POWER OF DATA FACILITATION GUIDE

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INTRODUCTION TO POWER OF DATA

The Power of Data or POD Project, which focuses on Geospatial Inquiry, has been providing professional development to diverse groups of secondary teachers since 2009. POD professional learning programs enable secondary teachers to increase students' content knowledge, 21st century skills and awareness of geospatial technology careers through Geospatial Inquiry and data analysis.

POD project evaluators have found that teachers who participated in past POD professional development increased their technological and pedagogical skills and confidence teaching with Geospatial Inquiry. Participating teachers implemented lessons which provided more opportunities for students to analyze data and make claims based on spatial evidence. POD programs have impacted learning for approximately 1,600 secondary and post-secondary students.

Expanding Geospatial Technology Career Development for High School Students through Teacher Professional Development (the Power of Data Project) is funded by the National Science Foundation's Division of Research on Learning, Innovative Technology Experiences for Students and Teachers (#1513287). The intent of the project is to provide teacher educators the skills and support they need to deliver POD Teacher Workshops across the nation. Thousands of students will have the opportunity to engage in Geospatial Inquiry, which integrates multi-disciplinary practices and 21st century workforce skills, increasing their awareness of and interest in GST careers (Figure 1).

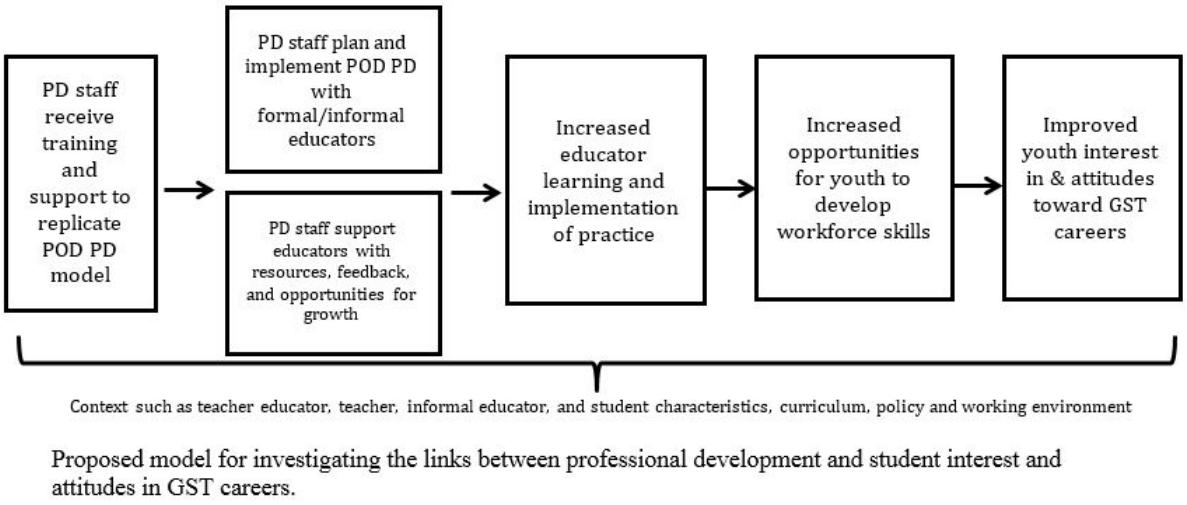


Figure 1. POD model for investigating the links between PD and student interest and attitudes in GST careers.

As a Teacher Educator and Facilitation Academy participant, you are the key to the success of this project. Your participation, insights, and feedback will guide project development and ultimately support the effective integration of Geospatial Inquiry into classrooms. Thank you for your time and commitment.

Goals for Facilitators of POD Teacher Workshops

- Increase understanding of POD Principles
- Increase understanding how Geospatial Inquiry cycle embodies the POD Principles
- Increase confidence and skills for facilitating POD Teacher Workshops
- Collaborate with POD development team to study and refine POD Facilitation Academy, POD Teacher Workshop, and supporting guides

Goals for Teachers in POD Teacher Workshops

- Increase understanding of Geospatial Inquiry
- Increase confidence and skills for facilitating Geospatial Inquiry with students
- Identify opportunities to implement Geospatial Inquiry to enhance student learning of key disciplinary concepts
- Increase awareness of careers that could inspire students to enter STEM fields

What you will experience

During this Facilitation Academy, you will experience a typical POD Teacher Workshop, which engages participants in adult-level, **Geospatial Inquiry** with a focus on science.

