Big Sky Standards

Real World Data Webinar Series

Why Data Science?

MONTANA OFFICE OF PUBLIC INSTRUCTION
THE GREAT SEAL OF THE STATE OF MONTANA
ORO Y PLATA

DataScience4

MEET YOUR HOSTS

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Data literacy refers to the ability to read, understand, interpret, and communicate data or claims derived from data.

It involves teaching students how to:

- critically evaluate data, including understanding its origins, limitations and potential biases.
- effectively communicate data through visualizations and other means.

Data science education refers to instruction focused on systematic processes, analytical techniques, and utilization of appropriate technologies to gain knowledge from data.

It involves teaching students how to use tools and methods across the curriculum to:

- collect or consider, analyze, interpret, and communicate data to answer investigative questions.

1. Marketing Manager
2. Customer Experience Strategist
3. Sales Manager
4. Penetration Tester
5. Bioinformatic Scientist
6. Fundraising Manager
7. Clinical Data Manager
8. IT Project Manager
9. Digital Forensics Analyst
10. Supply Chain Manager

https://www.mthightech.org/news/special-report-31-hot-montana-jobs-for-2025

Industries

MONTANA STEMEcosystem

Top Industries
(by number of 2024 jobs):
- Government
- Health Care & Social Assistance
- Retail Trade

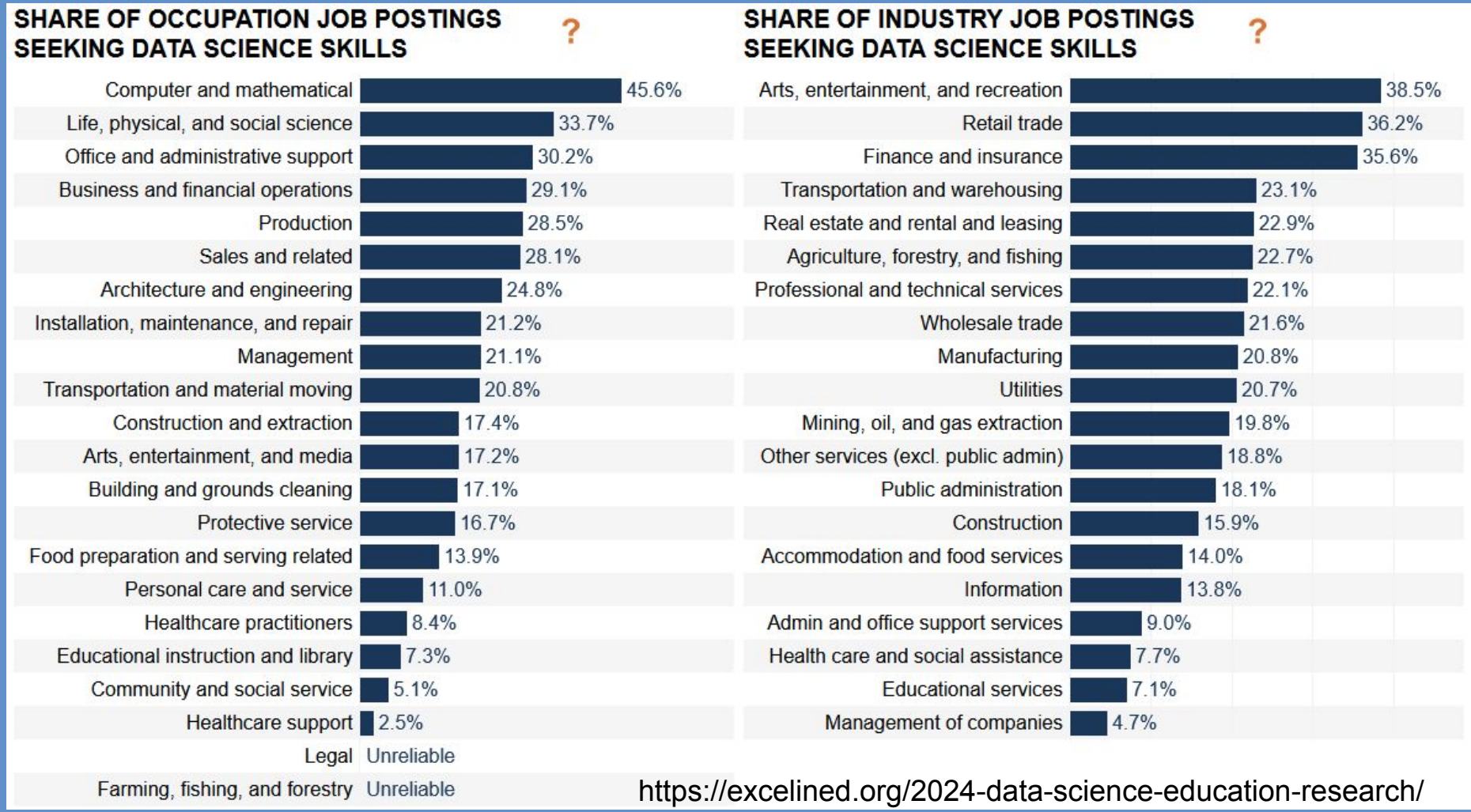
Top Industries (by LQ) (without Unclassified):
- Mining, Quarrying, and Oil & Gas Extraction
- Agriculture, Forestry, Fishing, and Hunting
- Arts, Entertainment, and Recreation

