Evaluation of the QuarkNet Program: Evaluation Report 2018-2019 Executive Summary

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The QuarkNet Collaboration, referred to as QuarkNet, "is a long-term, national program that partners high school science teachers with particle physicists working in experiments at the scientific frontier." QuarkNet is a professional development program that "immerses teachers in authentic physics research and seeks to engage them in the development of instructional strategies and best practices that facilitate the implementation of these principles in their classrooms; delivering its professional development (PD) program in partnership with local centers" (Program Theory Model, PTM, 2019).

This report is a prototype of the final evaluation report of this program that will be submitted at the end of this award period; as such, it presents a draft of the final evaluation report (although in final form as an interim report). In serving as a prototype, the present report and its review demonstrate the shift in evaluation efforts that has occurred from formative (and summative) assessment to an outcomes-based evaluation; and, it is hoped that this will provide opportunities to help QuarkNet program staff members better understand this shift. It will also allow opportunities for staff to identify principal needs and concerns that the evaluation may be able to be responsive to; and to give the evaluator time to adjust to these needs and suggestions proposed by staff to help aid in the usefulness of evaluation findings and recommendations.

Going forward a distinct difference between this and future evaluation reports will be the inclusion of actual evaluation results drawn from the Program Theory Model and based on the evaluation plan relative to teachers, centers and sustainability. Nevertheless, portions of this report may be presented again as a consistent reminder of the basis in which evaluation decisions and interpretations stem.

With the onset of a new external evaluator, we have proposed a new direction for the evaluation focused on the following, that is, the: (1) Development of a Program Theory Model (PTM); (2) Assessment of program outcomes at the national and center levels through teacher-level outcomes; and, (3) Assessment of the sustainability of program centers, based on center-level and sustainability outcomes.

The fully-articulated PTM is complete. The process used to create the PTM has been described in this report and the model has been described in detailed. Ideally, a program theory model offers a cohesive and representative picture of the program, "an approximate fit" of the program as *designed*. We have sought consensus on the representativeness of this model with key stakeholders and will revisit the PTM over the course of the award period, as this is needed.

To a large extent the PTM elaborates on how change is expected to occur, based on the following QuarkNet Theory of Change:

By immersing teachers in doing authentic particle physics research and by engaging them in professional development that supports guided-inquiry and standards-aligned instructional practices and materials designed for the classroom, teachers become empowered to teach particle physics to their students in ways that model the actual practices of scientists and support instructional best practices suggested by the educational research literature. (Modified from Beal & Young, QuarkNet Summative Evaluation Report 2012-2017).

The development of a PTM and a Theory of Change is consistent with common guidelines proffered by the Institute of Education Sciences, U.S. Department of Education and the National Science Foundation (2013). Weiss (1995) noted that grounding evaluation in theories of change means integrating theory with practice. She postulated further that making assumptions explicit and reaching consensus with stakeholders about what they are trying to do and why and how may ultimately be more valuable than eventual findings (Weiss, 1995), having more influence on policy and popular opinion (Rallis, 2013).

We have used the PTM to direct the development of evaluation measures and methods designed to address the remaining two goals. A Teacher Survey and a Center Feedback template have been designed to measure the teacher-level and center-level outcomes articulated in the PTM, respectively. In this report, we have briefly highlighted the planned method to assess program outcomes through these measures directed toward teachers, centers, and the sustainability of the program and to link this information to program-operations data. We plan on analyzing results from teacher-level responses nested by centers (when feasible); and on linking program participation-level data to program outcomes and other data sources such as implementation plans and teacher interviews, when feasible. We also propose drawing on data from past evaluation efforts when relevant.

Program Recommendations

The following program recommendations are proffered:

1. The program has had a long standing practice of holding regularly-scheduled staff meetings. These tend to be topic/task specific meetings involving those most involved with that aspect of the program and tend to be held weekly. Continue to use this meeting structure to the extent that it is helpful. Include the evaluator in these discussions when meaningful and reasonable. Consider less frequent but periodic program-wide meetings to inform stakeholders across tasks and responsibilities to communicate across the program.
2. Continue to improve program documentation efforts and use it to inform other program staff and stakeholders as well as those external to the program.

3. Reflect on ways in which the Program Theory Model may be used to inform others in the program, those participating in the program (including centers), and those external to program.
4. Support efforts to gather program information contained in the program-operation databases including inputs from teachers, mentors, and program staff.
5. Continue to be mindful that QuarkNet is "first and foremost, a teacher professional development program."
6. Continue to maximize the use of Data Portfolio Activities[a] by teachers at center-led and QuarkNet-led workshops and meetings.
7. Continue to engage in reflective thinking on ways to help teachers integrate their QuarkNet experiences and instructional practices into their classrooms.
8. Support the development by teachers of implementation plans and the subsequent use of these plans in the classroom when feasible.
9. Continue to support the evaluation and its efforts as reasonable. Work with the evaluator, as planned, to help embed evaluation efforts and requirements within the structure and delivery of the program.

Evaluation Recommendations

The following evaluation recommendations are proffered:

1. Review and reflect on feedback from QuarkNet program staff on how the Program Theory Model (PTM) can be improved or changed to help improve its representativeness (as an "approximate fit") of the program and its Theory of Change.
2. Work with program staff to help articulate ways in which the PTM can be used and how to facilitate this use.
3. Help articulate the difference between program theory and program implementation and why this is important.
4. Implement the new, proposed evaluation plan to coincide with the 2019-2020 QuarkNet program year.
5. Review the PTM and evaluation measures to assure that implemented evaluation measures align with the PTM as planned.
6. Help program staff transition from past evaluation efforts that combined formative and summative efforts to an outcomes-based evaluation.
7. Continue to be mindful of the many responsibilities that program staff, mentors and teachers have. Work to ensure that evaluation requests are reasonable and doable in a timely manner. And to the extent possible, embed evaluation requests and efforts within the structure and delivery of the program.
8. Work with program staff to help ensure that program-operations data are collected in a timely manner and with high compliance.
9. Work with QuarkNet program staff to distribute the Teacher Survey and implement the Center Feedback template.
10. Work to ensure that evaluation efforts and results are of value (or of potential value) to all those involved in the process.

[a]The Data Activities Portfolio is a vibrant, on-line compendium of classroom lessons that can be adapted at four distinct levels of student skill-sets; lessons that align with current scientific thinking; and instructional practices aligned with NGSS standards; and, modified based on teacher feedback.