1. You will engage in a common **Geospatial Inquiry experience:**
    - **Examine** geospatial data
    - **Ask questions** about geospatial data
    - **Analyze and interpret** geospatial **data** with the help of geospatial technologies, specifically, ArcGIS Online
    - **Engage in argument** using geospatial data as **evidence** to support written arguments
    - Present and receive feedback on your argument to peers
    - **Revise** your argument based on peer feedback.
2. You will repeat the **Geospatial Inquiry** based on your own interests.
3. You will **reflect** on your experiences as both a participant in the POD Teacher Workshop, and also as a Facilitator of a POD Teacher Workshop:
    - **Consider** to what extent these experiences affected your conceptual understanding
    - **Identify** the key components of the POD Teacher Workshop that helped you to come to these understandings
    - **Contemplate** facilitation moves and structures that contributed to a high-quality adult learning experience
    - **Plan** how you will facilitate immersive, active POD Teacher Workshops in your area

By the end of the Academy, you will be prepared to facilitate POD Teacher Workshops in your area and to support teachers as they implement Geospatial Inquiry in their classrooms.

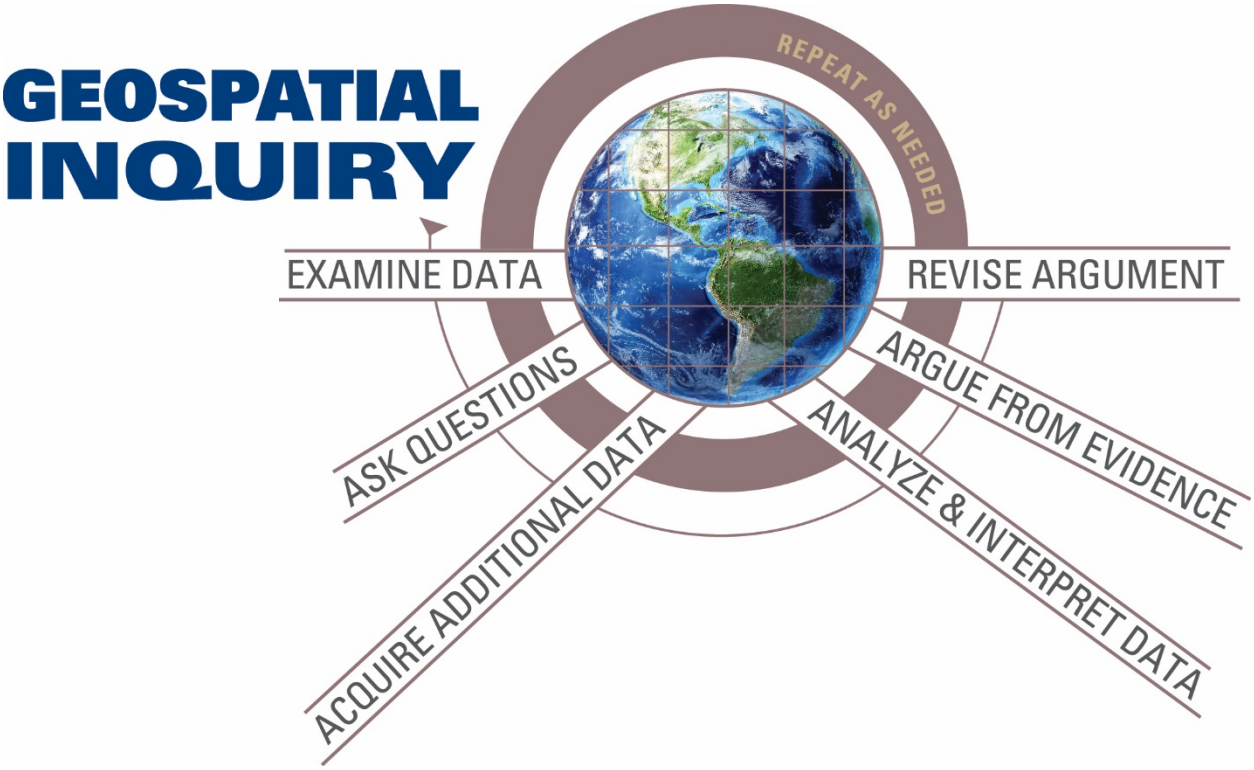
What should you expect?

