
Center-Level Portfolio: Black Hills State University SURF

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 **Black Hills State University Center**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year	Subsequent Program Year
Black Hills State University	2019	2020	2021	2022	2023
	For application of physics concepts, I find it very useful.				In program year 2024 example: Rolling with Rutherford
	Haven't used DAP. For application of physics concepts, I find it very useful. (Don't teach physics)		I run a CRMD in my classroom and definitely use LIGO information with my earth science class.	I have used Ligo activities with my whole class and have used the cosmic ray e-lab on an individual basis with students. I do not teach physics, so it is harder for me to incorporate activities from DAP.	
	Program Year (Year of Full Survey)	Subsequent Program Year			Subsequent Program Year
	2021	2022			2023
	I have several activities identified for use this upcoming school year.	The project I worked on at this summer's QuarkNet was to import the data from the CRMD into CoLab and use python coding to analyze the results. This is what I plan to do with my own students. In addition, the colleagues that I spent these past few days with also shared their projects which I hope I can also use with my students. This has been a great week of learning and applying coding for data analyses. I am beginning to learn python coding and how to apply it to analyzing data. Making Tracks 1; Energy, momentum and mass; Rolling with Rutherford, Particle Transformations			Rolling with Rutherford--modeling subatomic particles and helping students build images in their minds. This activity also opens up discussion about how theories are modified and science involves with new evidence.
	Rutherford Scattering, QuarkNet workbench. QuarkNet workbench is a great summary of information for kids and good resource for teachers. QuarkNet provides great content and resources.				
Utilized multiple years of my CRMD in an analysis with Dr. Peggy Norris at SURF. Lots of ideas to implement however implementing them can be difficult. Used CRMD data to describe Hexadecimal to my students.				CRMD Build and plateau	

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 **Black Hills State Hills University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	
Black Hills State University	2021	2022	2023	
	As a first-time participant and STEM teacher, this workshop allowed space for my learning and to find ways to incorporate data activities in my high school STEM classes which will enhance the learning experience for the students. QuarkNet gave me the opportunity to network with teachers and scientists in my home state and surrounding states.		Have not used the DAP. As a life science teacher, my interactions with particle physics teachers is nonexistent before this workshop	
	Program Year (Year of Full Survey) 2022	Subsequent Program Year 2023		
	(First year) Looking forward to using this year.	The coding 1 and 2 both built on each other, and I found them valuable		
	I haven't used any yet (DAP), this is my first workshop.			
	This is my first QuarkNet experience.			
	This is my first one so I have no comparison. This was a very good experience and look forward to learning more and using this with my students.	The coding Camps are all that I am familiar with and believe this is a vital skill for our students.		
	All have been good to take back to my students or for my students to experience like masterclass. I have taken my students to masterclass each year that it has been available, and I think that has the most impact. They are good activities, and masterclass has been a good way to expose students to particle physics.			
	Program Year (Year of Full Survey)			
	2023			
	This coding 2 camp will be helpful because I will be able to expose my students to physics and different coding approaches. (First year) As a teacher who doesn't have a particle physics background, this workshop has given me enough knowledge on it to be able to bring it back to my students and have a starting spot to keep learning. It was a great experience, and I look forward to more interactions with QuarkNet. I'm glad to have joined this group.			
	I teach life science but I would recommend these (DAP) to physics teachers.			
Neutrino data, muon data and the colabs for using python for various tasks. I think the resources and the training advances our ability to teach the subject well.				

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.