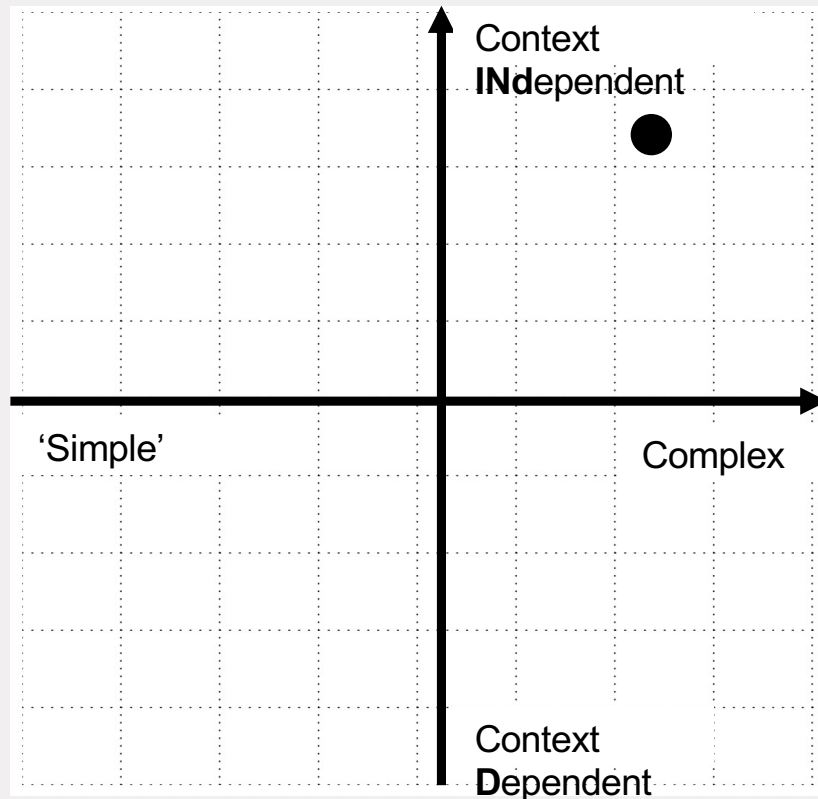
Context
Dependent

In equation form: $v = \frac{\Delta x}{\Delta t}$„

Context Dependency: No!

Complexity: Change position, interval of time

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The Semantic Plane – Kinematics & 'Hands-on' Intuition

Context **IN**dependent

'Simple'   Complex
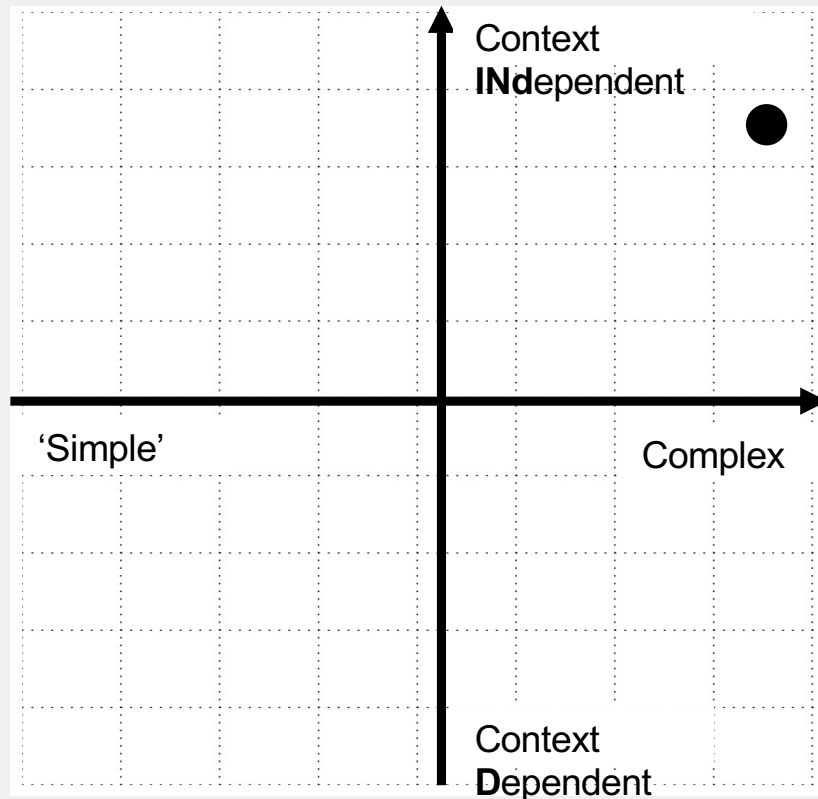
Context **D**ependent

Derivations
e.g. $v^2 = u^2 + 2 \cdot a \cdot \Delta x$

Context Dependency: No!