The focus of this Academy is to **learn how Geospatial Inquiry, when facilitated using instructional practices which promote learning, can support teachers' integration of Geospatial Inquiry into their classrooms**. You might increase your knowledge of Earth Science concepts and you might learn some geospatial technology skills and tools but these are not the main goals of the Academy.

What is Geospatial Inquiry?

POD defines Geospatial Inquiry as:

> Asking and answering a question through the analysis and communication of data that is linked to a geographic location on, above, or near Earth. These data are often represented visually via maps.



Geospatial Inquiry involves analysis of geospatial data:

Geo: of or pertaining to Earth

Spatial: of or pertaining to space

Data: facts and statistics collected together for reference or analysis

Geospatial Inquiry is learner-focused and grounded in multiple learning cycle theories and approaches. Geospatial Inquiry includes multiple phases, but it is a continual process and does not necessarily begin or end at any one point. Often, the inquiry begins with opportunities for learners to collaboratively **EXAMINE GEOSPATIAL DATA**. They surface their ideas and **ASK QUESTIONS**. Not only does this give learners a purpose for learning, but it also provides a foundation upon which they can build new knowledge. This is followed by an opportunity to **ANALYZE AND INTERPRET GEOSPATIAL DATA.** Exploration allows learners to think critically about data as they look for geospatial patterns, relationships, and/or inconsistencies between two or more points on Earth. While making sense of geospatial data, learners can see how these data support or refute their initial ideas. They can compare their ideas with their peers, and consider how their understanding of these data fit into their existing conceptual frameworks. At this point, learners may need to rethink their initial conceptions and engage in further exploration of geospatial data. Eventually learners are ready to **ARGUE FROM EVIDENCE**. They must decide how to creatively communicate their ideas with geospatial data and visual representations, subject to peer review.

This process of fitting new ideas into existing conceptual frameworks helps develop deeper conceptual understanding. Deep conceptual understanding results in greater transferability to new contexts, which is, ultimately, the goal of learning.

Design Principles for POD Teacher Workshops

As mentioned earlier, the POD Teacher Workshops are based on the POD team's experiences helping teachers integrate Geospatial Inquiry into existing courses. An extensive literature review was conducted, not only on teaching with geospatial technologies, but also on effective instruction which promotes student learning and best practices in professional development for teachers. This review resulted in the creation of POD Teacher Workshop Principles. The following Principles guide all design and delivery decisions.

- Geospatial Inquiry requires **purpose:** answering a question, solving a problem, or explaining a phenomenon.

- Geospatial Inquiry employs geospatial technologies as **tools** which enhance the ability to make sense of **relationships and patterns** in geospatial data and to create **visual** evidence to support written arguments.

- Geospatial Inquiry promotes **cross-disciplinary practices** and **21st century skills** such as collaborating with peers to ask questions, creatively selecting and displaying appropriate geospatial data, critically analyzing and interpreting geospatial data, and engaging in argument using geospatial data as evidence to communicate ideas to diverse audiences.

- Geospatial Inquiry is **iterative and sequenced over time** and employs technological and communication **scaffolds** to promote **conceptual understanding** of big disciplinary ideas.

- Geospatial Inquiry is **socially constructed**. It provides opportunities to collaborate, compare ideas, and receive feedback on those ideas through productive, equitable and respectful discourse.

- Geospatial Inquiry involves **reflective practice**. Learning builds from prior knowledge and experience and requires metacognition to support conceptual understanding.

- Engaging in Geospatial Inquiry and seeing how Geospatial Inquiry is used by professionals provides inspiration to enter **STEM careers**.