ties
Uniting Partners. Transforming Learning.

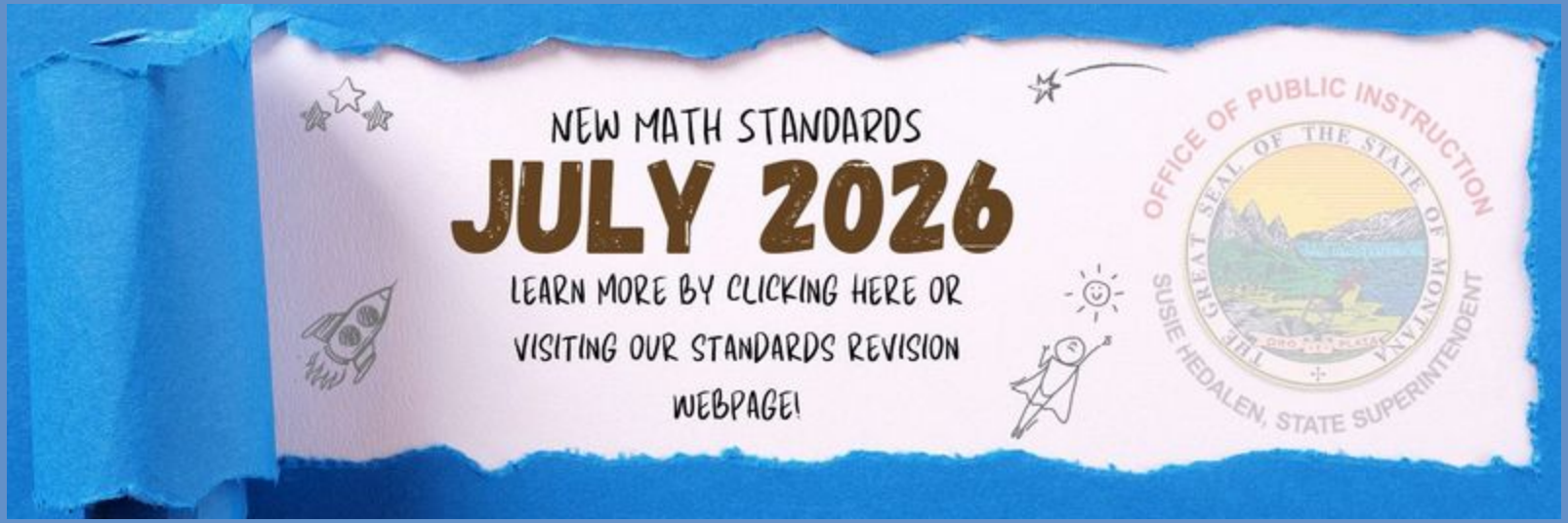
Location Quotient (LQ):
Quantifies the concentration of employed workers in a region relative to the national average. It can reveal what makes a particular region "unique" in comparison to the national average.