Complexity:
$v = u + a\Delta t \ and \ \Delta x = u\Delta t + \frac{1}{2}a(\Delta t)^2$

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We want the Most Difficult!
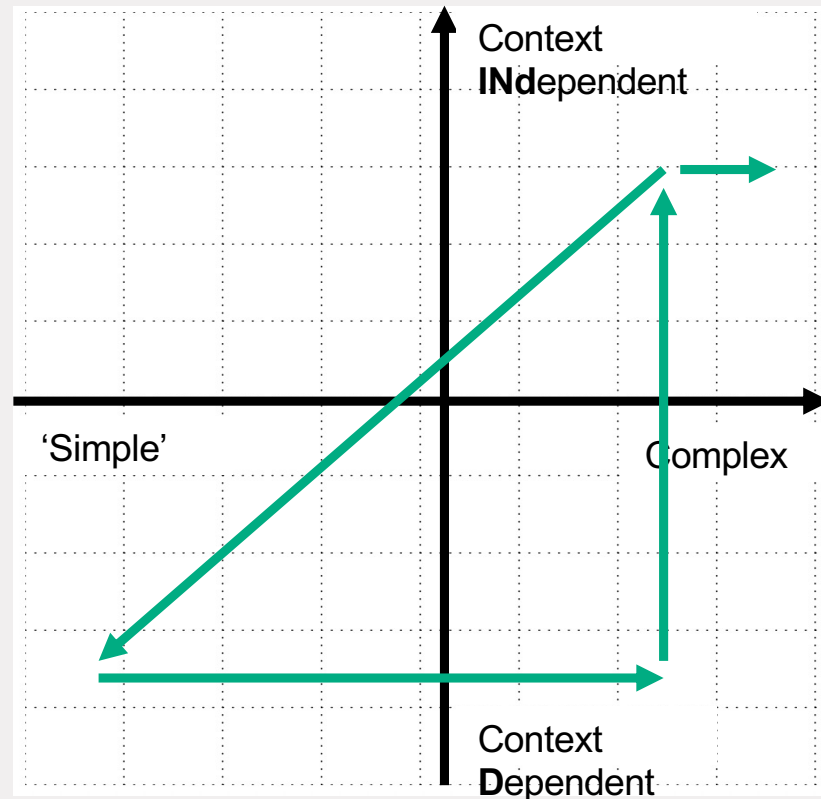
- 'Discursive Mobility' (e.g. Larsson, 2018)

- 'Return Trips' (Doran, 2021)

- Heen-en-weer denken' (Van den Berg, 2012)

- 'The Scientific Gaze' (Doran, 2021; Georgiou, 2014)

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Visualising an Episode
(Introduction Conservation of Energy)

Context **IN**dependent

'Simple'

Complex

Context **D**ependent

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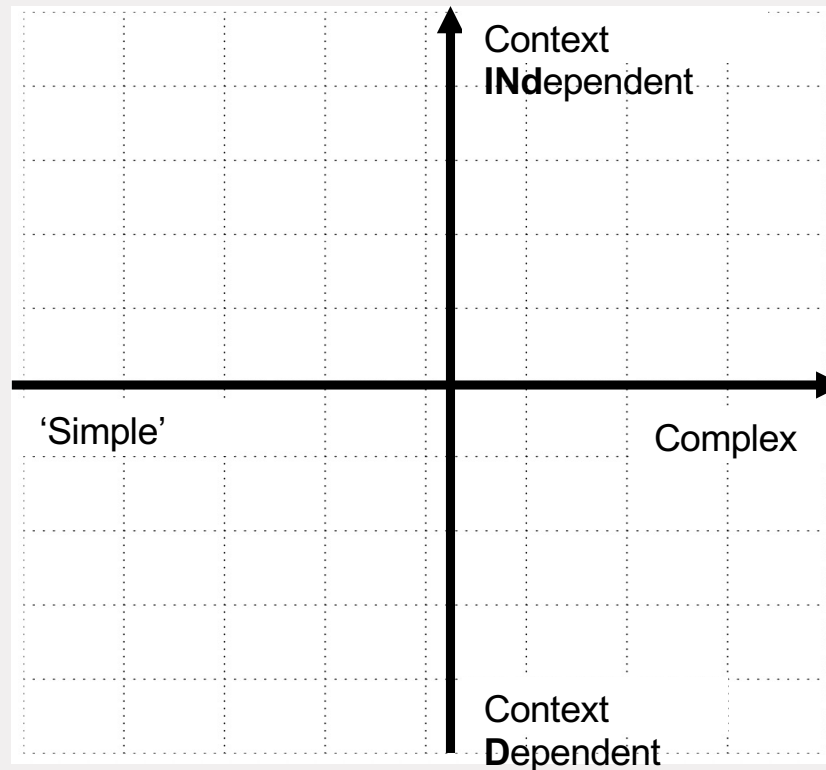
(Ambitious) *Talk Moves* are (just one) Key
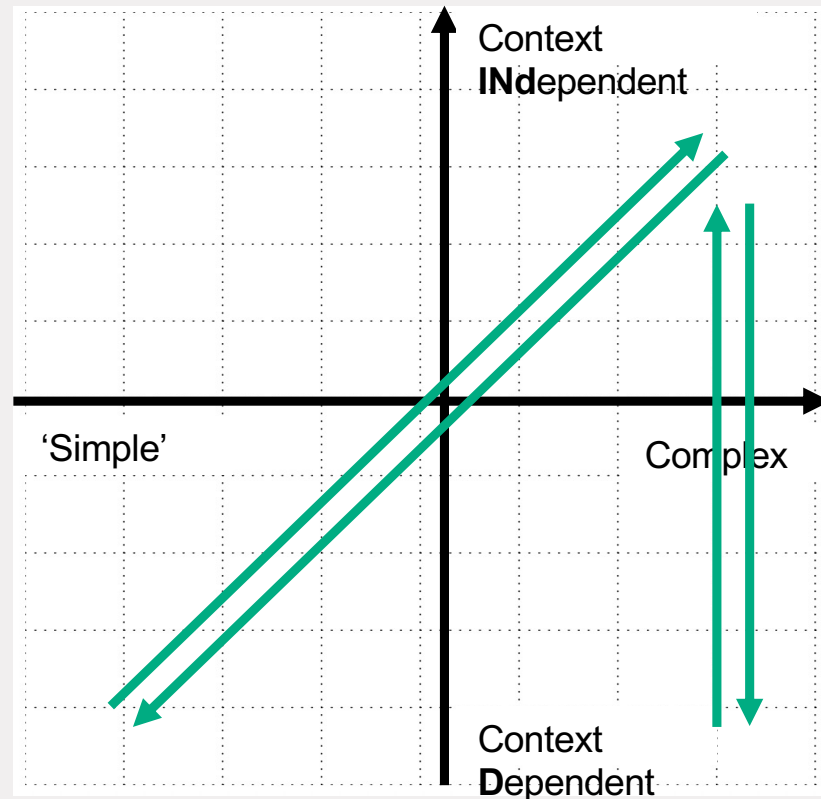
"How would you explain what you see?"

