Two-Day Data Workshop Script ver 1.2

Objectives:

Participating teachers will:

* Apply classical physics principles to reduce or explain the observations in data investigations.
* Identify and describe ways that data are organized for determining any patterns that may exist in the data.
* Create, organize and interpret data plots; make claims based on evidence and provide explanations; identify data limitations.
* Develop a plan for taking students from their current level of understanding data use to subsequent levels using activities and/or ideas from the workshop.

We will also provide opportunities to engage in critical dialogue among teaching colleagues about what they learn in the workshop.

Preparation:

* Develop a website well in advance of the workshop that has Objectives, Agenda, Resources, Contact Information, and Practical Information.
* You need at least one Internet-enabled computer for every two participants as well as a computer-and-projector for overhead work.
* Several activities in the Data Portfolio require manipulatives that you need to acquire beforehand. If used in the workshop, be sure to have these on hand. It is nice to have sets that can be given to teachers to take back to the classroom.
* If a videoconference is part of the workshop, test the connection and address any issues *prior* to the workshop.

Day One:

* Introductions and brief overview of the agenda for the next two days.
	+ Discuss Objectives found on workshop website.
	+ Show the Data Portfolio and explain that most or all of the activities can be found there. Point out NGSS practices and Levels. Return to this at several points in the workshop in the context of discussion of activities.
	+ Set the tone of "wearing the student hat" for today's activities and then “wearing the teacher hat.” Organize participants into pairs and, if appropriate, small groups, mindful of putting less prepared teachers with more prepared teachers. Give teachers post-it notes to add questions to a “parking lot” for later discussion.
* Physicist presentation – this is especially encouraged for ATLAS and CMS Data Workshops.
* *Note: In choosing activities below, take care to pick those that best relate to the data strand of the workshop (e.g. ATLAS). Where appropriate, participants may choose from a menu of activities.*
* Level 1 Data Portfolio Activities:
	+ Participants arrange into small groups.
	+ Activities may include 2-3 of these:
		- Penny Mass
		- Rolling with Rutherford
		- Quark Workbench
		- Mass Calc Z
		- Top Quark Mass
		- Other appropriate activities as they become available in the Data Portfolio
	+ Facilitators circulate to troubleshoot technical issues, ask probing questions, and help participants stay engaged and enjoy the experience.
	+ After the activities are complete, teachers discuss and report how activity objectives were met.
* Level 2 Data Portfolio Activity:
	+ Choose among:
		- ATLAS Data Express
		- CMS Data Express
		- TOTEM Data Express
		- Other appropriate activities as they become available in the Data Portfolio
	+ Follow up with a discussion of results by participating university faculty.
* Reflections:
	+ At the end of the day, groups present how workshop objectives were met so far and what teachers learned from being in the student role; this seeds all-participant discussion. The use of posters or whiteboards is very helpful.
	+ Address parking lot questions.

Day Two:

* Recap of previous day; address questions; introduce events for the day
* Level 2 Data Portfolio Activity:
	+ Choose among:
		- ATLAS W or Z path masterclass measurement
		- CMS J/Y or WZH masterclass measurement
		- ALICE or LHCb masterclass measurement (require outside assistance)
		- Other appropriate activities as they become available in the Data Portfolio
	+ Follow up with a discussion of results by participating university faculty.
* (Optional) Virtual visit to CERN, Fermilab, or another lab
* Level 3 Exploration:
	+ Teachers explore and do short activities in:
		- CMS e-Lab
		- Cosmic e-Lab
		- LIGO e-Lab
* Participants spend part of the day thinking about how they can use one or more Data Portfolio activities with their students. This may include editing, adding content, or fully redesigning the activity as well as a plan for how it will fit into the teacher's year plan.
	+ Remind teachers of the sequencing in the Data Portfolio (Level 1, 2, 3) and how you modeled this. If teachers use multiple Data Portfolio activities, they should think about sequencing. They can get help from QuarkNet staff and fellows.
* Rearrange (if desired) into "affinity" groups with other participants interested in working with the same activity.
* Participants present their day's work, then complete exit survey online.
* Be sure to address remaining parking lot questions before the workshop ends.

General notes:

* It is very difficult to assess prior knowledge without a survey ahead of time, which is not a part of this workshop. Therefore, it is important to assess this informally on an ongoing basis and offer help as needed, either directly or by enlisting the assistance of other participants. At times, you may need to adjust the presentation of an activity based on prior knowledge. Appropriate grouping will help with this but be clear that you expect participants to help each other.
* Try to start each activity with a question that elucidates the goal. For example, in introducing Rolling with Rutherford, you might ask, “How can we measure the size of an object you can’t see?”
* Give context and background information on the concepts of the activity. Again using “Rolling with Rutherford,” you might explain how the Rutherford experiment set the paradigm of probing very small objects with beams of particles and inferring something about those objects from the measured effect on the beam.
* Be sure to report out results and notes on implementation at the end of each activity. Record both. The report of results should be shaped by the claims-evidence-reasoning model where practical.
* Model guided inquiry throughout the workshop.
* There is a draft activity implementation plan attached. It is not necessary to use this (it might be cumbersome), but it addresses key issues in implementation.

A quote from an evaluation of a Data Workshop that sets the right tone:

*The facilitator suggested that participants think of conducting activities as learning to swim: science teachers teach about science rather than throw students into the pool . . . why? He told them that he likes QuarkNet because teachers get to try out activities, e-Labs and share implementation plans. He noted, “Part of this is having the ‘student hat’ on.”*

*Throughout the workshop, the facilitator conducted discussions about content learning then also how students might best learn the science through activities. He shared his own experiences teaching particle physics and research.*

*At one point, the facilitator reminded participants that when they do the measurements and perform analyses, they are doing the thinking; when the teacher does all the talking, the teacher is doing the thinking: “Before lunch you’ll learn to do measurements and perform analysis. We have some wiggle room; to teach students to do this we’ll do differently because if I do all the talking I’ll do the thinking. I’m going to engage you.”*

Activity Implementation Plan

Teacher(s)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Class/level\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Unit or lesson\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Expected prior student knowledge\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What students should get out of activity\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Support needed\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Notes on implementation (include modifications to activity)**: