Linking Physics and the Disciplines: Reinterpreting Biglan's Framework for Sustainability Integration

The 15th eSTEeM Annual Conference, MK
Session: C2

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Wednesday, 29 April 2026

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Introduction

ESTEEM: Interactive session ➔ Worksheet

Based on learning journey of ESTEEM project *Embedding environmental sustainability in the Physics curriculum*

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Aim of presentation: Improve understanding of what is possible (and why) when including environmental sustainability in your discpline.

- Biglan's classification of academic disciplines
- Sustainable Development Goals
- Key Sustainability Competencies
- Time to reflect ➔ Please email me your completed front sheet

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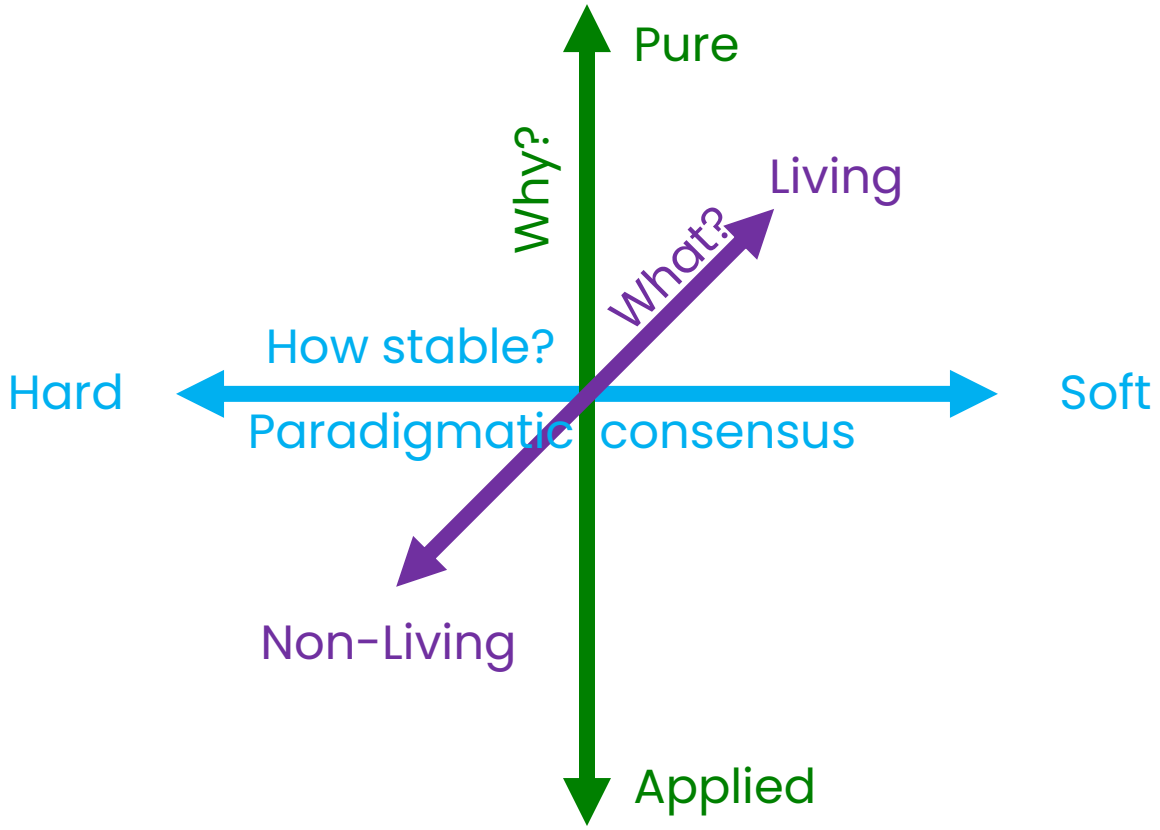
Biglan's classification

Background

- Biglan, A. (1973). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology*, *57*(3), 195.
- Describes epistemological characteristics of disciplines, i.e. the nature of knowledge and inquiry within them



