Data Activities Portfolio

Alignment with:

Next Generation Science Standards

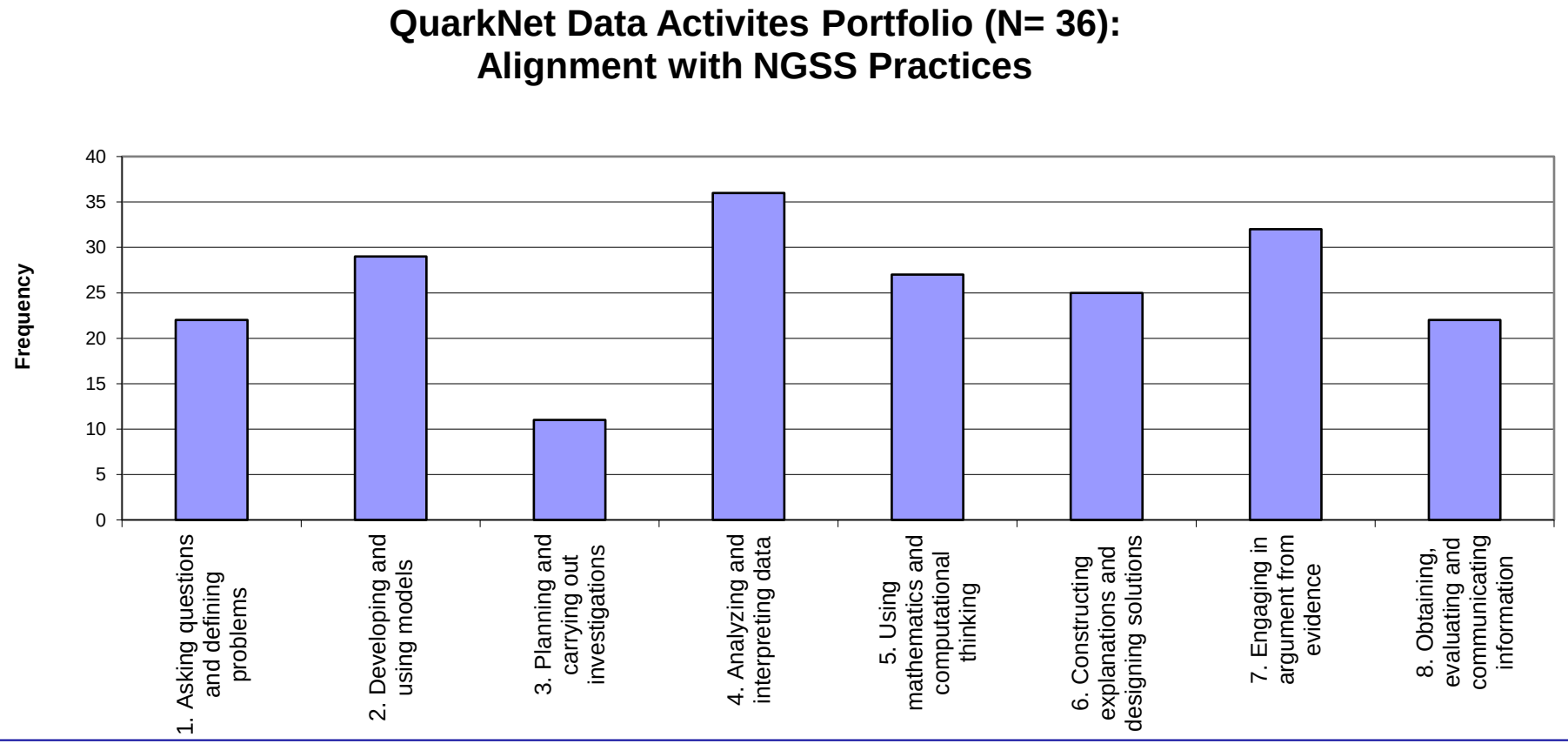
As designed

As implemented through workshop exposure

QN's Enduring Understandings

DAP as Designed

Alignment with Next Generation Science Standards



Exposure to NGSS Practices: Based On DAP Activities Presented in Workshops: 2019 through 2022 (March through November for each year)
As Implemented

