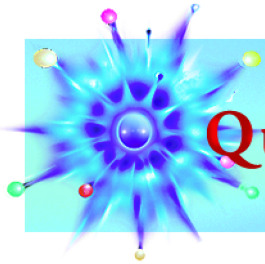




Data Activities Portfolio: A Research Based Approach for Infusing 21st Century Physics into the High School Classroom

Deborah Roudebush
QuarkNet Education Specialist
droudebush@cox.net



QuarkNet

Data Activities Portfolio

Activities Incorporating 21st Century Physics

- <https://quarknet.org/data-portfolio>

Data Activities Portfolio

The Data Portfolio is a compendium of particle physics classroom activities organized by data strand and level of student engagement. Follow the links provided for information about using the Data Portfolio to plan your students' experience. **Level description** - Any - Alls that students apply at each level can be explored individually, level can be explored individually, level increasingly engaging and particularly **NGSS Practices**.

Your students can follow a path through activities that lead to understanding practices that lead to discovery. Each pathway provides connections to be explored in physics class and particle physics content and methods. Use the pulldown menu (Data Strand and Strand) to find activities related to the content you are currently covering. To learn more about sorting these activities.

We want your feedback on how the activities are working. Please complete the [survey](#) to help us improve our activities.

| Data Strand | Level | Category | NGSS Practices |
|-------------|---------|---|----------------|
| - Any - | - Any - | <ul style="list-style-type: none"> Conservation Laws Diversity & Inclusion Electricity & Magnetism Half-Life/Mean Lifetime Instrumentation Waves & Interference Kinematics Nature of Matter Quantum Mechanics Special Relativity Standard Model Skill: Coding Skill: Developing Models Skill: Graphing Skill: Histograms Skill: Uncertainty | - Any - |

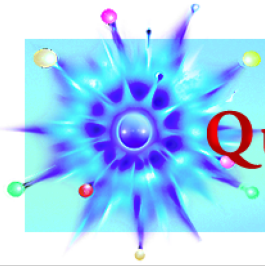
Apply



Engaging Teachers

Making 21st Century Physics Approachable

- **Connect to traditional content topics**
- **Clearly address standards**
- **Overcome fear of complexity**



QuarkNet

Connection to Standards

Standards across the United States

- **Next Generation Science Standards (NGSS)**
- **Common Core**
- **Advanced Placement (AP)**
- **International Baccalaureate (IB)**
- **[Example of Standards in Particle Transformation Teacher Pages](#)**



Research

Effective Teacher Professional Development

June 2017

**Linda Darling-Hammond, Maria E. Hyler,
and Madelyn Gardner,
with assistance from Danny Espinoza**



1 Content Focus

Activities include:

- **Particle physics**
- **Data analysis**
- **Skill-building**



QuarkNet

2 Active Learning

Guided Inquiry

- **Research questions guide thinking**
- **Teacher hat vs. student hat**
- **Claim – Evidence – Reasoning**

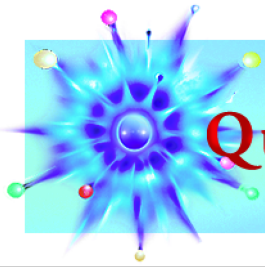


3 Collaboration

Emphasis on Group Work

- Break task into small chunks.
- Share results across groups.
- Analyze whole class data.
- Use histograms frequently.



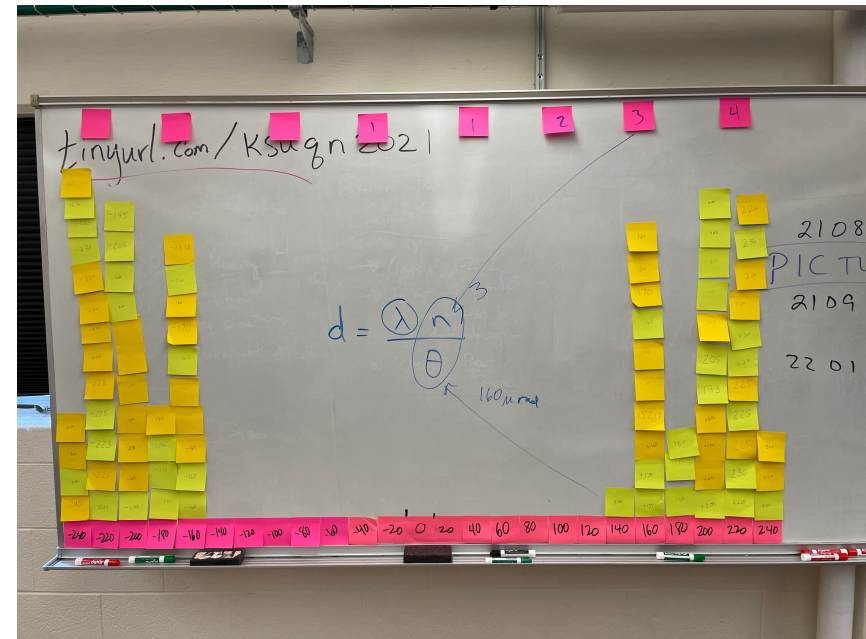


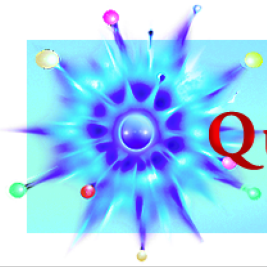
QuarkNet

4 Use of Models & Modeling

Role of Models in Physics Research

- Models change over time.
- Evidence drives model development.
- Models take many forms.
 - Mathematical
 - Physical
 - Qualitative
 - Graphical

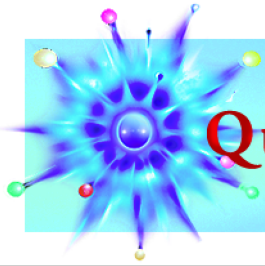




QuarkNet 5 Coaching & Expert Support

Importance of Workshops

- **Train teachers on using the activities.**
 - **Teacher hat – student hat**
- **Ask teachers to develop implementation plans.**
- **Encourage student use.**
- **Use vocabulary from traditional physics curriculum.**

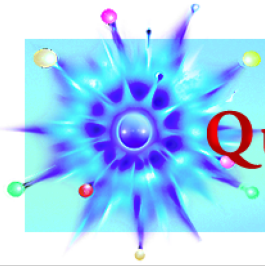


QuarkNet

6 Feedback & Reflection

Meaningful Discussion on Teachers' Needs

- **Reflect on the claims that are supported by the evidence found in data analysis.**
- **Teachers tune activity for their setting.**
- **Advice from experienced teachers**



QuarkNet

7 Sustained Duration

Meaningful Impact in the Classroom

- **Develop long-term relationships with teachers.**
- **Ask teachers what they need.**
- **Work collaboratively to support their situation.**



QuarkNet

Evidence of Effectiveness

Effectiveness

- **Half of the QuarkNet teachers surveyed report using DAP activities.**
- **Anecdotal reports of use of skills and strategies.**
- **Sustained virtual contact during Covid.**



Conclusion

Impacting Curriculum

- **Provide access to vetted activities available on public web site.**
- **Reach out to existing programs & organizations to develop relationships.**
 - **Science teacher organization**
 - **State, local physics teacher groups**
- **Share data to support additional activity development.**