Week 9 - Iterations and GEM

Learning Objectives and Checklist

Learning objectives

- describe how GEM supports refinement within inquiry
- analyze when iterative testing can deepen understanding
- identify where a GEM cycle could support your final project

To-Do

□ Review the Week 9 material below
□ Complete the EcoGEM interactive simulation
□ Participate in discussion, including response

Inquiry as a Cycle

Inquiry does not end once students arrive at an answer. In many cases, the most important learning occurs when students revisit their initial ideas, test them against evidence, and refine their understanding over time. This process of iteration is central to meaningful inquiry. One model that supports this kind of learning is the Generate-Evaluate-Modify (GEM) cycle.

GEM

GEM describes learning as an iterative process in which learners generate an initial relationship or explanation, evaluate it in light of new evidence, and modify their thinking based on what they discover (Khan, 2007; Khan, 2010). In this way, learning is not treated as a linear progression, but as a cycle of prediction, testing, and revision. This is especially important in science and mathematics contexts where students often hold incomplete or overly simple mental models. Research on ecosystems, for example, shows that students frequently interpret food webs as disconnected food chains and struggle to recognize indirect effects, feedback loops, and dynamic system behaviour (Webb & Boltt, 1990; Hokayem & Gotwals, 2016). Even when they can identify organisms and

feeding relationships, students may still rely on linear explanations rather than systems thinking (Eilam, 2011).

Technology can play a meaningful role in supporting GEM cycles when it allows learners to manipulate variables, observe outcomes, and compare their predictions with the behaviour of a dynamic model. Simulations are particularly useful when they make otherwise hidden processes visible and allow students to test relationships quickly across multiple conditions (Khan, 2010). Specifically, simulations allow students to:

- manipulate variables and observe outcomes in real time
- visualize relationships that are otherwise difficult to see
- compare predictions with actual system behaviour
- revisit and revise their thinking across multiple attempts

As you move into this week's experience, consider how GEM supports refinement and iteration within the inquiry cycle.

References

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Khan, S. (2010). New pedagogies on teaching science with computer simulations. *Journal of Science Education and Technology,* 20(3), 215–232. https://doi.org/10.1007/s10956-010-9247-2

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