Williams STEM Leadership PD Proposal

- **What is the title of your STEM Professional Development?**
  Differentiated Data Literacy (Resources and strategies for data interpretation in Science and Social Studies as well as any subject area that does not have data interpretation resources built into their curriculum) using NASA data cubes.

- **Why did you select the topic?**
  Interpreting data is a cornerstone of science, yet I have never had resources built into my curriculum to teach it at the 6-8 grade levels. Further, when I took my second Endeavor course, Eyes on Earth: Teaching Earth Science from Space, I learned about the data resources that NASA offers. I have mentioned the website and resources to my department but nothing has come of it. I have also not figured out how to use it correctly in my classroom (putting together the resources with the cubes/questions for ease of daily use. This PD is an opportunity for me to finally use these resources and help other teachers use them too. Further, this will also help teachers develop their own set of resources to use with the cubes.

- **How does your PD integrate NASA assets and/or content from the Endeavor courses?**
  My PD is based on the MyNasaData Data Literacy Cubes and differentiated data interpretation questions. The PD will also build in time for teachers of each subject area to have the opportunity to search for data resources that students will interpret using the cubes. Science teachers will be directed to use the NASA data visualization resources.

- **Who is your proposed audience? Which teachers will you serve with your PD and activities? What grades, subjects and how many students do they teach?**
  I will ask five science teachers, 6 social studies teachers and five elective teachers to attend (PE/Health, Engineering, Photography, Choir/Band). The PD will help any teacher who uses tables, graphs, charts, etc. All subject areas should have data interpretation opportunities or any statistics about their subject area that students could interpret.

- **What STEM components or learning goals will you and your materials address which can potentially replace other classroom activities?**
  Data interpretation and analysis are the components of this PD. NASA provides the Data Cube and differentiated questions. Science teachers can use this for data that we most likely already use. Social studies teachers could use the cubes also, especially the map version. The elective teachers could use these for interpreting data in their subjects. For example, health and fitness charts and graphs, engineering trends, patterns, safety, etc.)

- **List NGSS standards**
  There are multiple middle school science standards that specify the use of data literacy. This PD is focused on the Science and Engineering Practice: Analyzing and Interpreting Data. This SEP applies to all four domains of science via the disciplinary core ideas as

well. However, this PD is not specific to science teachers. I want to understand how teachers of all subject areas (except Math because they have curriculum resources built in) incorporate data analysis in their classrooms. Further, most other subject areas do not have resources, so it is left to teachers to individually build this into their lessons or unit. It is the goal of this PD to allow teachers of all subject areas to find data visualization resources to use with the data cubes from NASA. Science teachers attending this PD will be directed to the data visualization resources using MyNasaData and other NASA specific sites.

According to the Oceans of Data Institute, “On average, 12% of the PEs in the NGSS specifically cite Practice #4: Analyzing and interpreting data. Across grades, the percentage of PEs citing this practice are highest in elementary (13%) and middle school (15%)...” Being a sixth grade teacher at a middle school for five years, I have found that most students have limited knowledge of creating tables, graphs, etc., and have even less experience with data analysis of these tools.

Performance Expectations

MS-ETS1-3 Engineering Design

Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ESS3-2 Earth and Human Activity

Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

MS-ESS2-3 Earth's Systems

Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

MS-ESS1-3 Earth's Place in the Universe

Analyze and interpret data to determine scale properties of objects in the solar system.

MS-LS4-3 Biological Evolution: Unity and Diversity

Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

MS-LS4-1 Biological Evolution: Unity and Diversity

Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-PS3-1 Energy

Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS1-2 Matter and its Interactions

Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

NGSS SEP Analyzing and Interpreting Data:

> *Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.*

Specific to Middle School: *Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.*

- *Construct, analyze and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.*
- *Use graphical displays (maps, charts, graphs and/or tables) of large data sets to identify temporal and spatial relationships.*
- *Distinguish between causal and correlational relationships in data.*
- *Analyze and interpret data to provide evidence for phenomena.*
- *Apply the concept of statistics and probability to analyze and characterize data, using digital tools when feasible.*
- *Consider limitations of data analysis and/or seek to improve precision and accuracy of data with better technological tools and methods.*
- *Analyze and interpret data to determine similarities and differences in findings.*
- *Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.*

- **How long will the session be? How will you recruit your audience? Where will you advertise your PD session?**
  The PD session will be one hour long. Teachers value their time and I want to honor that by providing t pre and post session interviews and surveys via email. The one hour time in the PD will focus on learning the data cube and differentiated levels of interpretation tasks as well as finding data sources within the teachers' own curricula. It would be ideal for teachers to leave the PD with the resources and plan to implement this easily and whenever they wanted or needed.
- **What will your pre-survey and post-survey ask?**
  Open ended/interview for before and after:
    - How would you define data literacy?
    - Provide examples of how you use data in your classroom (tables, charts, graphs, etc.)
    - What are your biggest challenges using data in your classroom?

  Scale questions to quantity using Likert scales (1-4) for before and after:
    - I use data interpretation strategies (any of the following: tables, charts, maps, graphs) in my classroom currently.
    - My comfort level in using data interpretation in my teaching is
    - I have curriculum resources to help me plan lessons that include data interpretation
    - I have found my own resources for utilizing data in my classroom.

- **What outcomes or expectations do you hope to see for your educators?**
  I hope to understand how other subject areas view data literacy as well as how data interpretation is used in other subject areas. Our school data comes from Math and ELA alone. Administrators point out the weak points that all subject areas can work on to support Math and ELA. Data interpretation was identified by our administrators at the beginning of this school year. I hope to provide teachers of all subject areas with resources to allow for easy implementation of data interpretation activities in their classrooms.

- **How will you follow up with the teachers in attendance?**
  Teachers who volunteer to attend will be contacted before and after the PD to complete the interviews and Likert surveys.

- **What data collection methods will you use to analyze the PD's success?**
  Analysis of the Likert scale questions as well as the interviews.