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### Center-Level Portfolio: University of Puerto Mayagüez

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 1  
 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 **University of Puerto Rico – Mayagüez Center**

Center	Program Year (Year of Full Survey)	Subsequent Program Year	Subsequent Program Year
<b>University of Puerto Rico- Mayagüez</b>	2019	2021	2025
	lo más beneficioso para mi ha sido poder explicarle a mis estudiantes de los experimentos actuales en el campo de la física y de lo importante que es su estudio.		
	Everything is interesting. Compared a cosmic ray received in the different climate zone. Example: Rolling with Rutherford. Very interesting and pertinent.		
	To review and apply different physics concepts. Excellent Workshop to promote active learning involving physics in the experience. Collaborate with each other was a great experience to share ideas and acquire knowledge. Great experience Cosmic Ray. This year we used the muon detector with my students. This data is the future of science technology. It is very important that the student learn about this. I like this opportunity to learn more about particle. how to explain to my student and provide the opportunity to discover and work with the detector. Excellent, we have the opportunity to share with other professional in physics. Excellent I feel more comfortable to explain this concept. Rolling with Rutherford and detectors	Explaining conservation and atomic particulars. Examples: Rolling with Rutherford and detectors.	
	Cosmic ray, Conference information. Information (DAP) helps the students to amplify the options to decide their future studies. Make various data activities portfolios and compare the results between some activities. That strategies bring the opportunities to share experiences and to learn for others scientists. At this moment, I don't teach physics, but in my class I spoke about physics particulates and motive my students to study physics.	Adrons and mesons puzzles; Rolling with Rutherford. It is really helpful to provide recent scientific examples in my classes.	
	All of them. Rolling with Rutherford. Yes I would (recommend DAP).		
All. In astronomy theme. I want one of these detectors in the classroom. Everything is good. I did not bring students.		Comics ray and e-labs I incorporated in my science club on Fridays, also in chemistry class showing the theme of elementary particles.	

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	CERN HST workshops, and CMS Masterclasses. Rolling with Rutherford as an example to make histograms. I would recommend it because are activities that might be integrated with several topics in the physics class.	He incorporado ejemplos de fisica de particulas en temas como conservacion de momentum, energia y fuerzas fundamentales. Pienso crear mas ejemplos y ejercicios utilizando codigos de python que aprendi Examples: He utilizado Rolling with Rutherford y Histogram the basics. Planifico utilizar otros. Han sido las mejores experiencias que he tenido dentro de actividades de educacion cientifica. (Have been the best experiences that I have had in all scientific education activities.)		
	Neutrino Master Class. The student learned the basic topic about the actual neutrino experiments. Example: Quark Puzzle. I would recommend it because students preferred learning by doing instead of reading. Students like to work in collaboration with others students from other school and be part of laboratories where they becomes the leader and participants. Teachers from other schools can work together to share data from their experiments. QuarkNet is a great experience because it keeps teachers up to date.	I will incorporate the activity of Particle Conservation (DAP) in the discussion of conservation and energy. Examples: A year ago I was A years ago I was able to identify a group of student interested in particle physics. Students like learning better doing the activities than just explaining the concepts of particle physics. They like to play and be part of the action.		
	More practical. Presentation on atomic theory and Rutherford with Rutherford. This Class is very important for the sciences. More strategies about the Cosmic Ray. Students like to work in teams and with a lot of instrumentation. This gives you the opportunity to experiment and conduct your scientific research. My experience in these workshops is very professional and this helps me to be a better teacher when it comes to teaching science in the classroom.	Actualmente ofrezco el curso de Química y el la unidad 2 de mi curso incorpore todo lo aprendido en QuarkNet cuando ofrezco el tema de la Estructura Atómica, entonces actualizo mi curso integrado. Examples: La actividad de Roderford y programa de rayos cósmicos. Es una excelente iniciativa y todo el tiempo estoy aprendiendo algo nuevo que a su vez lo transmito a mis estudiantes	I plan to incorporate the theme of Cosmic Rays in a Scientific fair project. Examples: Rolling with Rutherford, and cosmic ray information. Thanks to QuarkNet I consider myself a teacher who is up to date with scientific research. Every time I participate, I learn a lot and try to pass on to my students.	He incorporado ejemplos de fisica de particulas en temas como conservacion de momentum, energia y fuerzas fundamentales. Pienso crear mas ejemplos y ejercicios utilizando codigos de python que aprendi. Examples: 1. Actividad de Rutherford. 2. Experimento de MINVERvA. Mi experiencia ha sido maravillosa porque he logrado ampliar mi conocimiento científico, estar al día con los nuevos descubrimientos y siempre estoy aprendiendo cosas nuevas que a su vez les transmito a mis estudiantes.
Everything was and is important I always learn. Rolling with Rutherford, puzzle and card game. I recommend it is (DAP) highly useful for the student particle physics knowledge. I like because my teaching is science is update. QuarkNet helps me to explain better the concept of particle physics	I incorporate QuarkNet informacion en todo el curso de Fisica. Examples: Histograms, Rolling with Rutherford, jpsi decay, Mass of penny and STEP UP presentation. Astrophysics with particle physics. Especially the fusión prosses in the stars core.	Use QuarkNet for energy and momentum and nuclear fission. Examples: Rolling with Rutherford; making histograms.	All, I use all information Rolling with Rutherford, Coding, STEP UP. The QuarkNet program has positively transformed my classroom. It has helped me design my physics courses in such a real way and attached to the reality of scientists. I can better prepare my students for physics research.	

