Center-Level Portfolio: Florida State University/University of Florida

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 in using QuarkNet content and materials in their classrooms (and in-after class events). The value of these qualitative reviews is to expand on the instructional practices measured quantitatively via Teacher Survey responses to specific sets of questions/self-reported by teachers providing narrative examples of implemented or planned instructional practices in teachers' classrooms and in schools. This evaluation approach is consistent with the use of *authentic assessment* 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.

These 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. Also, each row starts with the original responses to the first time a teacher completes his/her full teacher. If a particular box in the table is blank, it likely means that that teacher did not participate in an event for that program year (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 from that particular teacher.

Because 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 **Florida State University/University of Florida Center**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year
Florida State/ University of Florida	2019	2020	2021	2022	2023	2024
	Rolling with Rutherford, and Pennies		I've used them before in just having the students look at real world data and how to analyze it. Examples: Rolling with Rutherford, Shuffling the Particle Deck. These experiences help to give new ideas on how to add in more real-world data and incorporate how science is collaborated around the world.	I intend to incorporate more histograms, go over the standard model and possibly try to do a masterclass this year. Examples: Mass of pennies.		I have used the Mass of Pennies and the CoLab coding activities. I have recommended the CoLab and Mass of Pennies cause they are easy to implement without having to have to much background knowledge for teachers to use while some of the others are more intimidating for some teachers who haven't seen them fully implemented out by someone. QuarkNet has been helpful in building community among other teachers in the area and with the local area to help bring more ideas and strategies into the classroom and was to implement those ideas.
	Quark workbench; Top Quark	I plan on using some of the great ideas for coding implementation from the other teacher participants. Examples: Top Quark, Quark Workbench, Muon Time of Flight, Rolling with Rutherford				

Table (con't)

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 **Florida State University/University of Florida Center**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year
Florida State/ University of Florida	2019	2020	2021	2022	2023	2024
	I want to use the Rutherford activity and the card sort. I have not used them yet. I think these both are activities I think my students can grasp and have a conversation on. (*First year teaching general physics*)				penny histogram. I appreciate the welcoming energy I always feel in my QuarkNet workshops. The fellows meet you where you are and never shame a teacher for not knowing things.	
	Rolling with Rutherford is a great activity and shuffling particles is something I use in the classroom. This camp/training has been very helpful and provided many ideas/activities for my classroom. Being able to connect with other physics teachers in the community has helped build a great relationships between the schools.	I will be implementing the Rolling with Rutherford activity and standard model activity in my classes. As well as the case of the hidden neutrino. Examples: I will use Rolling with Rutherford, case of the hidden neutrino, and standard model 2d/3d. The resources are great tools for my classroom.		Penny mass, standard model, uncertainty, NOvA neutrino oscillation data. Examples: Penny mass, NOvA neutrino oscillation. Very informational. I enjoy being updated on physics content.		Good activities.
	Penny mass histogram activity, great for showing measurement variation and identifying peaks in histograms. Easy analogue to particle masses.	Google Science Journal for labs and science fair. Rolling with Rutherford virtual simulator is very convenient. Great way to do the activity if you are pressed for time or going virtual. Examples: Rolling with Rutherford Mass of U.S. Pennies Quark Workbench Case of Hidden Neutrino		Conservation of momentum and energy finding particle mass from LHC etc. data.		

Table (con't.)

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 **Florida State University/University of Florida Center**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year
Florida State/ University of Florida	2019	2020	2021	2022	2023
		Pennies, Z-mass, Rolling with Rutherford Vectors, conservation, energy, atomic models, ... Examples: Rutherford, top quark, pennies.	Rolling with Rutherford, top quark, pennies. Examples: Penny lab, Rolling with Rutherford, particle mass calculations, Jupyter notebooks.	Pennies, Probability, Rolling with Rutherford, Calculate the mass of a particle.	I have used data and topics related to: LHC, Conservation, uncertainty, standard model, histograms, data collection. Examples: Penny mass, film canister nickels, NOvA,Phython activities from Data Camp.
	Program Year (Year of Full Survey)		Subsequent Program Year	Subsequent Program Year	
	2020		2021	2022	
	Rolling with Rutherford *(first year with QuarkNet*)				
	Program Year (Year of Full Survey)		Subsequent Program Year	Subsequent Program Year	Subsequent Program Year
	2021		2022	2023	2024
	I would recommend these activities because they expose students to particle physics, and they don't have to deeply understand the subject prior to exposure.		Used coding to find surface area of a large data set in my geometry class. I plan to adapt penny mass and rolling with Rutherford for middle school and use them as nature of science lessons.		I will be integrating particle physics into the momentum section of my physics class in addition to using python for data analysis, and I will use various activities from the portfolio to explore particle physics more specifically. Examples: Penny Mass Rolling with Rutherford Intro to Coding Quark Workbench
			I plan to adapt penny mass and rolling with Rutherford for middle school and use them as nature of science lessons.		

Table (con't.)

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 **Florida State University/University of Florida Center**

Center	Program Year (Year of Full Survey)	Program Year (Year of Full Survey)
	2022	2023
	I've used the Mass of Pennies and the Dice activities to introduce data analysis and histograms to my Physics Honors students. Most of my students don't have any prior experience in data analysis, so I like to start the year with helping them learn what we can do with data, how we can manipulate it. I'm excited to introduce a little coding.	A few of the momentum activities
Florida State/ University of Florida	Program Year (Year of Full Survey)	
	2023	
	Rolling with Rutherford intro to statistics histogram activities *(new to program)*	
	I've worked through them during a QuarkNet workshop, but have not taken them back to my classroom. (They don't fit in with the courses I teach.) They are great minds-on activities that bring current physics into the classroom.	
	Relating conservation of energy and momentum in the detection and identification of specific particles.	
	I'm excited to discover the available resources that QuarkNet has to offer.	

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 18 teachers.)