IDENTITIES

Enlightening
Interdisciplinarity
in **STEM**
for Teaching

Complexity in research in science education

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Understanding complexity: research literature in education

- Research in science education has been studying since the 1990s the difficulties of *novices* in approaching these concepts
- Main difficulties encountered (e.g. Perkins & Grotzer, 2000; Wilensky & Resnick, 1999) :
    - Overcoming classical linear thinking
    - Distinguishing the 'levels' of which the system is composed
    - Formulating explanations of complex phenomena: tendency to *slippage* from the microscopic level of parts to the macroscopic level of systemic behaviour
    - Recognising causal relationships within the system

The deterministic-centralised mindset

- The difficulties have been attributed to the fact that typical concepts of complex systems are often at odds with common experience
- Resnick and Wilensky (1998), studying the way *novices* reason with complexity concepts, identified an attitude called 'deterministic-centralised mindset'.
- Complex phenomena tend to be explained by non-experts assuming
    - that there is a **centralised control to** the system itself that forces it to behave in that way
    - that there are only **simple causal relationships**
    - that, for these reasons, the behaviour of the system is exactly **predictable**

Beyond the difficulties, the importance of complexity education

- Complex systems theory is having an increasing impact on all sciences (physical, natural, social)
- Many of the decisions that are made in the socio-political sphere concern complex systems that cannot be dealt with in a classical way that is important for students and citizens alike
- The basic concepts of complexity reflect a **change of perspective** in science that can help students develop new intellectual horizons, explore new methods and new ways of explaining phenomena

Imagine you live in the desert. You have a house in the desert and one day you decide to go for a walk in the surrounding area. You walk two or three kilometres, the exact distance doesn't matter, and you arrive at a place in the desert where there are sand dunes. You notice that, near one of these dunes, there is a permanent sign, like a hoisted flag or something permanently fixed in the ground. You go home and do not return to that area for five or six months. One day you come back and you notice that the flag is still there, in the same place where you left it - and you are sure about the GPS signal - but the dune is no longer there. And there is a new sand dune that has appeared 50 or 100 metres away. How could this happen? Why does it look like the dune has moved into the desert?

(Barth-Cohen, 2018)

ACTIVITIES

- Discussing the question in pairs
- Write down the reasoning followed
- Time for activity: 20 minutes

NOTES FROM THE GROUP DISCUSSION