Over to you

- Where does your discipline sit?
- Be specific, for example
  - *Electrical* engineering
  - *Design* engineering
- Time: 1 min

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SDGs (Ends)

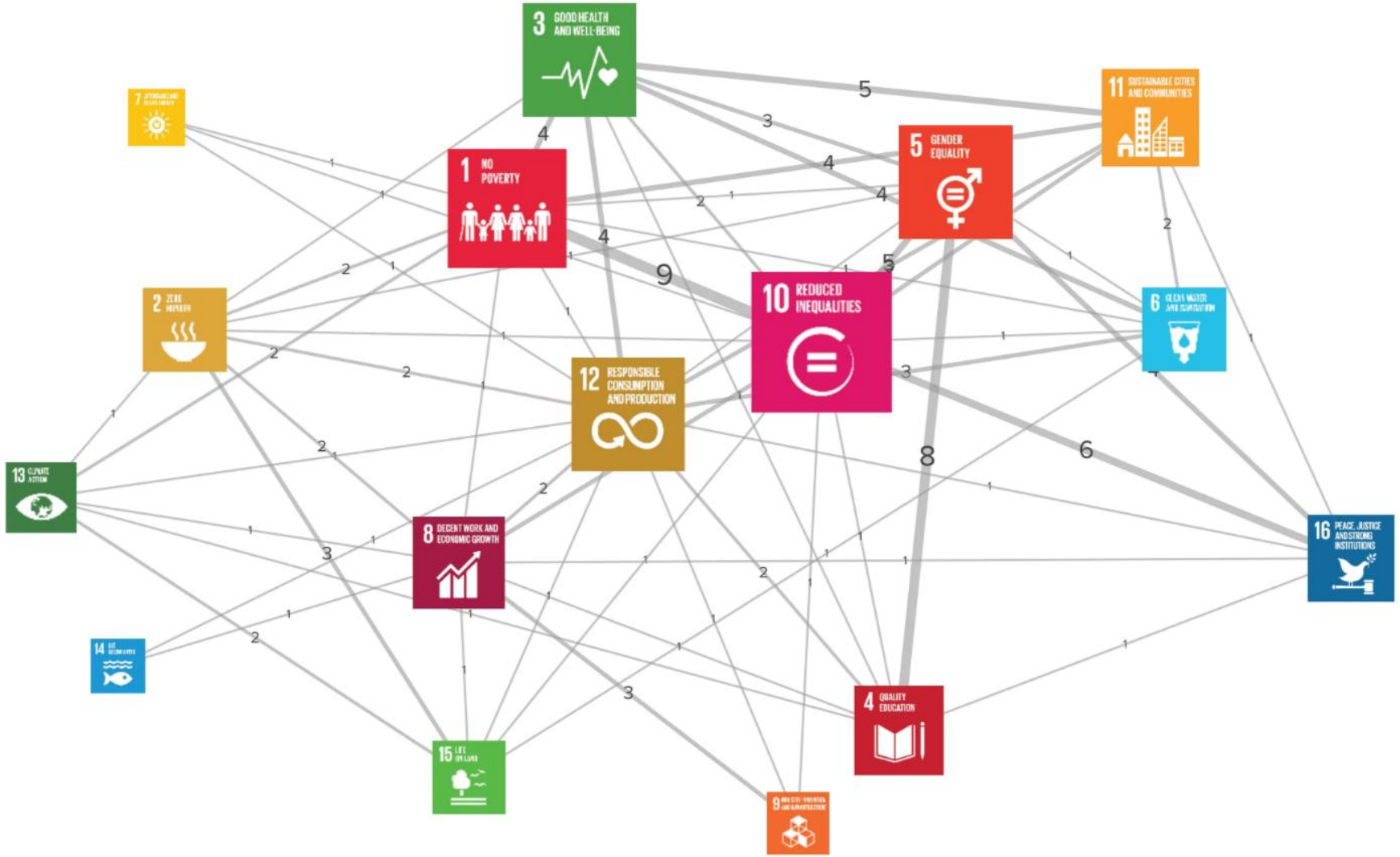
SDGs – Introduction

- The 17 SDGs define desired global outcomes
- Global problem domains
- Has targets & indicator under each goal