"What does this mean?"

"Could you elaborate further?"

Etc.

Planning 'a Trip'

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From the Colloquial to the Scientific Story (and Back Again) – What I would like to know more -
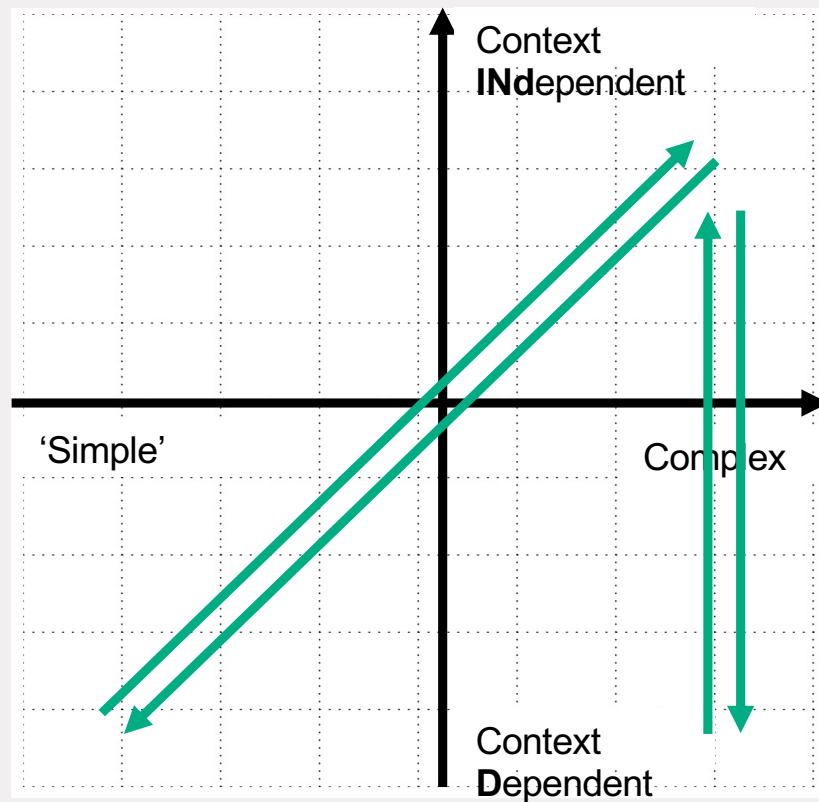

MUST... MAKE IT...

SCAN ME

My Research - by Teachers for Teachers

Intended Outcomes

1. Understanding current practices physics classrooms - part 1

2. Understanding current practices physics classrooms - Part2

3. Teachers prepared to deliver good dialogues

4. Students dialogue and understanding have improved

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Let's Stay in Touch!

- Spar about ways to creating 'hands-on intuition'

- Spar about improving our lessons

- Help me with filling a niche:

  - Which dialogues are actually leading to better understanding and application of topic x and topic y in secondary-school physics lessons?
  (c.f. Erath et al., 2018, Howe, 2019, Hennessy et al., 2021)

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