Industries (NAICS)	2019 Jobs	2024 Jobs	2019 - 2024 % Change	2024 LQ
Agriculture, Forestry, Fishing and Hunting (11)	**6,056**	**6,890**	**14%**	**1.66**
Mining, Quarrying, and Oil and Gas Extraction (21)	**6,736**	**6,604**	**2%**	**3.40**
Utilities (22)	2,822	2,906	3%	1.50
Construction (23)	29,914	36,954	24%	1.39
Manufacturing (31-33)	20,972	21,624	3%	0.51
Wholesale Trade (42)	17,189	18,991	10%	0.94
Retail Trade (44-45)	**58,254**	**62,734**	**8%**	**1.22**
Transportation and Warehousing (48-49)	12,677	13,234	4%	0.62
Information (51)	6,209	5,488	12%	0.57
Finance and Insurance (52)	16,093	16,948	5%	0.81
Real Estate and Rental and Leasing (53)	6,106	6,742	10%	0.85
Professional, Scientific, and Technical Services (54)	23,148	28,451	23%	0.80
Management of Companies and Enterprises (55)	2,066	2,253	9%	0.26
Administrative & Support & Waste Management & Remediation Services (56)	18,203	21,181	16%	0.69
Educational Services (61)	5,047	5,780	15%	0.55
Health Care and Social Assistance (62)	**69,599**	**73,558**	**6%**	**1.02**
Arts, Entertainment, and Recreation (71)	**12,412**	**12,744**	**3%**	**1.51**
Accommodation and Food Services (72)	54,596	60,224	10%	1.29
Other Services (except Public Administration) (81)	18,442	19,072	3%	1.25
Government (90)	**83,631**	**85,708**	**2%**	**1.17**
Unclassified Industry (99)	348	1,901	446%	2.14

Source: Lightcast


SHARE OF OCCUPATION JOB POSTINGS SEEKING DATA SCIENCE SKILLS
Computer and mathematical 45.6%
Life, physical, and social science 33.7%
Office and administrative support 30.2%
Business and financial operations 29.1%
Production 28.5%
Sales and related 28.1%
Architecture and engineering 24.8%
Installation, maintenance, and repair 21.2%
Management 21.1%
Transportation and material moving 20.8%
Construction and extraction 17.4%
Arts, entertainment, and media 17.2%
Building and grounds cleaning 17.1%
Protective service 16.7%
Food preparation and serving related 13.9%
Personal care and service 11.0%
Healthcare practitioners 8.4%
Educational instruction and library 7.3%
Community and social service 5.1%
Healthcare support 2.5%
Legal Unreliable
Farming, fishing, and forestry Unreliable
SHARE OF INDUSTRY JOB POSTINGS SEEKING DATA SCIENCE SKILLS
Arts, entertainment, and recreation 38.5%
Retail trade 36.2%
Finance and insurance 35.6%
Transportation and warehousing 23.1%
Real estate and rental and leasing 22.9%
Agriculture, forestry, and fishing 22.7%
Professional and technical services 22.1%
Wholesale trade 21.6%
Manufacturing 20.8%
Utilities 20.7%
Mining, oil, and gas extraction 19.8%
Other services (excl. public admin) 18.8%
Public administration 18.1%
Construction 15.9%
Accommodation and food services 14.0%
Information 13.8%
Admin and office support services 9.0%
Health care and social assistance 7.7%
Educational services 7.1%
Management of companies 4.7%
https://excelined.org/2024-data-science-education-research/

WHY ARE WE HERE?



2022	2023	2024	2025	2026
Research and Review	Revisions + Negotiated Rulemaking	Board of Public Education Review and Adoption	Professional Learning on New Standards and Guidance Documents Creation	District Implementation in July

The Why: *Philosophy and Rationale Behind the Change*

REL Handout A

Focuses on early learning and elementary topics

- Identified data as a **foundational** PK-5 concept essential for student success.
- Young students **are able to work with and understand data.**
- Working with data helps students develop skills necessary to work with more complex mathematical concepts.

REL Handout C

Focuses on secondary topics

- Workplace research states that of the top three technical skills missing in applicants, **data science and analysis were the second.**
- Many jobs **require employees to work with data,** from new careers like AI development to traditional fields like social work and nursing.
- Students should have access to **flexible 4-year pathways** that **include a data and statistics option** rather than being locked in to the calculus pathway.
- Research suggests that data science courses **may be more inclusive** than traditional courses leading to **increased confidence, empowerment and belonging** among students

...and more.

The What Now: *What Does this Mean for Teaching and Learning?*

Teaching

Implications for Instructional Design

- Schools offer diverse pathways for students that include opportunities to work with data.
- Districts critically evaluate K–12 curricula—especially high school math and science—to ensure explicit coverage of data topics embedded in the standards
- Teacher PD includes coaching, workshops, and structured decision-making models to build both data interpretation and pedagogical data-use skills
- Interdisciplinary integration ensures students see data use not just in math, but also in CTAE, science, social studies, art, and language arts, etc.
- Educators can model data literacy by using data to inform decision making in schools.

Learning

Implications for Students

- Students actively collect, analyze, interpret, and present data, fostering analytical reasoning and critical evaluation—key 21st-century skills (NWEA, 2025)
- Data literacy prepares students for active citizenship and participation in a digital workforce.
- Starting in early grades, learners explore data through age-appropriate contexts to nurture foundational literacy skills.
- Students use data to explore issues relevant to local communities and indigenous knowledge to make math connected to cultural and contextual experiences.