SDG 13 - Take urgent action to combat climate change and its impacts

  - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
  - Integrate climate change measures into national policies, strategies and planning
  - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
  - …

SDGs are related



Source: https://blog.kumu.io/a-toolkit-for-mapping-relationships-among-the-sustainable-development-goals-sdgs-a21b76d4dda0

S227 – Core Physics

- Build on ESTEEM project

2 x 

, 2 x 

, 2 x 

, 1 x 

Sustainability concept

SDG 11 Sustainable cities and communities focuses on making urban areas more sustainable, including reducing their environmental impact. One practical way physics contributes to this goal is through technologies like electrostatic precipitators, which reduce the amount of particulate matter released by power plants. This improves air quality and helps cities become cleaner and healthier places to live.

This is a good example of how applying physics can support environmental protection. By understanding and using scientific principles, you may be able to develop solutions that make a real difference.

Please see the Module guide for more information.

Over to you

- To which SDG(s) does your teaching discipline align?
- 3-5 top SDGs
- For reflection: Why?

  Using Biglan's framework

- Time: 1 min

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Key sustainability competencies (Means)

KSCs – Introduction

- **Purpose**: Capabilities people need to address sustainability challenges

- 8 UNESCO proposed KSCs
  - Ways of thinking
  - Ways of practicing
  - Ways of being

2

Key Competencies: Ways of Thinking

Connected to learning outcomes, adapted from UNESCO

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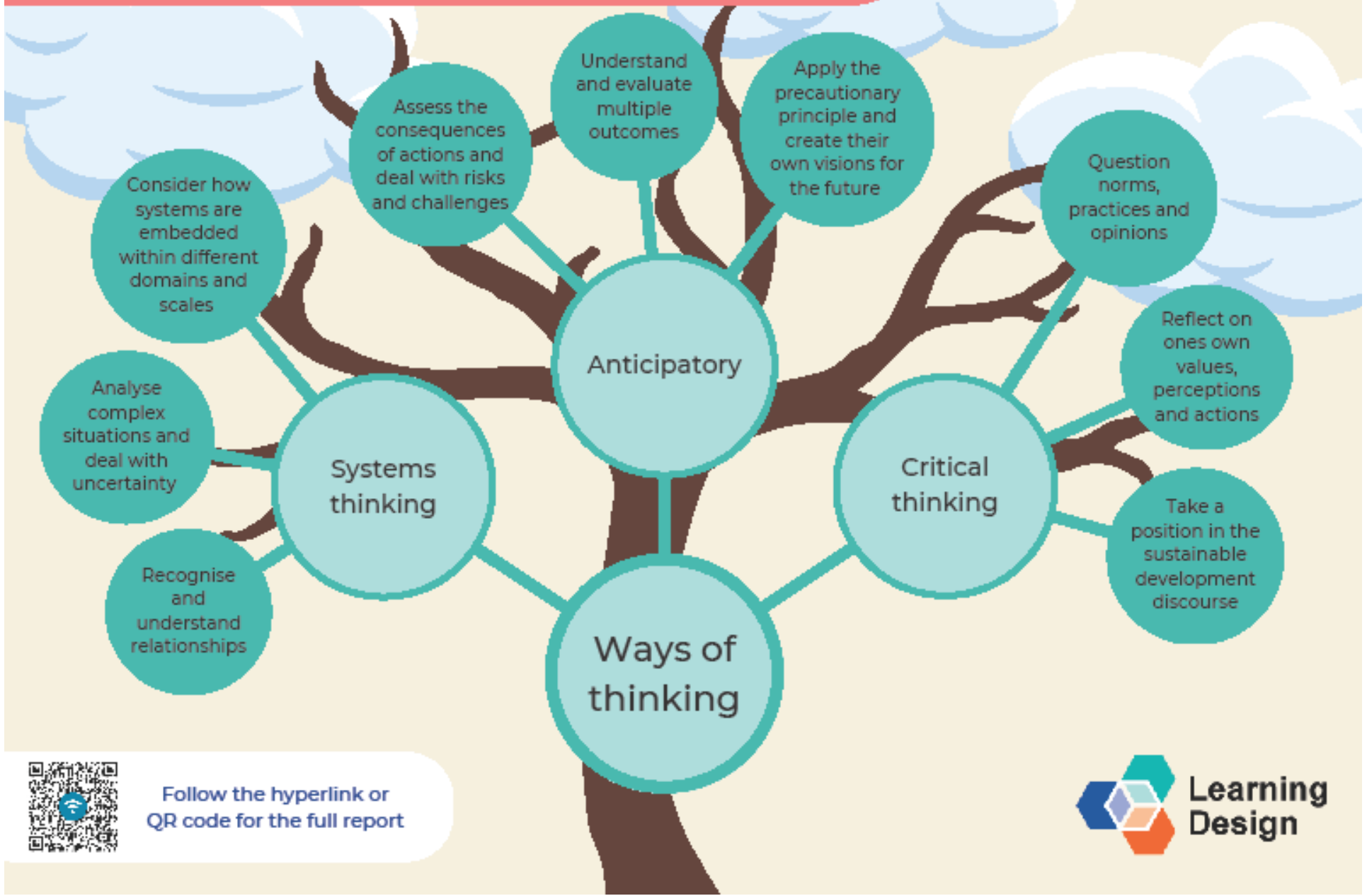

