Center-Level Portfolio: Lawrence Berkeley National Laboratory

The following table, proposed implementation plans by participating teachers, and when available other examples are intended to provide an overall narrative about how and in what ways program participation has influenced teachers on their use of QuarkNet content and materials in their classrooms (and in-after class events). We see the value of these qualitative reviews as expanding on the instructional practices measured quantitatively via Teacher Survey responses. The table presents answers to select open-ended questions providing narrative examples of implemented or planned instructional practices by teachers in their classrooms and school environments. This evaluation approach is consistent with the use of *authentic assessment* as a means to evaluate performance, "teaching for understanding and application rather than for rote recall" (Darling-Hammond & Snyder, 2000, p. 523).

In keeping with Darling-Hammond, Hyler and Gardner (2017), we do not naively expect a single workshop (or event) to have a measurable impact on teachers' knowledge and subsequent classroom implementation. A characteristic of effective professional development is a program of sustained duration, providing "multiple opportunities for teachers to engage in learning around a single set of concepts or practices; that is rigorous and cumulative" (Darling-Hammond, et al., 2017, p. 15). As such, the table summarizes responses by teachers over the course of several program years and likely several QuarkNet programs and/or events.

Responses come from the Teacher Survey (either the full or update version) where each row represents the responses to open-ended questions from the same teacher over time. Each row starts with the original responses to the first time a teacher completes his/her full survey. If a particular table box is blank, it likely means that that teacher did not participate in an event for that program year or skipped the question (or, the center may not have had a major event that year). The table provides the essence of these responses; a given response, as presented, may be a direct quote, a paraphrase, or lightly edited; the intent is to convey the overall idea or its essence.

As these are responses to open-ended questions, teachers are free (and encouraged) to provide information that he or she thinks most relevant. Each highlighted response is intentionally anonymous to respect the principles of collecting evaluation data (*Guiding Principles for Evaluators*, American Evaluation Association) and to help encourage teachers to respond frankly to these questions. If a reader is familiar with a given center, it may be possible to "reverse engineer" the identify of a particular teacher. We encourage readers to respect this anonymity. At various times, we may have identified a given teacher by name and/or school; when this happens the written approval of that teacher has been obtained. It is also important to note that the full breath of a response by a given teacher may not be fully articulated in this table. For example, responses related to how QuarkNet may have advanced the knowledge of a given teacher or bolstered a collegial network among participants are likely discussed elsewhere in subsequent evaluation reports.

The table is followed by examples of implementation plans, and at times teacher presentations and student presentations when available. The intent of providing these examples is to deepen the narrative as to what and how teachers have planned (and have used) QuarkNet content and materials in their classrooms and in-after class events (e.g., Physics Club). Examples from Annual Center annual reports may be highlighted as well.

Table

Self-reported Use of Data Activities Portfolio Activities: Based on Responses from the Full Survey and then Responses from the Update Survey in Subsequent Years: **Lawrence Berkeley National Laboratory**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program
Lawrence Berkeley National Laboratory	2019	2020	2021	2022	2023	2024
	With the advent of Next-Generation Science Standards (NGSS), school curriculum is in flux--and topics of study have not yet been firmly established at this time.	QuarkNet materials were implemented into my General Physics classes in two areas: 1) study of forces, and 2) applications of Conservation of Energy/ Momen- tum. The LHC was the primary tool. My current school Physics program has a fairly set lab schedule which makes it challenging.	I integrate the fundamental force carriers/The Standard Model when we introduce the forces unit. E-labs will be integrated on a case-by-case basis depending on the topics. Internet connectivity at my school is unreliable--so any access to websites or the 'Cloud' is on a hit-or-miss basis--which limits access to portals like QuarkNet's DAP		Rolling with Rutherford. The activities support inquiry-learning of Physics through applications in particle physics	I consistently use Modeling Instruction developed at ASU and Physics Tutorials developed at U of Washington. Time-permitting, I may use the Quark cards and Tool Bench activities to reinforce the nature of fundamental particles and taxonomy in Science. In general--students have been entering my class with fewer scientific skills since the C-19 pandemic--so I need to be realistic in my expectations of what students can demonstrate.
	I have not used these activities yet (this workshop was my first introduction to them) but I will do so!					