The POD Design Principles provide the foundation for Geospatial Inquiry. The facilitation notes in this guide are intended to help you to be thoughtful about how you are presenting the Geospatial Inquiry and facilitating conversations with your participants. The strategies in the facilitation notes also draw upon three key ideas from research on teaching and learning:

1. Ideas must be continually surfaced, acknowledged, shared, and used as resources to further not only the individual's but also the group's thinking and learning (Bransford, Brown, & Cocking, 2000; Campbell, Schwarz, & Windschitl, 2016).
2. Effective instruction should be sequenced over an appropriate amount of time and situated in a larger context to build conceptual understanding (Bransford, Brown, & Cocking, 2000; University of Washington, 2013).
3. Metacognition is essential to learning. Learners must have multiple opportunities to process new information and construct meaning for themselves (Bransford, Brown, & Cocking, 2000).

> Ideas must be continually surfaced, acknowledged, shared and used as resources to further not only the individual's but also the group's thinking and learning.

In order to create a space for sharing ideas, participants need to feel safe asking questions and sharing their thoughts. Spending extra time in the beginning of a workshop building rapport and establishing working agreements will help ensure a safe space for learners.

Discussing individual ideas through small group conversation is a great way to share ideas. Keeping a public record of these ideas on chart paper or with digital maps is a way to use individual ideas as resources for group learning. Facilitators can then refer back to these ideas as new data is presented. The group can decide whether to revise the initial ideas based on new evidence. This process of making thinking visible supports the principle that ideas are used as resources (Campbell, Schwarz, & Windschitl, 2016).

Effective instruction should be sequenced over an appropriate amount of time and situated in a larger context to build conceptual understanding.

Effective Geospatial Inquiry has a defined purpose and is situated in a larger context. The goal of instruction is to help learners develop conceptual understandings of big ideas. Engaging in a Geospatial Inquiry that culminates in an evidence-based argument supports conceptual understanding. Learners interpret patterns and relationships in data to better understand disciplinary content. They communicate their level of conceptual understanding via the presentation of arguments which include maps to illustrate claims based on evidence. POD Teacher Workshops are structured so participants are actively engaged in Geospatial Inquiry. Teachers examine geospatial data, interpret results, and make sense of the content as learners. This provides a common experience to subsequently unpack the experience: What did we do? Why did we do it that way? All the instructional activities in the POD model are aligned to a central driving question anchoring the learning and providing a purpose for engaging in the inquiry.

The activities are structured to focus on only a few critical pieces and geographic relationships at a time. This structuring limits cognitive overload.

The goal of Geospatial Inquiry is for students to create a representation and accompanying written argument communicating a claim about the geospatial data they explored, thus demonstrating their level of conceptual understanding. Skilled facilitators can guide participants to think critically about the data and back up their claims with evidence by asking appropriate questions at key junctures. The summary table is an organizational strategy to keep a public record of learning through the sequence of instruction and consider how each learned concept addresses the driving question. The templates provided help scaffold the process of writing claims based on geospatial evidence with appropriate reasoning. It cannot be assumed that teachers are familiar with this skill.

> Metacognition is essential to learning. Learners must have multiple opportunities to process new information and construct meaning for themselves.

Content has little value if learners do not have time to make sense of the information for themselves and apply it in some way. A good rule to follow is for every 10 minutes of information presented, participants should have at least 2 minutes to make sense, discuss, and reflect. If participants are talking to one another about a prompt you provide, they are processing the content and are more likely to learn. While you are facilitating, look for opportunities to engage participants as individuals, in pairs, and in small groups to share what they are thinking. During these interactions, be sure everyone has access to ideas and resources and everyone has an opportunity to share their thoughts.

Because POD Teachers are participating as both learners and teachers, they sometimes get so wrapped up in one point of view they completely miss the other. Metacognition is even more crucial in these situations. Facilitators must be explicit about which perspective the teachers are to focus on at any one time, and about the goals and values being promoted. For example, participants must be asked to consider which multi-disciplinary practices were used during the Geospatial Inquiry, how these promoted not only their learning, but also how they might provide more opportunities for students to engage with these practices and skills. Facilitators must remind participants which lens they are viewing and considering at any given time during the Workshop.

Geospatial technologies are tools that support Geospatial Inquiry: to make sense of relationships and patterns in geospatial data and to create visual representations which can be used as evidence to support written arguments.