(1) Problem Solve and Persevere.
Mathematically proficient students:
(a) make conjectures, plan, and follow solution strategies,
(b) evaluate their progress and accuracy,
(c) engage in sense-making and self-monitoring,
(d) persevere in seeking solutions, and
(e) value alternative approaches.

Example:

Students explore a community dataset (e.g., rainfall, store foot traffic), make conjectures (“I think Friday is busiest”), test through graphs, and refine strategies if patterns don’t match expectations.

Image Source: AI Generated

Image Source: AI Generated

(2) Abstract and Generalize
(a) Mathematically proficient students are able to decontextualize and symbozlically represent both mathematical and non-mathematical situations to search for and analyze regularities, patterns, and structures.

Example:
From a table of school garden plant growth measurements, students develop formulas or functions that model trends.

(3) Justify and Prove
(a) Mathematically proficient students create, evaluate, justify, and refute mathematical claims in developmentally and mathematically appropriate ways.

Example:
Students examine graphs from various sources, look for bias or inaccurate representations, and refute these claims in developmentally appropriate ways.

(4) Model with Mathematics

Mathematically proficient students:

(a) Make sense of a scenario

(b) Identify a problem to be solved, and mathematize it, and

(c) Apply a mathematical model to reach a solution and verify its viability.

Example:

Students collect shadow lengths over multiple hours, build a ratio model, and use this to approximate height of objects and understand proportional relationships.

(5) Represent

Mathematically proficient students:

(a) Recognize, use, create, interpret, and translate representations using appropriate methods and tools, and

(b) Understand multiple ways of representing mathematical ideas and how they are related.

Example:

Learners display data in multiple forms (e.g., bar charts, box plots, pictographs). They compare their appropriateness and choose the best for specific audiences or contexts.

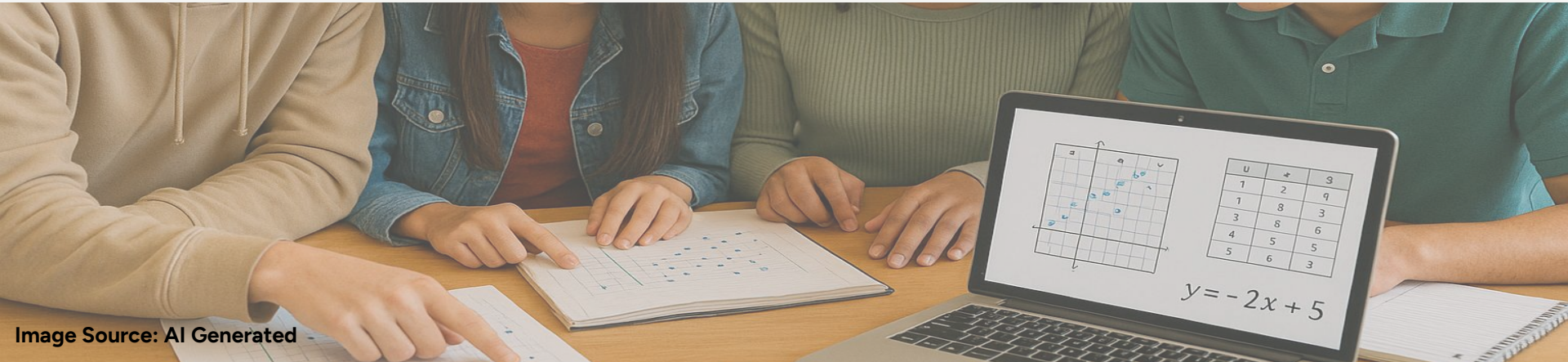


Image Source: AI Generated

(6) Collaborate Mathematically
Mathematically proficient students engage in mathematics as a social enterprise through discussion and collaborative inquiry where ideas are offered, debated, connected, and built upon toward solutions, shared understanding, and appreciation of other perspectives.

Example:
In peer groups, students consider problems that can be solved by data, define data collection protocols (e.g., how many samples, intervals, survey questions), form visualization models, and engage in collective critique.

(7) Culturally Connect
Mathematically proficient students:
(a) Recognize cultural connections and contributions to mathematics and
(b) Appreciate the role of mathematics in various cultural contexts, including those of tribally specific Montana Indigenous Peoples.

Example:
Learners work with tribal community data—such as tracking local animal crossing data or dam energy outputs—and discuss findings in cultural context.

