Center-Level Portfolio: Southern Methodist University

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 anonymously 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 Reponses from the Full Survey and then Responses from the Update Survey in Subsequent Years **Southern Methodist University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Year	Subsequent Year
Southern Methodist University	2019	2020	2021	2024	2025
	Does not match any requirements	e-Labs, especially for remote students. Did not use because of Covid	Puzzles for sorting python programming (puzzles for sorting and programming for skills); useful.	The card sort and the histogram activity. I really gain a lot from the interactions with other teachers. I look at the camp as a place to practice some skills and have some fun activities for the kids. Particle physics is not on the curriculum, and there are still some times when I can use this.	I use several of the activities we learned. I will use some data analysis techniques I learned this year. Rutherford, quark card sort
	No response				
	Not a chance yet. It is a good way to use actual data to achieve some of the same instructional goals in the classroom. Some are subject to future use. Excited to see the opportunities available through QuarkNet.				
	Understanding the different approach to introduce these concepts. Dice/histograms *(plan to use)*. It is a good way to use actual data to achieve some of the same instructional goals in the classroom. The advanced curriculum of Project Lead the Way Teachers struggle with accomplishing the criteria of pre-established agenda. There is such a broad spectrum of abilities that any new strategy can only help enrich the student experience.				
	I am excited to use info learned during this seminar in my classroom. (New to program) Was nice to see some familiar faces from other physics seminars. Potential examples: Rutherford, quark card sort				

Table (con't.)
Self-reported Use of Data Activities Portfolio Activities: Based on Reponses from the Full Survey and then Responses from the Update Survey in Subsequent Years **Southern Methodist University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Year
Southern Methodist University	2019	2020	2021	2022
	I have only done the one data camp but would love to attend others just based on this workshop. I have not had a chance to apply these in the classroom but look forward to looking through all the activities and seeing what I can do with them. This is material provided by a reliable source in physics and I would be selfish not to share this among my other physics teachers. I have yet to explore all of the resources and activities provided by QuarkNet but look forward to all it has to offer. I did not get much interaction with the teachers in what the classroom due to plenty of instruction time. This is my first year with QuarkNet and I have not had the opportunity to apply these concepts and ideas. However with school around the corner I look forward to applying new teaching practices at school.			
	New to program. Meets "real life" objectives. Less time analyzing data and more time looking at resources and discussing implementation.			
	The most useful thing for my teaching is to have learned about all the materials available in the "Data Activities". The activities related to histograms will have great use in my lab class. The activities illustrate important concepts very well; can be modified to adjust them to the level of your particular students. I plan to use them early this year. Also, I am planning to use the activities related to E&M. *(first year)*			
	Data Camp due to the inclusion of actual physics data and its analysis. I have used things from every and I mean EVERY QUARKNET workshop I attend at SMU and from data camp there are 7 labs permanently added to my curriculum and I anticipate that CERN HST will add many more as I continue to try to expand modern physics in my classes. I recommend as they promote/create higher order thinking skills and the students really like them.		I plan on using the coding information we used this week to have students create motion graphs. Examples: Dice, Histograms, and Probability Rolling with Rutherford. I've used both of these to discuss how data is collected, shared, and how to interpret it. I always get a lot out of QuarkNet as a means of not just learning new material, but connecting with other teachers and recharging for a new year.	Collection and analysis of data is critical to my students, especially after COVID, so many activities are useful. Example: Mass of Pennies, and Rolling with Rutherford. I will be retiring after this year, so this is most likely my last year. I have been with QuarkNet for about 10 years, and I have thoroughly enjoyed my experiences, and they have been able to utilize many of the practices I have learned.
	Cosmic Ray, I have a CRMD. To introduce students to live data			

Table (con't.)
Self-reported Use of Data Activities Portfolio Activities: Based on Reponses from the Full Survey and then Responses from the Update Survey in Subsequent Years **Southern Methodist University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Year	Subsequent Year
Southern Methodist University	2019	2020	2021	2022	2023
	Data Camp and the neutrino data. I use data camp activities at the beginning of the year and after the AP testing. The dice histogram which I make use of for a number of things like data analysis and even answering that age old student lab question of how many data points do I need, to which I answer you need as many as you need. QuarkNet has elevated my teaching by increasing my knowledge. QuarkNet has transformed the way I teach. Not much to add other than QUARKNET has helped me to become a better teacher and that is proven by my students success in their AP Physics scores.				
	All because they allow me to put new things to my students. Showing them that science is new and ongoing research. Examples: Histogram Rolling with Rutherford and conservation. I feel that the information and materials is wonderful and allows teachers to bring new information for the students to develop an understanding of how science is ongoing and changing. I think that the information is great and I like doing the activities to get the feel of problems and success that the students will have. I love the interaction of the learning and doing. However I feel that to improve it would be to have some things to do on the weekend over the school year or web based activities like webinars.	I am planning on using the STEP up information on careers and diversity in the classroom. I am going to have students use the cosmic ray detector for gathering data and analysis. I can not remember which ones I have used. I love the way we always have something new to give to our students and incorporate into the class. Every workshop I learn something new.	I have an advisory period every day for students to learn anything and relearn. I am planning on implementing this during the advisory period as learn some cutting edge science. Examples: Mass of a penny; momentum, shuffling the particle deck, coding, Cosmic Ray detector. I love the interactions and sharing of the knowledge which gives me different viewpoints. It also at times stretch's my understanding and at times, lets me feel like the students when I introduce something new.	I am planning on using these activities to explain graphing and understanding data. I am planning on using the cosmic ray information, rolling with Rutherford, and masterclass information. Also comparing the interaction for momentum and energy conservation. Examples: Rolling with Rutherford; Shuffle the deck; missing neutron; I love the sharing of the information and skills from other people and how I am always being pushed to improve my skills through QuarkNet	**In 2024:** Using information for astronomy and in physics momentum. CMS data. I am needing help setting up and running the detector