Follow the hyperlink or QR code for the full report

Learning Design

1 Key Competencies: Ways of Practicing

Connected to learning outcomes, adapted from UNESCO

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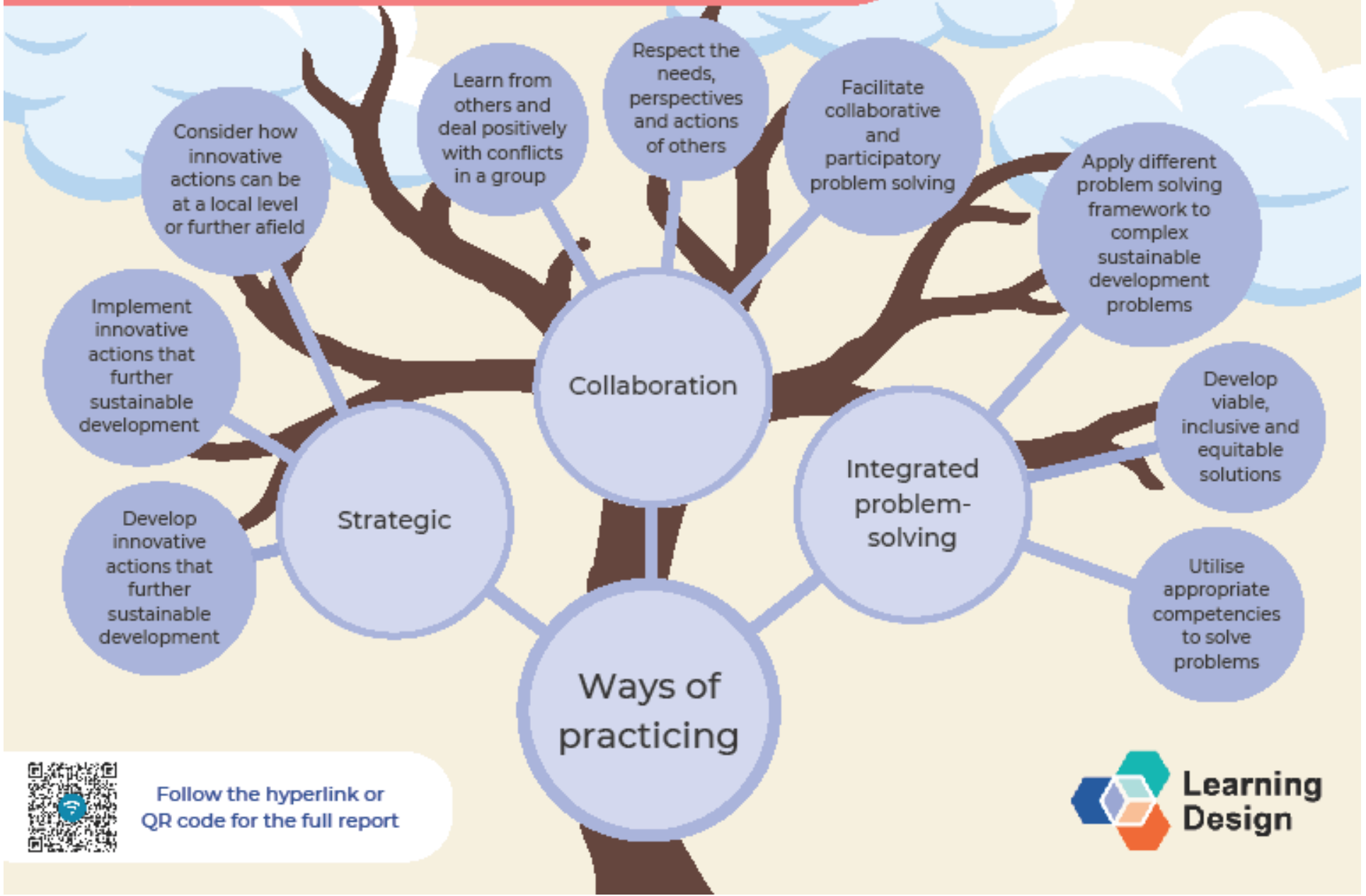