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<b>University of Puerto Rico- Mayagüez</b>	2020	2021	2023
	Cosmic Rays - because it was useful with many applications in mathematics. Examples: Dice histogram and probabilities. Is (DAP) useful for applications of topics that we teach.		
	Neutrino. Transformaciones de partículas. En mi caso, seleccionó estudiantes que tengan el interés en la física para profundizar en estos temas. Excelentes actividades para integrar en la clase de física. Poder conocer y compartir conocimientos con otros profesionales en el área de física, consideró que es excelente y bien necesario. Es una experiencia enriquecedora y nos mantiene al día en lo último en la física, para poder así explicarle a los estudiantes.		
	Today's workshop was very interesting, on a physics topic I can work on the activity. Are well developed, easy to understand and fill. It is my first workshop in QuarkNet, it is very interesting, the development of activities is very organized, they have real data, it has a scientific level. I will use it soon with my students on topics that are related to the class and I will use the activities presented on the page. Thank you.	Conservation of momentum, standard model vocabulary, STEP-UP resources. Examples: Shuffling of Particle deck, the case of the missing neutrino. Coming to these conferences always give me invigorating thoughts for use in my classroom. I need to make it a point to implement them.	

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<b>University of Puerto Rico- Mayagüez</b>	2023	2024	2025
	Data Camp and the masterclasses have been helpful to stay up to date in recent discoveries in particle physics. The particle physics activities help with the fundamental forces subject. Histograms and particle deck have been the most useful. Most recently I used the particle deck to introduce physics during the first week. I would recommend the activities and I wish more activities like this existed that could help my students get familiarized with modern physics. Some of the activities need a little adjustment to incorporate them into the curriculum and the level of my students.	Deck of cards, rolling with Rutherford, histograms. QuarkNet is refreshing, every experience motivates me to continue teaching physics and keeps me up to date with current research and teaching practices.	I mostly use the activities related to histograms and incorporate references to Particle Physics and Detectors as examples or exercises in units/lessons within our curriculum such as kinematics, fundamental forces, momentum, magnetism. References to the LHC and neutrinos are used while discussing the frontiers of Physics and the origin of the universe. Use the lesson models and peer practices to improve on my own activities and lessons. Particle deck of cards Rolling with Rutherford. Activities are well thought and are helpful to introduce other concepts in laboratories such as indirect measurements, errors, variance in data.
	CCI, the skills gained will be implemented in my Physics and Math courses		
	In the only one I have participated in I learned how to code using Python and how to use Google Colaboratory which I learned are great tools to implement in the classroom. I haven't used any yet but I plan to start next month. I would recommend instructional materials in the Data Activities Portfolio because they are innovative, educational and most of all fun. I would like to say that everything is excellent.		
	First start learning about coding. I have to learn much, much more. New to program have not used it yet. I appreciate the opportunity to learn about coding and learning that it exist and it was because this virtual opportunity.		Fenómenos Atmosféricos. Recién he tomado el curso de una semana. Se podría coordinar con maestro de tecnología para la programación y utilización de las computadoras.
	Learning coding language and putting it into practice in activities that can be implemented in the classroom. Because as teachers we can access innovative tools that can take students further in topics related to science and technology. The tools provided by QuarkNet are very relevant to HELP TEACHERS IN THEIR PROFESSIONALIZATION AND BE UP TO DATE ON SCIENCE AND TECHNOLOGY ISSUES. Having participated in this summer camp was a great experience that I would like to repeat. There were many things that I was able to learn and that I am going to implement in my teaching. I would like to be able to have this opportunity again to evaluate what I was able to implement on coding in the classroom.		