Image Source: AI Generated

In Summary:

- The mathematical practice standards can be used as methods for strengthening students' data literacy and analysis by:
    - offering increased opportunities for students to collaborate and explore contextual examples - perfect opportunities for learning with data.
    - Abstract & Generalize and Represent drive students to convert data across symbols, tables, graphs, and narratives.
    - Justify & Prove invites students to inquire and critique - which supports probing for bias or ambiguous graphs in the world.
    - Modeling and cultural contexts encourage authentic examples.

5 data science starter concepts

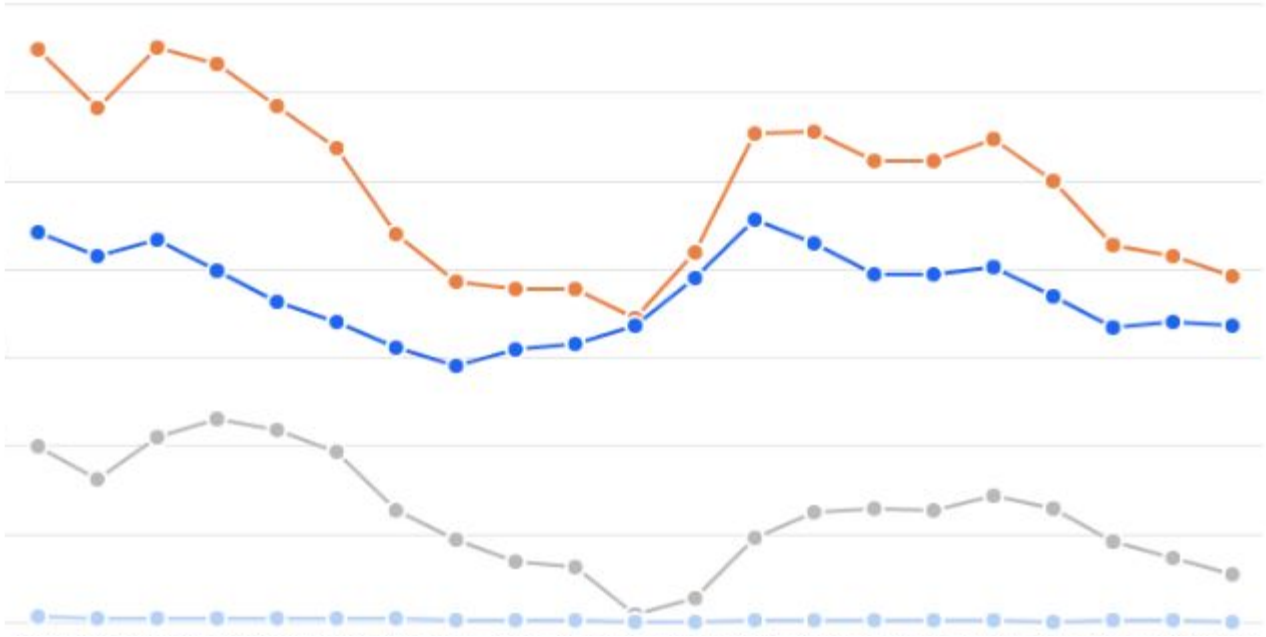
Best Practice: cultivate these data skills with students

1. Telling Stories That Matter
2. Questioning Everything
3. Making It Real
4. Asking Better Questions
5. Working with Complex Information