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Learning Design

3

Key Competencies: Ways of Being

Connected to learning outcomes, adapted from UNESCO

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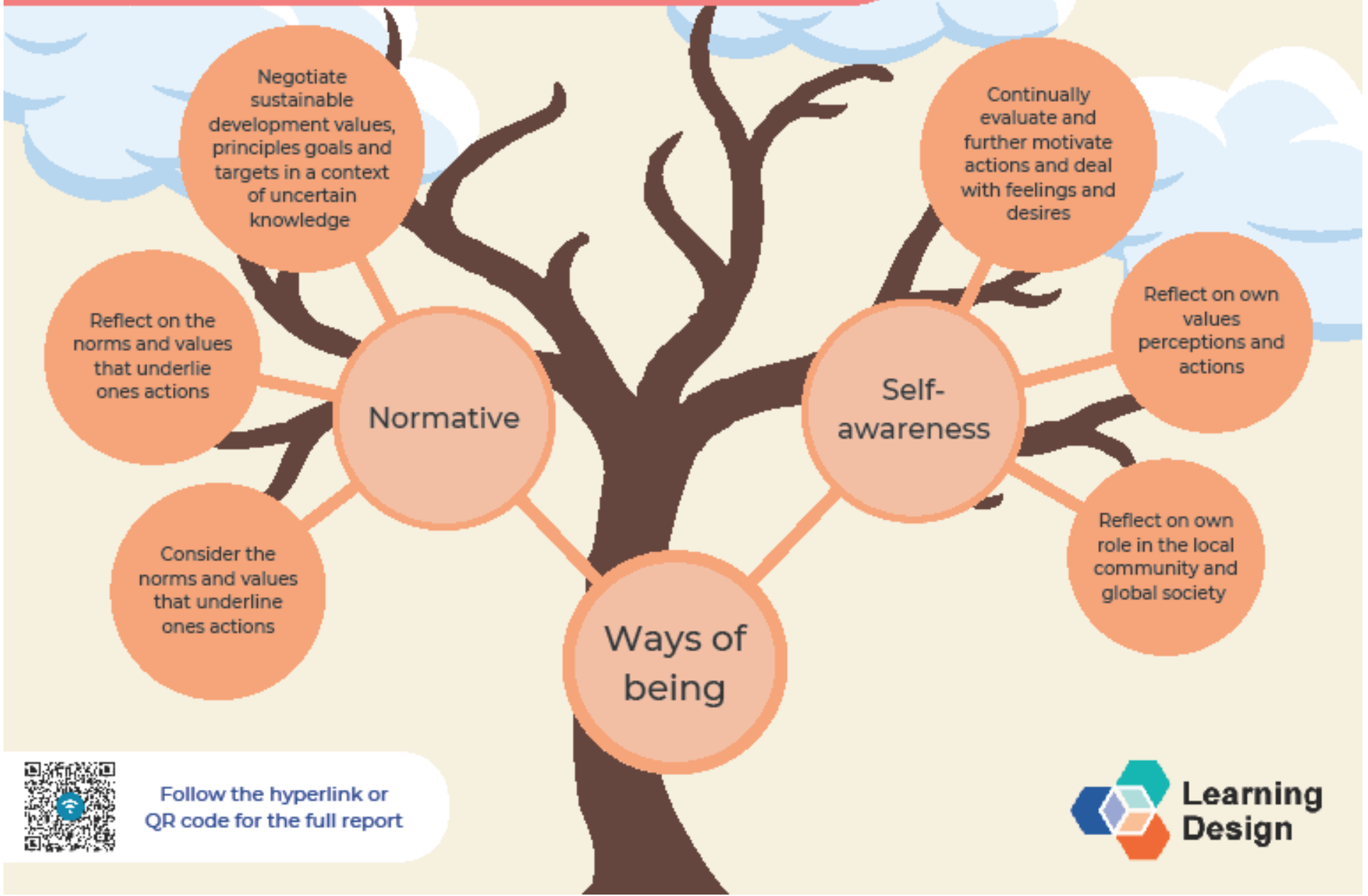