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	Un poco de practica. Cambios d Temperatura, Astrofisica, Velocidad y Aceleracion, Maquinas Simples.			
	Sharing ideas with others teachers.			
	Not being a Physics teacher, coding camp has gave me an idea on how and where to use it with my students.			
	Program Year (Year of Full Survey)			
	2024			
	The information about energy, mass and momentum and the use of real data to prepare graphs. The use of data in the Energy, mass and Momentum laboratory activity. I want to use that activity in order to introduce the student to real data and proper and accurate ways to manage the data. I would recommend the instructional materials because I find them quite interesting and practical for developing data analysis skills. I wish these opportunities became more visible to physics teacher in Puerto Rico.			
	Data Camp 1 and 2 have been great and helped me a great deal in breaking into the field of coding and its applications to Physics. Coding in Python to graph data sets and calculating the Line of Best Fit for a scatterplot. I would recommend these activities to any teacher seeking to integrate coding into their science and math courses.			
	Both of them, the topics learned are different and complement one another.			
	All the topics are great and help me to expand my class with other information.			
Coding Camp 1 and 2. The data analysis activities are great and I used them extensively in my teaching practice. I strongly recommend the activities and instructional materials to introduce ninth grade students to coding using Python 3. The QuarkNet experiences had been a game changer in my teaching practice. The work and guidance provided by coding and education fellows has been fantastic. QuarkNet is a great. Students have engaged in real life data analysis and became comfortable with coding in Physics				

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 23 teachers.)

Presented on the next page are examples of proposed coding projects created by participating teachers who participated in a Coding Workshop in 2023, and 2025.

Table 2  
Workshop Implementation Plans/Coding Projects Summer 2023

<b>University of Puerto Rico Mayagüez July 10-12, 2023<sup>2</sup></b>				
Project	Title (As written)	Brief Description (As written)	Title (English)	Brief Description (English)
1 <sup>a,b</sup>	Introduction to Coding	Run and edit code in Python; reading code and running code in order.	Introduction to Coding	Run and edit code in Python; reading code and running code in order.
2 <sup>a,b</sup>	Densidad	Determina la densidad de un objeto. Densidad es la relación entre la masa de una sustancia y el volumen que ella ocupa.	Density	Calculate density, mass, volume, and graph this relationship.
3 <sup>c</sup>	Conversion de Temperatura	Tomar la temperatura del mismo cada minuto y generar una tabla de datos. Generar una grafica con estos datos.	Converting Temperatures	Converting Celsius and Fahrenheit temperature measures to Kelvin and graphing changes in temperature over time.
4	Libreta De Balanceo De Reacciones Quimicas	Balaceo de ecuaciones químicas pero utilizando el sistema operativo de Python.	Chemical Reactions	Balancing chemical equations using Python.
5 <sup>d</sup>	Tipos de células <sup>c</sup>	Los estudiantes podrán identificar y describir las características de las células procariotas y eucariotas, así como las diferencias entre las células vegetales y animale	Types of Cells	Identify and describe the characteristics and the differences between prokaryotic and eukaryotic cells, and the differences between plant and animal cells.
6 <sup>e</sup>	Conversión de números entrees a binarios y vice-versa <sup>d</sup>	Convierta un número entero en binario y convertir un número binario en entero	Converting Numbers from Decimal to Binary and the Reverse	Converting decimal numbers into binary numbers and vice versa.

Note. <sup>2</sup>As posted as of July 14, 2023.

<sup>a,b</sup>Created by a team of four teachers.

<sup>b</sup>This team adapted and created two coding projects.

<sup>c</sup>Created by a team of teachers.

<sup>d</sup>Created by a team of three teachers.

<sup>e</sup>Created by another team of two teachers.

Table 3  
**University of Puerto Rico --Mayagüez**  
**Coding Workshop June 23-25, 2025**  
 Implementation Plans

Teacher	Title	Brief Description
1	Periodic Properties of Elements	Coding based on data from the properties of the elements in the Periodic Table.
2	Libreta de notas	Importing data and creating histograms based on these data
3	Mi primer codigo	Introduction to coding various items to build a histogram
4	Plan de implementacion (created by two teachers)	Examples of coding to plot data (e.g., mass and acceleration)
5	Libreta de Práctica	Introduction to coding (creating data graphs, importing data)
6	My coding notebook	Using coding to create data plots (e.g., labeling axes, importing data)