Table
Self-reported Use of Data Activities Portfolio Activities: Based on Reponses from the Full Survey and then Responses from the Update Survey in Subsequent Years **Southern Methodist University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year	Subsequent Year	Subsequent Year
Southern Methodist University	2019	2020	2021	2022	2023
	I have only participated in the neutrino workshop but I have found the activities applicable to my AP students. This gives students the opportunity to analyze real world data collected by scientists. This will make their work more relevant and engaging. This is the best way to get students excited about science. I really enjoyed my time with QuarkNet and plan on attending more workshops in the future!	I will incorporate materials periodically throughout the year when time permits. Examples: Shuffling the Particle Deck, Dice, Histograms & Probability and QuarkNet: Changing the Culture. I really enjoyed the workshop! The discussions are always thought provoking. Hearing how other teacher implement the activities helps with finding ways to do the activities in my own classroom. Hearing how other teacher implement the activities helps with finding ways to do the activities in my own classroom.			
	CMS. Good for indirect measure				
	Cosmic Ray Building and Data Collection: It was active informative information involving real student and classroom participation with real data used by students. Cosmic Ray Data, Particle Analysis, and LHC lab experiments. Some are excellent resources especially for teachers that do not have a CRMD for classroom use and want to provide particle physics in the curriculum. Cosmic Ray Data, Particle Analysis, and LHC lab experiments. With the first LHC Fellow director I felt that my abilities and skills were useful and I provided information and helped with the writing and formation of materials to be used by QuarkNet groups when the second director replaced the first due to lack of funding it became clear that it was a friends/family relationship and if you were not one of “the good ole boys” so to speak your ideas were not of value. At this point I became rather disinterested and was asked to remove myself from the group also since I retired a few years later it was time to return my CRMD and become more invested with PTRA where my talents are appreciated. The SMU QuarkNet group along with the entire SMU physics department has gone above and beyond to help science teachers in the DFW area excel in promoting activities and resources in physics, especially particle physics and I am thankful to have been a part of the group for many years.				

Table (con't.)
Self-reported Use of Data Activities Portfolio Activities: Based on Reponses from the Full Survey and then Responses from the Update Survey in Subsequent Years **Southern Methodist University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year
Southern Methodist University	2020	2021	2022
	Not yet, but am looking forward to it. Lots of resources vetted/recommended by high school competent teachers who are passionate about teaching physics. Also, expert advice/resourcing has also made these resources excellent. It was harder to have hands-on experience during the COVID-19 pandemic. Yet, I am SO GRATEFUL for this virtual QuarkNet Workshop! Thank you for still hosting it this year! I got some great resources, connections and motivation to be an excellent teacher in both in-person as well as virtual delivery situations. Thank you for making this possible.		
	Data Camp. Provides context and enrichment to my curriculum. Goes beyond the text. Keep up the good work.	Classifying particles, intro to SM. Examples: Rolling with Rutherford, Quark Workbench.	The Half Life activity will have many uses in my classroom. In Algebra, the strands of data of representation, probability, and exponential decay. In earth science, the idea of half-life as a measure of geographic time, as well as radioactive decay with implications for long term nuclear waste storage. Examples: Too early to tell at this time.
		As a 6th grade teacher, I will be able to use a couple of the activities such as Rolling with Rutherford as I introduce students to the concept of the atom for the first time. Examples: Mass of US Pennies, Rolling with Rutherford, Dice, Histogram and Probability. I am currently teaching 6th-grade science and some of the activities are above the level of my students but I have been teaching long enough to adapt some of them for my students.	I will be using Rolling with Rutherford when introducing the nature of atoms. Though I have taught high school physics in the past, I am currently teaching 6th grade science. I will implement many of the philosophical strategies even if I don't use any of these specific activities. Since I am teaching 6th grade, these are beyond the scope of my students.
	Data Camp and Portfolio. Rolling with Rutherford and Making it Round the Bend have been relevant to state standards and easily worked into the time allotted to teach the prescribed curriculum. Time constraints usually do not allow the full lesson to be taught therefore the concept development does not occur. Coding camp was an excellent opportunity to develop a model for online delivery of physics concepts as well as other disciplines that are data rich. Coding camp and local QuarkNet at SMU are both sharing spaces for best practices. The speakers who visited us virtually were fluent on what is going on in astrophysics, CMS data curation, and interdisciplinary applications of Physics in medicine. These topics when shared with students make Physics and coding more relevant. Remote learning has opened the door for more data based lab activities. This would be a good time to insert more inquiry and project type labs to replace cookbook labs. A problem exists in that many faculty resist change and students often	**2020** (con't,): feel lost if they cannot find and verify answers. The general population resist the nature of science because they want static answers and do not recognize the value of dynamic thought. Another door opened by COVID-19 is that science literacy is valuable in assuaging fear and empowering logical, evidence-based thinking. Training up that process should be a tool in everyone's skill set.	