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Learning Design

S227 – Core Physics

- Systems thinking: 4 x
- Integrated problem solving: 3 x
- Collaboration: 1 x
- Critical thinking: 1 x

Sustainability concept: Key sustainability competency - Critical thinking

Special relativity is a powerful example of how critical thinking drives scientific progress. The theory emerged when Einstein challenged the prevailing idea of the 'aether', showing that it couldn't explain experimental results. By questioning accepted norms and re-evaluating evidence, he transformed our understanding of space and time.

This mindset is just as vital in sustainability. Addressing global challenges requires analysing, evaluating, and questioning information rather than accepting claims at face value. While you may learn established physics principles as facts, your studies should also encourage an open mind. That is to say you should be ready to explore new interpretations and rethink assumptions when evidence demands this.

Please see the Module guide for more information.

Over to you

- To which KSCs does your teaching discipline align with?

- For reflection: Why?

  Using Biglan's framework

- Time: 1 min

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Reflection

So what?

Example: SDG 13 – Climate Action

- Targets
  - Strengthen resilience and adaptive capacity
  - Integrate climate change measures into national policies, strategies and planning
  - Awareness-raising and human and institutional capacity
  - Implement the commitment by developed-country

- KSCs
  - Systems thinking (earth systems + social systems)
  - Anticipatory competence (futures, uncertainty)
  - Normative competence (justice, responsibility)
  - Strategic competence (intervention, policy, transition)

Physics

Hard–pure–nonlife

A disciplinary lens on environmental sustainability in HE

Disciplines shape what is possible (Biglan's framework)

- What kind of knowledge is used?
- Why is it produced?
- What is studied?

SDGs set the challenges (SDGs = Ends)

- Normative, global problem spaces
- Reveal where disciplinary knowledge is relevant and where it is limited

Education develops competencies (KSCs = Means)

- Thinking, practicing and being
- Some competencies align naturally to a discipline
- Others are absent. Not as failures, but because of disciplinary limitations

Sustainability isn't "added" to disciplines – It is negotiated with them

Exit ticket

- Before you leave today

- Discuss with others

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Thank you

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