Advancing Tools and Processes for Next Generation Science

Model A: Three-Dimensional Phenomena Driven Instruction

Purpose: Administrators will gain a greater understanding of phenomena-focused three-dimensional teaching and learning to increase their ability to support teachers' enactment of the NGSS.

Audience: Superintendents, assistant superintendents, principals, science supervisors, instructional specialists, and instructional coaches who need a deeper understanding of what phenomena-focused three-dimensional teaching and learning is and what it looks like in a classroom setting.

Components of the model: A brief NGSS introductory immersive experience, parts of Tools 3 and 4, and analysis of Mr. Coles' and Ms. Rivera's classroom scenarios.

Time: One full-day session (recommended) or two half-day sessions.

Introduction

Model A offers an opportunity to help formal leaders develop a deeper understanding of phenomena-focused three-dimensional teaching and learning. It is designed for administrators who have little knowledge of the NGSS or this approach to science teaching and learning and who are interested in learning more because they will be supporting teachers who are expected to implement a phenomena-focused three-dimensional classroom. A school or district should consider this model if they want to ensure that formal leaders have a common, working understanding of phenomena-focused three-dimensional teaching and learning. Neither prerequisite knowledge about phenomena-focused three-dimensional teaching and learning, nor experience with the Five Tools and Processes is needed for participants in this model.

Goals of Model A:

- Increase understanding of phenomena-focused three-dimensional teaching and learning.
- Develop understanding of the opportunities and challenges implementing phenomena-focused three-dimensional teaching and learning presents.
- Promote awareness of how phenomena-focused three-dimensional teaching and learning of science connects to mathematics and ELA student learning.

Prerequisite: NONE

Participant Outcomes after Completing Model A:

Participants should be able to

- articulate how phenomena-focused three-dimensional teaching and learning is different from previous science instruction,
- describe the opportunities and challenges that implementing phenomena-focused three-dimensional teaching and learning presents, and
- recognize and articulate evidence of phenomena-focused three-dimensional teaching and learning in an instructional experience.

Total Time: 6.5 -7 hours

Two half-day sessions (recommended) with possible work time in between, or one full-day session

Part 1 **Introduction and Effective Science Teaching and Learning** (Slides 1 – 6) (30 minutes)
Purpose: Set the stage for the focus of session and begin to build community
Summary: Participants have an opportunity to connect to each other and to the content of the day through a grounding activity. Professional Development (PD) Leaders review the goals and agenda. Initial group norms are agreed upon. Participants consider what high quality teaching and learning look like in light of the NGSS.

Part 2 **Immersive Experience: Zebra Mussels** (Slides 7 – 14) (70 minutes)
Purpose: Provide participants with an immersive phenomena-focused three-dimensional learning experience to create a common vision of effective phenomena-focused three-dimensional learning.
Summary: Participants will explore the effects of invasive zebra mussels on the Hudson River ecosystem. Participants will use the Identify and Interpret strategy to analyze the relationship between zebra mussels and phytoplankton and develop a scientific explanation as learners. They will debrief the common experience and revise their Effective Teaching and Learning charts.

Part 3 **Effective Science Teaching and Learning** (Slides 15 – 28) (140 minutes)
Purpose: Provide participants with an opportunity to compare two classroom planning and instructional practices to create a common vision of effective phenomena-focused three-dimensional learning.
Summary: Participants will jigsaw Mr. Coles' and Ms. Rivera's instructional units and describe differences between them. Participants will consider the role of phenomena and the three dimensions in creating a coherent instructional sequence and how they support student learning. Participants will revise their Effective Teaching and Learning charts.

Closing (If doing two half-day sessions) (Slide 29) (5 minutes)

Opening (If doing two half-day sessions) (Slides 30-32) (30 minutes)

Part 4 **Considering the NGSS Innovations in Your Context** (Slides 33-41) (140 minutes)
Purpose: Provide participants with an introduction to the shifts and innovations of the NGSS and engage in conversation about what's important for teacher development (How do we create more teachers like Ms. Rivera?).
Summary: Participants will jigsaw readings about the vision of the NGSS and consider how the NGSS differs from old state standards. Participants are introduced to the Five Tools and Processes for Translating the NGSS into Instruction and Classroom Assessment. Participants analyze challenges to implementing the NGSS and supports needed as they create an action plan to translate the NGSS into phenomena-focused three-dimensional instruction and assessment.

Part 5 **Closure** (Slides 42-43) (10 minutes)
Purpose: Revisit the goals for the session and reflect on learning from the session.
Summary: Participants will review the goals for the session and reflect on learning from the session through a closing activity.