The POD Teacher Workshops rely on technology. Specifically, ArcGIS Online, a web-based geographic information system.

Although ArcGIS Online can simply display geospatial data, the power lies in its capacity to enhance human abilities to find relationships and patterns between two or more places on Earth and create visual representations which highlight these patterns and relationships to others. Geospatial analyses that once took years can be accomplished in seconds using technology tools like ArcGIS Online.

Because ArcGIS Online is powerful, using it to its full capacity can get complicated. When provided step-by-step instructions, it can be easy for participants to get lost in the "button pushing" and lose track of what they are trying to accomplish. To promote metacognition, POD Teacher Workshops employ a geospatial analysis framework (Mitchell, 1999). This should help participants to focus on what they are trying to accomplish and to think more deeply about how and why they might explore and present geospatial data. The geospatial analysis ideas highlighted in the POD Teacher Workshop include:

1. Examining where things are
2. Examining most and least
3. Finding areas of concentration
4. Finding what's inside
5. Finding what's nearby
6. Examining change over time

Facilitation Model

When presenting to adults it is important to honor their time and experience as professionals. As a POD Facilitator you will have access to daily agendas that you can post so your participants know what to expect from each session. Each activity is related to POD Principles, which promotes coherency for participants.

The POD model process for working with adult learners is to share *what* activity or process the group will be doing, *why* they are doing it, and *how* they will accomplish it with specific instructions. For example, we often suggest changing participation structures from small groups, to pairs, to whole group. This is to promote equity and access to ideas and to enable participants to hear different perspectives. Sharing the POD rationale for these structures and processes encourages adults to participate and reduces resistance.

The POD model scaffolds processing and learning over the course of the Workshop. At the beginning, participants experience a great deal of structure for interactions and activities to increase their feelings of safety. Over time, less structure is provided and more independence is allowed as investigations progress.

Predictable processes can aid in group learning. The POD Teacher Workshops engage participants in an iterative Geospatial Inquiry focused on Earth Science Content: *Examine geospatial data; Ask questions; Analyze and interpret geospatial data; Engage in argument; Revise arguments*. Each session in the POD Teacher Workshop participants can look forward to active learning including: *Geospatial Inquiry* where they experience the Hazard and Risk example Geospatial Inquiry; *Implications for Teaching with Geospatial Inquiry* during which they consider benefits and dilemmas others have experienced when teaching with Geospatial Inquiry; *Pedagogical Moves to Support Geospatial Inquiry*, which helps them consider ways they can structure a learning environment conducive to positive learning outcomes for students; *Career Spotlight*, which introduces a diverse pool of professionals who engage in Geospatial Inquiry to accomplish a variety of multidisciplinary tasks; and

Designing a Geospatial Inquiry, which provides time for them to plan a Geospatial Inquiry to enhance their instruction.

The POD Teacher Workshop provides teachers an opportunity to explore existing resources and plan to implement a Geospatial Inquiry in their classroom. However, the professional support should not end on the last session of the POD Teacher Workshop. To ensure implementation and changing practices, professional development should not only be of substantive duration but it should also include follow up support. After teachers have had an opportunity to implement some of the strategies they planned, you should be available to help them. Facilitate a time for them to come back together either face-to-face or online to discuss challenges and successes. This additional support from you is critical during the implementation phase.

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HOW TO USE THIS GUIDE

This guide is intended to help you facilitate a POD Teacher Workshop with integrity. It is not intended for Teacher Participants. Each session includes the following:

Summary
A brief description of what occurs in the session

Goals
A list of what participants should know and be able to do by end of the section via opportunities you provide; aligned with POD Principles

POD Principles Emphasized
The most relevant principles highlighted in the section

Outline
List of steps and estimated length of each step

Preparation and Logistics
Items to prepare ahead of time specific to that Session and to have available to participants. Note there are some items that will be needed in every session. These are not repeated in Preparation and Logistics. See "Prior to Teaching a POD Teacher Workshop" for these items.

Facilitation Notes
Step-by-step instructions and suggestions for facilitation, including notes on what to emphasize and opportunities to highlight the POD Principles. Sample questions to push thinking and possible responses are provided. Finally, there are examples of charts you might create along the way.

