Core Time Digital Grant

Exploring Formative Assessments in the Realm of Genetics

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Project Goals:

- increase subject matter knowledge and standards-based teaching skills.
- increase content knowledge and model effective instructional practices through engaging activities and tasks

Today's Objectives

- Explain the difference between genotype and phenotype.
- Demonstrate understanding of phenotype using magazine cutouts.
- Demonstrate understanding of phenotype and genotype using paper plate faces.
- Illustrate the differences between genotype and phenotype using Reebops.
- Identify effective formative assessment strategies for each instructional activity.

Today's Instructional Strategies

- Explicit Instruction
  - Pre-assessments (informal)
  - Instruction
  - Application
  - Post-assessment s(informal)
- Guided Discovery
  - Pre-assessments (informal)
  - Tasks
  - Reflections on Outcomes
  - Generalizations
  - Post-assessment s(informal)
- Small Group Work and Discussion

Definitions

- Formative Assessments
  - make students' thinking visible in order to inform and modify instruction (NRC, 2001).
  - are part of ongoing instruction in order to monitor and make adjustments to ongoing instruction (Liu, 2010)
  - help teachers adapt instruction to meet students' needs (Wiliam, 2011)

Examples of Formative Assessments (Keeley, 2008)

- A & D Statements (p. 48)
- Agreement Circles (p. 51)
- Chain Notes (p. 62)
- Concept Mapping (p. 68)
- Data Match (p. 75)
- Explanation Analysis (p. 79)
- Familiar Phenomenon Probes (p. 85)
- Fist to Five (p. 93)

Examples of Formative Assessments (Keeley, 2008, 2015)

- Frayer Model (p. 99)
- Guided Reciprocal Peer Questioning (p. 106)
- K-W-L Foldables (p. 128)
- Look Back (p. 133)
- Paint the Picture (p. 145)
- P-E-O Probes (p. 153)
- RERUN (p. 172)
- Think-Pair-Share (p. 192)

NGSS Standards

1-LS3-1 Heredity: Inheritance and Variation of Traits

Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

Performance Expectation | Grade: K-2, 1

3-LS3-1 Heredity: Inheritance and Variation of Traits

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

Performance Expectation | Grade: 3-5, 3

3-LS3-2 Heredity: Inheritance and Variation of Traits

Use evidence to support the explanation that traits can be influenced by the environment.

Performance Expectation | Grade: 3-5, 3

Academic Language (Teacher)

- DNA - A very long chemical that can coil up to form a structure known as a chromosome.

- Chromosome - A very long piece of DNA coiled around some proteins. Each chromosome is a separate strand of DNA.

Academic Language (Teacher)

- Gene - A segment of a strand of DNA that codes for how to make a particular protein.
- Allele - A form of a gene. A gene actually consists of two forms, one from the mother and one from the father.

Academic Language (Teacher)

- Mitosis - The type of cell division that produces cells with the same number of chromosomes as the original cell.

- Meiosis - The type of cell division that produces cells with half the number of chromosomes than the original cell.

Academic Language (Teacher and/or Student)

- Homozygous - Having two alleles (i.e., forms of the gene) that are identical.
- Heterozygous - Having two alleles (i.e., forms of the gene) that are different.

Academic Language (Teacher and Student

- Phenotype - the appearance of an organism (aka, the look).
- Genotype - the genetic makeup of an organism (aka, the code).

Activity One – Exploring Phenotype

- Create a simple family tree using pictures from a magazine.
- Must have a mother, father, and two offspring.
- Explain what physical characteristics were inherited from each parent.
- Explain what physical characteristics are not explained by each person's physical appearance.

Activity One – Effective Formative Assessments

- A & D Statements
- Agreement Circles
- Chain Notes
- Explanation Analysis
- Others?

Activity Two – Faces: Exploring Genotype and Phenotype

- Create two sets of alleles (one from mother and one from the father) for three traits (i.e., eye shape, nose shape, and mouth shape).
- Choose only one allele for each trait from each parent.
- Combine each pair of alleles and determine the genotype of the offspring.
- Draw the face of the offspring on a paper plate illustrating the correct phenotype.

Activity Two – Effective Formative Assessments

- Concept Mapping
- Familiar Phenomenon Probes
- Frayer Model
- Reciprocal Peer Questioning
- Look Back

Activity Three – Reebops: Exploring Genotype and Phenotype

- Similar to Activity Two.
- Working with seven traits.
- Follow same procedures for choosing alleles and combining pairs of alleles for each trait.
- Construct the offspring using materials provided.
- Do we have any twins (i.e., genetically identical)?
- Why? Why not?

Activity Three – Effective Formative Assessments

- Paint the Picture
- P-E-O Probes (Predict, Explain, Observe)
- RERUN (Recall, Explain, Results, Uncertainties, New learnings)

Final Thoughts and Next Steps

- Think-Pair-Share

Resources

- Banilower, E., Cohen, K., Pasley, J. & Weiss, I. (2010). *Effective science instruction: What does research tell us? Second edition*.

  Portsmouth, NH: RMC Research Corporation, Center on Instruction.
- Committee on a Conceptual Framework for New K-12 Science Education Standards. (2011). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Washington, D.C.: The National Academies Press.
- Keeley, P. (2008). *Science formative assessment: 75 practical strategies for linking assessment, instruction, and learning.* Thousand Oaks, CA: Corwin Press.
- National Research Council (2001). Classroom assessment and the national science standards. Washington, DC: National Academies Press.
- Zembal-Saul, C., McNeil, K., & Hershberger, K. (2013) *What's your evidence? Engaging K-5 children in constructing explanations in science.* Boston, MA: Pearson.