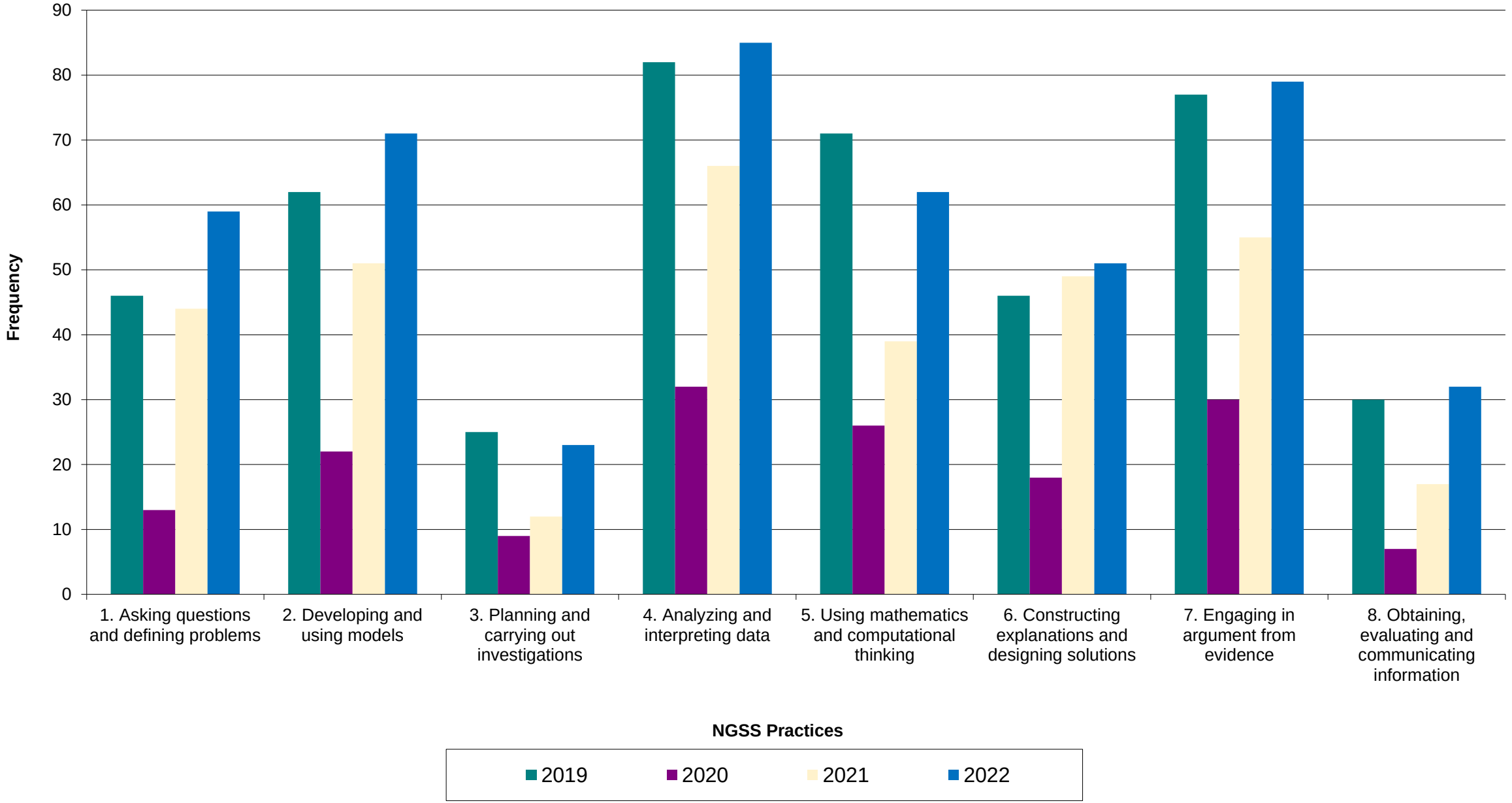


Table 10
Enduring Understandings: Alignment of Activities in the Data Activities Portfolio

Enduring Understandings	QuarkNet Activity	Level
1. Scientists make a claim based on data that comprise the evidence for the claim.	• ATLAS Z-path Masterclass • CMS Masterclass WZH-path	2 2
2. Scientists use models to make predictions about and explain natural phenomena.	• Cosmic Ray e-Lab • CMS e-Lab	3 3
3. Scientists can use data to develop models based on patterns in the data.	• Mapping the Poles • Making it 'Round the Bend – Qualitative • Making it 'Round the Bend – Quantitative • Mean Lifetime Part 1: Dice • Mean Lifetime Part 3: MINERvA • Introduction to Coding Using Jupyter	0 0 2 1 2 0
4. Particle physicists use data to determine conservation rules.	• Making Tracks I • Making Tracks II • Rolling with Rutherford • The Case of the Hidden Neutrino • ATLAS Z-path Masterclass • TOTEM 1	0 1 1 1 2 1
5. Indirect evidence provides data to study phenomena that cannot be directly observed.	• Making Tracks I • Making Traces II • Rolling with Rutherford • The Case of the Hidden Neutrino • ATLAS Z-path Masterclass	0 1 1 1 2
6. Scientists can analyze data more effectively when they are properly organized; charts and histograms provide methods of finding patterns in large datasets.	• Mass of U.S. Pennies • Dice, Histograms & Probability • Histograms: The Basics • Z Mass Spreadsheet Extension	0 0 0 2
7. Scientists form and refine research questions, experiments and models using observed patterns in large data sets.	• Cosmic e-Lab • CMS e-Lab • Research Using Coding	3 3 4
8. The Standard Model provides a framework for our understanding of matter at its most fundamental level.	• Quark Workbench 2D/3D • Particle Transformations • Cosmic e-Lab • CMS e-Lab	0 1 3 3
9. The fundamental particles are organized according to their characteristics in the Standard Model.	• Shuffling the Particle Deck	0
10. Particle physicists use conservation of energy and momentum to measure the mass of fundamental particles.	• Calculate the Z Mass • Calculate the Top Quark Mass • Energy, Momentum, and Mass • CMS Masterclass WZH-path • CMS Masterclass J/Psi	1 1 1 2 2
11. Fundamental particles display both wave and particle properties and both must be taken into account to fully understand them.	• TOTEM 2	2
12. Particle physicists continuously check the performance of their instruments by performing calibration runs using particles with well-known characteristics.	• CMS Data Express	2
13. Well-understood particle properties such as charge, mass, momentum and energy provide data to calibrate detectors.	• Calculate the Z Mass	1
14. Particles that decay do so in a predictable way, but the time for any single particle to decay, and the identity of its decay products, are both probabilistic in nature.	• Mean Lifetime Part 1: Dice • Mean Lifetime Part 3: MINERvA	1 2
15. Particle physicists must identify and subtract background events in order to identify the signal of interest.	• Signal and Noise: The Basics • Signal and Noise: Cosmic Muons • CMS Masterclass J/Psi	0 1 2
16. Scientists must account for uncertainty in measurements when reporting results.	• What Heisenberg Knew • Histograms: Uncertainty	1 1