Table (con't.)
Self-reported Use of Data Activities Portfolio Activities: Based on Reponses from the Full Survey and then Responses from the Update Survey in Subsequent Years **Southern Methodist University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year
Southern Methodist University	2020	2021	2022
	The FermiLab Data Camp was great, awesome ideas as to how to incorporate modern physics into the classroom. Have not seen this (DAP) yet, I think. QuarkNet serves two purposes in my view. One is the mission of incorporating more modern physics topics into the high school setting, but it also allows physics teachers to come together and share out ideas which is invaluable. I've gotten to know many Dallas-area physics teachers at different schools through QuarkNet. It's been a good four years so far with the program and I hope to continue learning and participating in many future QuarkNet activities.	Coding Workshop was very helpful, I plan on using some of those materials with my AP Physics Class. Examples: Projectile Motion on Google Colab. I think the other activities were great, but I don't think I can go through all of the curriculum that I need to and teach my students some of the background coding. I enjoyed the reflective piece at the end. It will definitely help me be more accountable in running some of these activities with my students in the upcoming school year.	
	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year
	2021	2022	2024
	Data Camp Connecting general physics to particle physics. Coding Program. I would recommend - very good source. I highly recommend this to teachers to increase student understanding in physics and particle physics.	I will be incorporating this information with conservation and momentum. I plan to use Mass of Pennies, Dice Histograms & Probability, Shuffling the Particle Deck, Rolling with Rutherford. As always, a very good source for knowledge and teaching techniques for physics and science.	
	I think the practical code for physics class was the most helpful in my case. I feel like I can integrate this with force and motion. We graph our data in the journal and it would be neat to use a different device and idea. Have not yet used content (DAP). I would recommend this to physics teachers because it can enhance their knowledge and give their students opportunities to code and showcase their information in a neat and cool way. The more they are exposed, the better they get.		
	Coding and data analysis. I will use the probabilities program/activity for my courses. Very powerful data analysis, and ease of modeling. Very good and thorough explanations, very engaging video presentations and Q/A. (first year). it would be nice to share contact info with other teachers/attendees	I have not due to my teaching assignment was forensic science not physics/ astronomy/or earth & space. Examples: rolling with Rutherford can be adapted to teach bias. having students aim at the objects will skew the calculated size of the objects in a way that can approximate bias in law enforcement. The physics content and specialization makes my teaching experience more valuable for my campus and district.	Instrumentation to discover and analyze data. I can't recall which ones are DAP. Great experience on genuine science research. **2025**: the scientific process and experimental design**.** The data activities portfolio is very specific to physics. and I teach forensic science with occasional physics assignments on other years. Appreciate the camaraderie and experimental design not specific to particle physics

Table (con't.)
Self-reported Use of Data Activities Portfolio Activities: Based on Reponses from the Full Survey and then Responses from the Update Survey in Subsequent Years **Southern Methodist University**

Center	Program Year (Year of Full Survey)	Subsequent Program Year
Southern Methodist University	2022	2025
	International Data Day fits best with my schedule. I like using the Penny lab for data collection and analysis. These activities are easy to use.	Neutrinos and Cosmic ray has both been incorporated into my APES and Physics classes as data practices and experiments. Rolling with Rutherford is a great way to introduce particle physics as well as randomness and data applications, graphing, and statistics into class.
	Program Year (Year of Full Survey)	Subsequent Program Year
	2024	2025
	Data Camp, learned how to analyze a large amount of data and how to teach the method and significance to the students.	
	I can show the future different careers in Physics.	
	The workshop I attended was interesting but did not apply to my curriculum. This program is new to me. I plan to explore the resources to see if there is anything that I can use in my curriculum. Although the physics course I teach is challenging for the students (all girls), it concepts are more surface level and the math is algebra 1 level.	
	This is my first time participating in the program. Many of the concepts are too advanced for my students. (New to program.) We listened to lectures but we did not do any research, discussion, or real activities. It was a passive learning experience. We did not have much interaction with each other or opportunities to collaborate. I would have loved to get more concrete examples of how to use the information shared with me in my classroom.	
	This is my first year. I have not had a chance to use this in my classroom.	
	I am excited to use the materials in my class this year	
	I don't know how to use them.	
	Cosmic Ray Information at FERMI and Summer at CERN	

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.

One teacher went on to participate in Coding Camp 2 (2023) and created a coding project that began during the 2023 SMU workshop. That coding project is Eclipse Colab Notebook Project, planned as a weeklong eclipse unit: Download data; Collect individual data; Upload collected data; Display as graphs; and Write conclusion.