Table

Self-reported Use of Data Activities Portfolio Activities: Based on Responses from the Full Survey and then Responses from the Update Survey in Subsequent Years: **Lawrence Berkeley National Laboratory**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	
Lawrence Berkeley National Laboratory	2020	2021	2022	
	I have not been introduced to the Data Activities Portfolio.			
	This is my first BAMA workshop and I'm planning on using what I'm learning here in my teachings of chemistry			
	Mean Lifetime, Part 1: I actually developed a lab that was similar to this and used it for several years in conjunction with our Muon Rest Life Experiment. So I can't comment on the specifics of the version in the Data Portfolio, but the idea of rolling dice to build a histogram of particle lifetimes, and then using this to study mean-life and half-life, and to build conceptual understanding of how distributions of particle lifetimes are very different from lifetimes of people or pets, for example... that's a really valuable exercise for students. Rolling with Rutherford is another good one. Again, I didn't use this exact version, but something similar from an old edition of the Conceptual Physics lab book. Stu- dents were guided to develop their own formula to calculate the size of objects they couldn't see using only the statistics from collisions with marbles. Another powerful scientific exercise with direct application to particle physics.			
	have not had a chance yet			

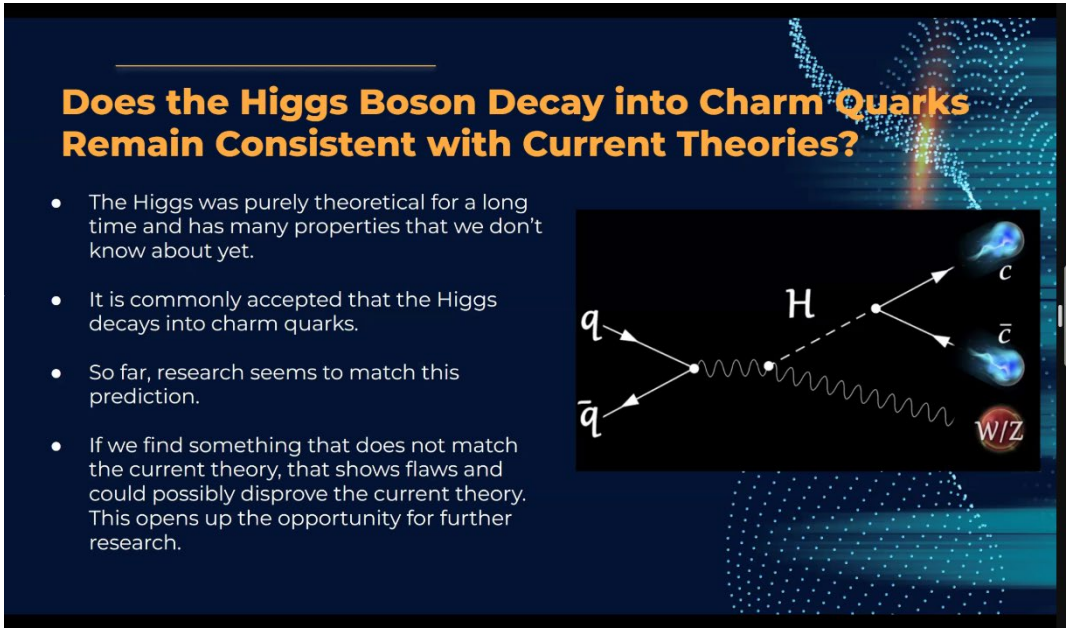
Table

Self-reported Use of Data Activities Portfolio Activities: Based on Responses from the Full Survey and then Responses from the Update Survey in Subsequent Years: **Lawrence Berkeley National Laboratory**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year
Lawrence Berkeley National Laboratory	2021	2022	2023
	N/A so far. Maybe in the future as I'm able to explore the activities more.	I'm building a Cloud Chamber for my Astro students to observe subatomic particles. I'm using that to talk cosmic rays and aurorae. I'm using histograms to collate data on labs. I'm hoping to use some of the e-labs but I haven't had a chance to decide on which/how yet. My Astro class is a survey class so I don't get a lot of chances to dive deeply as many of the QuarkNet resources.	
	Program Year (Year of Full Survey)		
	2022		
	Rutherford, Mass of the Higgs		
	Program Year (Year of Full Survey)		
	2023		
	I learned a lot and discovered multiple activities I will use with my students.		

Note: Each row presents responses from the same individual teacher from a given center. Empty table cells indicate that the teacher did not participate in QuarkNet in that subsequent program year(s). Or, less likely did not complete the Update Survey; or did not answer specific questions about the use of DAP activities in their classrooms. (Out of a total of 21 teachers.)

Below is an example of an excerpt from a student presentation given during a two-week virtual workshop at the Lawrence Berkeley National Laboratory Center from June 20-30, 2023. As reported in this center's Annual Report (July 20, 2023), a total of six physics teachers and 49 students participated via Zoom. As noted, most participating teachers and students came from public and private high school in the greater San Franciso Bay Area. As reported, " We have been making an effort to include underrepresented students in STEM (which include: African Americans, American Indians/Alaska Natives, Latinos, LGBTQ+, students from low income households, and first-generation college attendees) by outreaching to schools in lower income & underrepresented areas."



Source: Excerpt from Lawrence Berkeley National Laboratory Annual Report July 20, 2023
Screen shot from a student presentation.