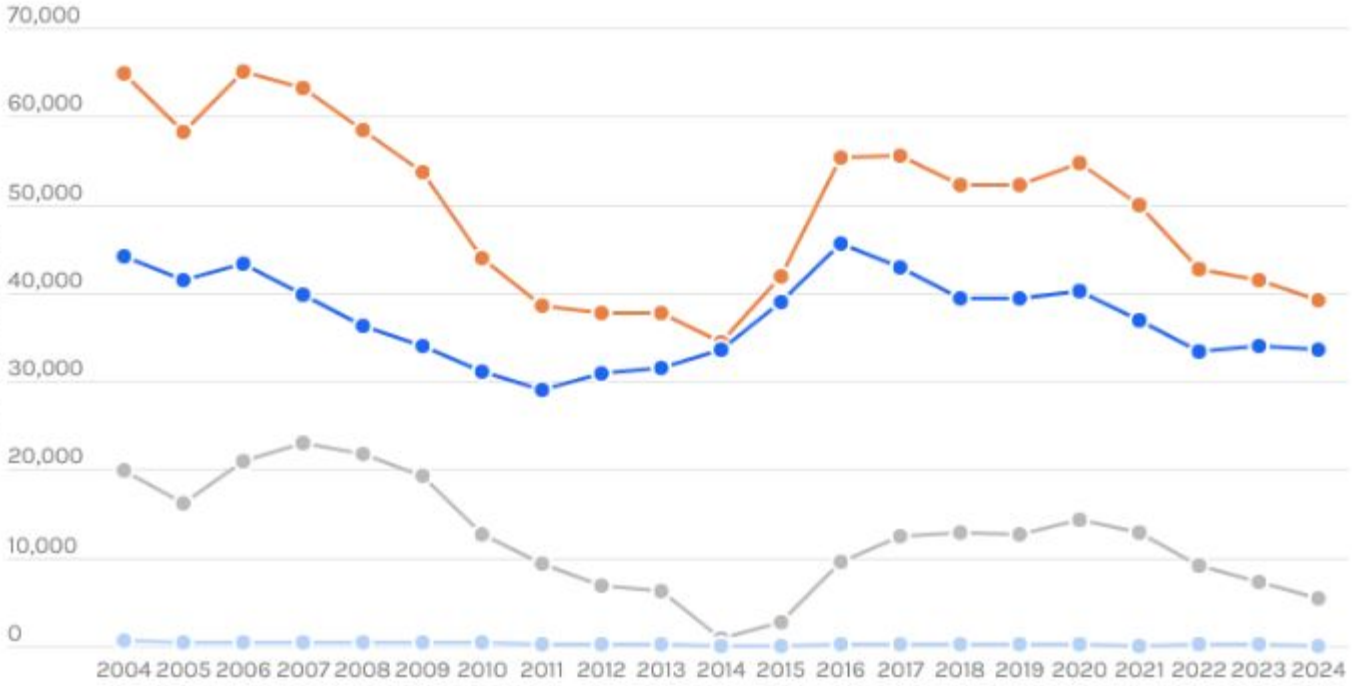
Image is AI generated

Now let's look at a classroom example.

What do you notice? What do you wonder? What do you think this graph might be about?



What new information did we just learn? Did it change your thinking? Now what do you think this graph might be about?



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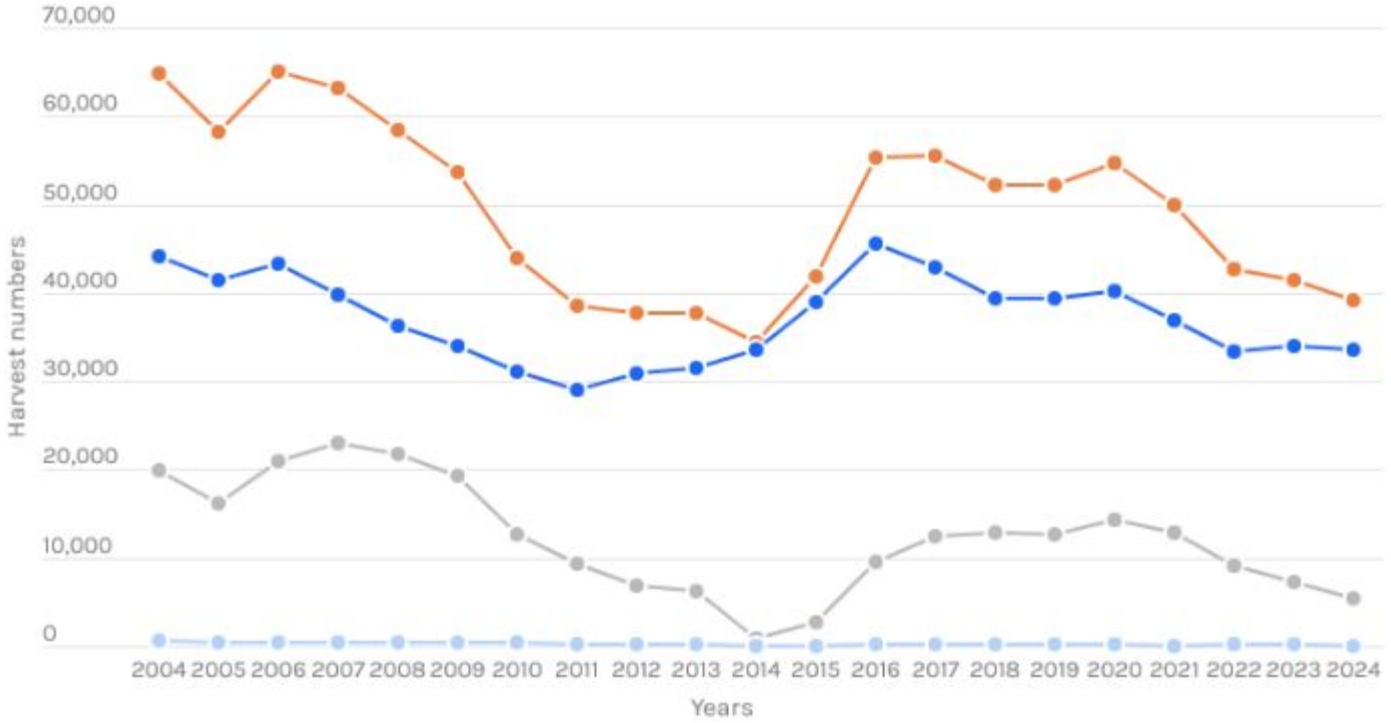

