NGSS Lesson Planning Template

Grade/ Grade 4-5	Topic: The Grace and Grace FO Mission	Tech/Science Lab
Brief Lesson Description: Students will be introduced to the Grace Mission past and present. They will understand the importance that water has globally and locally.		
Performance Expectation(s): Students will understand what the Grace Mission tracts and why the data collected is important to our lives. They will graph different regions of the US for water concentration.		
Specific Learning Outcomes: Be able to analyse data gathered for water and seasonal changes locally and compare to other regions in the US. Understand the importance of water. Understand how GRACE tracks the movement of water by measuring gravitational pull.		
NGS Standards		
4-ESS2-2.	**Analyze and interpret data from maps to describe patterns of Earth's features.**	
5-ESS2-2.	**Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.**	
Science & Engineering Practices: 4 - Analyze and interpret data to make sense of phenomena using logical reasoning. **5 - Using Mathematics and Computational Thinking** Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.	**Disciplinary Core Ideas:** **4 - ESS2.B: Plate Tectonics and Large-Scale System Interactions** **5 - ESS2.C: The Roles of Water in Earth's Surface Processes**	**Crosscutting Concepts:** **4 - Patterns can be used as evidence to support an explanation.** **S5 - Scale, Proportion, and Quantity**

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:
Lesson Introduction: Grace FO just launched. The first Grace mission lasted much longer than was planned and the research in water movement is important for our climate, weather and global warming.

Students will watch the following introduction videos and then discuss water in our local area.
https://www.youtube.com/watch?time_continue=2&v=s93i7m82h54 Grace Mission and purpose
https://www.youtube.com/watch?v=hsdjssgbZoU - Video explaining gravity and water mass moving around planet.

GRACE - Gravity Recovery and Climate Experiment
Background: The Grace Mission was launched in 2002. There were two earth spacecraft orbiters that map the gravity on earth and tracks the mass of water moving around the globe. The mission ended in 2017 and GRACE FO (Follow On) was successfully launched in May and

is continuing the mission.

Purpose: By measuring changes in Earth's gravity, the mission will track water movement around the globe, identifying risks such as droughts and floods and revealing how land ice and sea level are evolving.

Class Discussion regarding the importance of water to our land, business and life. Students will also post questions and thoughts regarding this mission and how it helps us in our state on https://padlet.com/.

Materials Needed: Digital device with internet access. Google Classroom set up.

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

Students will explore the latest news from https://www.nasa.gov/mission_pages/Grace/news/index.html which explains data and news events from around the globe. This explores specific events around the world regarding drought, floods, aquifers and ocean temperatures. This does reflect latest news so new information can be included. Students will access a document in Google Classroom and will summarize one of the news events. They will include information regarding where this event was, the conditions that are being affected and how the GRACE data can help.

Example: In 2011, catastrophic floods occured on the Missouri River. While the floods were directly the result of many inches of rain, the potential for a flood was recorded by GRACE months before. This kind of information could provide information to help prepare for such an event. This can help protect business, homes and lives.

EXPLAIN: Concepts Explained and Vocabulary Defined:

4-5 students per team, will visit this site and zoom in on towns in New Hampshire, Florida, Washington and New Mexico. Other areas could be used but these states were used as they have very different MASCON data. New Hampshire is our state.

https://ccar.colorado.edu/grace/jpl.html MASCON Visualization Tool (Mascon - Mass Concentration) This is a global map of water mass plotted throughout the year.

Students will plot the MAScon data that they find in a Google Classroom Spreadsheet. Each team will not be told what other locations the students are researching.

Students can compare spreadsheets and additional US maps and see if they can figure out where the other locations might be based graphs. They will discuss what the data means for each region.

Vocabulary:
GRACE
Gravity
Mass
Floods
Ice Sheets
Glaciers

Ocean currents
MASCON

ELABORATE: Applications and Extensions:

Why it is so important
https://gracefo.jpl.nasa.gov/resources/74/why-is-grace-fo-so-important/ - The importance of this mission.Review what we have learned and explored.

Discuss ways we could use this information: (predicting drought, floods…) Could we use information like this to stop or prepare for global warming? Could we prepare for a drought by collecting water from a flood ravaged area in the future?

Review questions and thoughts from the padlet page that was completed in the Engage section of this project.

EVALUATE:

Formative Monitoring (Questioning / Discussion):

Active participation in discussions and padlet activity. Team participation in the MASCON activity.

Summative Assessment (Quiz / Project / Report):
Graded activities:

- completion of summary of news event
- completion of spreadsheet from MASCON data

Elaborate Further / Reflect: Enrichment:
Continue with checking in with latest news from the GRACE Mission site throughout year or seasonally. Follow up with contacting a scientist involved in the Grace mission regarding unanswered questions.

Resources:

NASA Mission Gets the View on Earth's Water Resources from Space - Teachable Moments | NASA/JPL Edu. (2018, May 18). Retrieved from https://www.jpl.nasa.gov/edu/news/2018/5/18/nasa-mission-gets-the-view-on-earths-water-resources-from-space/

Greicius, T. (2013, July 30). Grace Mission. Retrieved from https://www.nasa.gov/mission_pages/Grace/index.html

Croteau, M. J. (n.d.). Mascon Visualization Tool. Retrieved from https://ccar.colorado.edu/grace/faq.html