Materials

<u>Charts</u>

- Effective Learning and Teaching
- List of Science and Engineering Practices (use BLUE font)

- List of Crosscutting Concepts (use GREEN font)

Handouts

HO1 Zebra mussels and Phytoplankton
HO2 Developing a Scientific Explanation Tool (NOTE: Print 2 copies of this handout; one for use in the session, one for participants to keep a clean copy.)
HO2a Sample Explanation (optional)
HO3 Ecosystems: Interactions, Energy, and Dynamics
HO4 The Three Dimensions
HO5 MSLS2 Common Core State Standards Connections
HO6 Teacher Scenario A (Mr. Coles)
HO7 Teacher Scenario B (Ms. Rivera)
HO8 Coherent Instructional Sequences Based on Anchor Phenomena
HO9 NGSS Innovations
HO10 Sample page from the NGSS (prepared by PD Leader) (NOTE: MS-LS2 is recommended to align with the zebra mussel immersive activity)
HO11 Sample page from previous standards (prepared by PD Leader)
HO12 Five Tools Graphic
HO13 Analysis and Action Plan

Resources (optional for this session)

R1 A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012) by National Research Council
R2 Next Generation Science Standards For States, By States Volume 1: The Standards (2013) by NGSS Lead States
R3 Next Generation Science Standards For States, By States Volume 2: The Appendices (2013) by NGSS Lead States

Materials

- Chart paper (preferably sticky for hanging on walls)
- Tape for hanging chart paper
- Chart markers
- Sticky notes
- Highlighters

Slides

Slide 1 Introduction to the Five Tools and Processes
Slide 2 Introductions
Slide 3 Goals
Slide 4 Agenda
Slide 5 Norms
Slide 6 Effective Teaching and Learning
Slide 7 Set Up
Slide 8 Science Learner
Slide 9 An Unwelcome Newcomer
Slide 10 Data Collection
Slide 11 Zebra Mussels and Phytoplankton
Slide 12 Developing a Scientific Explanation
Slide 13 Effects of Zebra Mussels on the Hudson River Ecosystem

Slide 14	Effects of Zebra Mussels on the Hudson River Ecosystem
Slide 15	Educator
Slide 16	Reflecting on the Experience
Slide 17	Writing a Scientific Explanation
Slide 18	Opportunities for Learners
Slide 19	Effective Teaching and Learning
Slide 20	Science Teaching and Learning
Slide 21	Science Teaching and Learning
Slide 22	Phenomena in Teaching and Learning
Slide 23	Phenomena in Three-Dimensional Teaching and Learning
Slide 24	Phenomena in Three-Dimensional Teaching and Learning
Slide 25	Thinking Beyond a lesson to an Integrated Instructional Sequence
Slide 26	NGSS Instructional Design
Slide 27	Three-Dimensional Teaching and Learning
Slide 28	Effective Teaching and Learning
Slide 29	State of Science Reflection (not used in 1-day session)
Slide 30	Opening (not used in 1-day session)
Slide 31	Review of Last Session (not used in 1-day session)
Slide 32	Effective Teaching and Learning (not used in 1-day session)
Slide 33	Innovations of the NGSS
Slide 34	Innovations of the NGSS
Slide 35	NGSS vs. Our Old State Standards
Slide 36	Meta Moment
Slide 37	How do we build the necessary teacher knowledge to translate the NGSS?
Slide 38	Five Tools and Processes
Slide 39	Analysis and Action Plan
Slide 40	Analysis: Challenges and Supports
Slide 41	Action Plan
Slide 42	Goals
Slide 43	Closing

PD Leader Resources

- Zebra Mussel Data Tool Instructions
- Using Phenomena in NGSS-Designed Lessons and Units (This handout provides the PD Leader with additional background information on phenomena. It should not be shared with participants in this session.)
- Ms. Rivera and the Three Dimensions (This handout provides examples of DCIs, SEPs and CCCs in the seven-lesson sequence.)
- I Can Use the Identify and Interpret (I^2) Strategy (Student and Teacher Editions), BSCS 2012 (These handouts provide the PD Leader with additional background information on how to use the Identify and Interpret strategy.)

Advance Preparation

- Make sure the meeting space has plenty of wall space for hanging chart papers in part 3.
- Communicate with participants prior to the session. Decide if you want participants to sit in predetermined groups (based on leadership teams or other criteria)
- Select sample page from the NGSS and related page from previous state standards

- Print handouts (1/participant) and prepare charts (list of SEPs and CCCs)
- Make sure you are comfortable navigating the zebra mussel data tool to demonstrate the tool to participants in the session.
- If desired, link a timer program to the hourglass icon in the upper right of each slide.
- If doing two half-day sessions, unhide the transition slides between Part 3 and Part 4.