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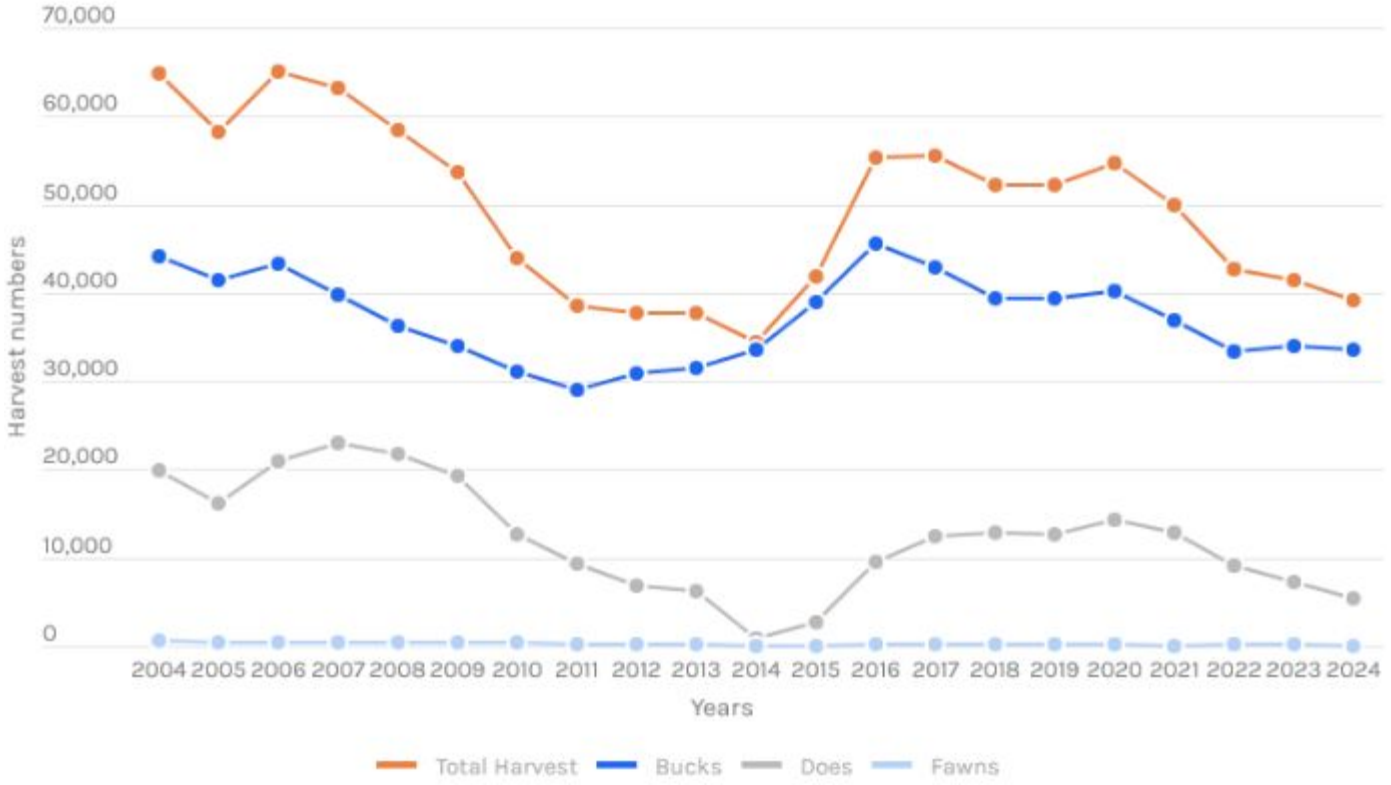
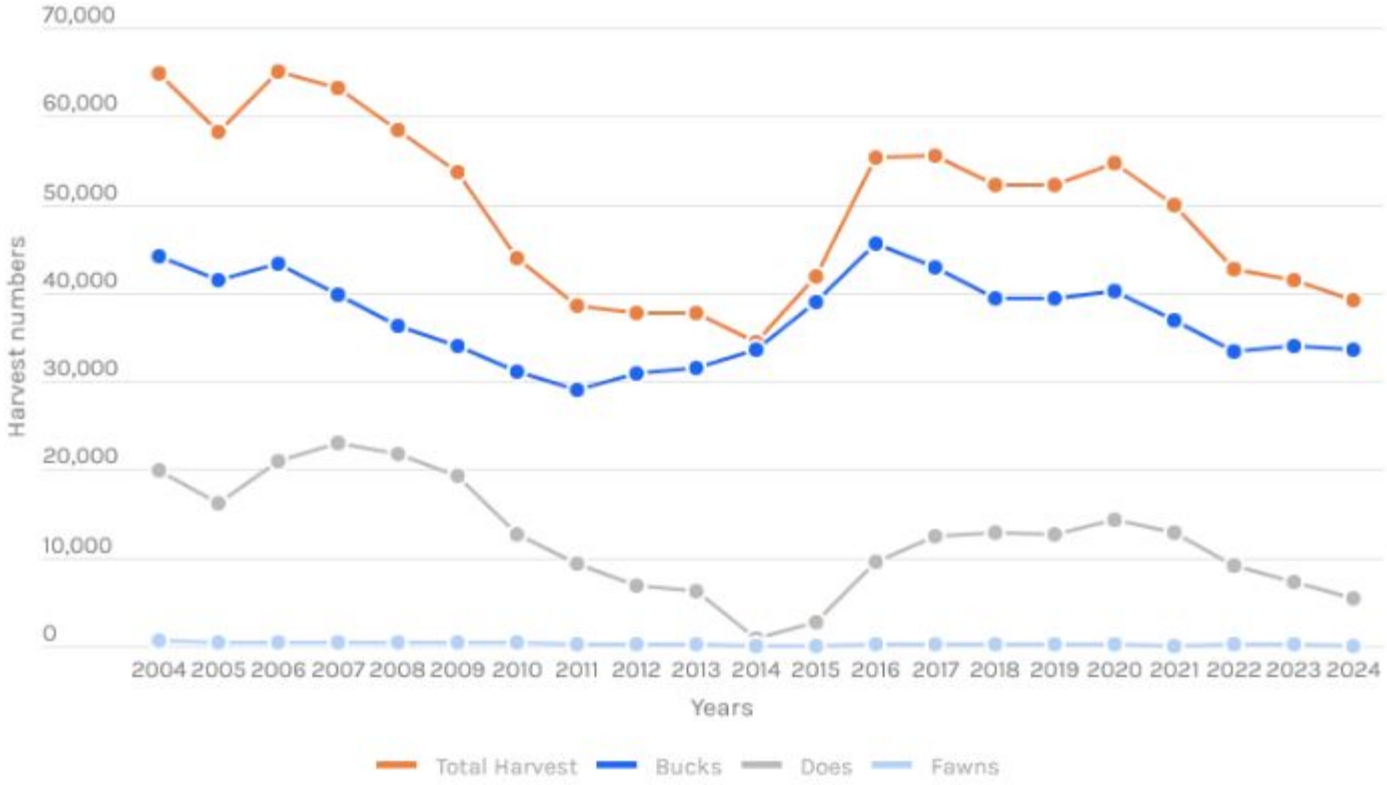


MONTANA STATEWIDE MULE DEER HARVEST (2004-2024)



Graph Source: https://www.gohunt.com/browse/tips-and-tricks/insider/montanas-mule-deer-population-harvest-success-and-hunter-trends-revealed

Slow Reveal Graphs

- An Instructional Routine to Promote Sensemaking about Data -

The **“Slow Reveal Graph”** instructional routine promotes cross-curricular sensemaking about data. As more and more of the graph is revealed, students refine their interpretation and construct meaning, often in surprising ways.

https://slowrevealgraphs.com/

Questions and Answers

Contact us at
OPICSI@mt.gov

JOIN US NEXT TIME

September 9th

“Take the Intimidation Out of Data Through Mathematics”

Feedback and Evaluation

Please complete the feedback form to request a Professional Development Unit Certificate from OPI and to provide feedback for improvement.