Facilitation Tips
Next to session notes, there are reminders and suggestions to you as the Facilitator to ensure you have a successful workshop. They include alternative activities, ways to get participants to engage, and other suggestions. Common roadblocks are anticipated, and tips and tricks for overcoming them are included.

Visit http://www.pod-stem.org/facilitators-lounge/ to access this Facilitation Guide online. The password is: imgeospatial

Legend to guide symbols

Demonstrate

This symbol indicates places where you demonstrate a tool or technology for participants.

Discuss

This symbol indicates a place where you facilitate a discussion (in small or whole group).

Teacher Guide

We often refer to the Teacher Guide. You will need a Teacher Guide to see what teachers will see.

Pages the teachers will see in their accompanying POD Teacher Guide are sometimes embedded in the Facilitation Notes. So you can see what the teachers will see, often Teacher Guide pages are outlined with a box.

EXAMPLE

If you were asked to evaluate your prediction, what information about this hazard would you want to know and what data would you want to acquire?

What we need to know	*Data we want to acquire and explore*

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OVERVIEW OF A POD TEACHER WORKSHOP

Most sessions for teachers will include:

- Geospatial Inquiry
- Implications for Teaching with Geospatial Inquiry
- Pedagogical Moves to Support Geospatial Inquiry – (Talk Science, TERC)
- Career Spotlight
- Designing a Geospatial Inquiry
- Metacognition
- Reflecting on the learning
- Homework

Though the order of these activities may vary on any given session, they are key components to the success of the POD Teacher Workshop. This Facilitation Guide follows a 5 session format, assuming 7 hour sessions. Below is an overview of the 5 sessions. **Note: The size of the boxes in the graphic agenda are not representative of time spent on each activity**.

Agenda for 35 Hour POD Teacher Workshop

Session 1	Intro to POD	Geospatial Inquiry		Pedagogical Moves	Geospatial Inquiry	Metacognition, Evaluation, & Homework
Session 2	Designing a Geospatial Inquiry	Geospatial Inquiry		Career Spotlight		Metacognition, Evaluation, & Homework
Session 3	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Designing a Geospatial Inquiry	Pedagogical Moves	Metacognition, Evaluation, & Homework
Session 4	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Pedagogical Moves	Designing a Geospatial Inquiry	Metacognition & Evaluation
Session 5	Implications for Teaching with Geospatial Inquiry	POD Research Overview	Designing a Geospatial Inquiry	Celebration	GST Post Assessment	Workshop Evaluation

What follows are brief overviews for each critical strand of a POD Teacher Workshop: Geospatial Inquiry, Pedagogical Moves to Support Geospatial

Inquiry, Designing a Geospatial Inquiry, Career Spotlight, and Implications for Teaching with Geospatial Inquiry. Metacognition and Homework are not outlined.

Overview of the Geospatial Inquiry: Hazards and Risk

This Geospatial Inquiry on Hazards and Risk occurs over four sessions. It is intended to provide everyone with a common introduction to Geospatial Inquiry. This provides an example of how Geospatial Inquiry might be added to an existing unit of study to support deeper conceptual understanding of an Earth Science concept.

Session 1 introduces the driving questions: *How can we predict if an area is at high risk for natural disaster?* and *How can geospatial data be used to help explain where and why natural hazards occur?* Participants **EXAMINE DATA** on current global natural hazards and consider the difference between a hazard and a risk. They explore the ArcGIS Online interface before engaging with the first geospatial analysis frameworks: "*Examining Where Things Are*", "*Finding Areas of Concentration*" and "*Examining Most and Least*".

Participants identify and **ASK QUESTIONS** they would like to answer and data they may need to explore in order to answer these questions. They examine zones of seismic activity as they **ANALYZE AND INTERPRET** global earthquake **DATA**. The session closes with participants presenting their **EVIDENCE-BASED ARGUMENTS** about where major earthquakes occur to their peers for feedback and **REVISION**.

In Session 2 participants continue to examine the relationship between earthquake characteristics and factors and refine their claims from Session 1B. Working with a partner, participants will ACQUIRE ADDITIONAL DATA to determine if it supports their claims. They will learn how to ACQUIRE additional data from external sources and ANALYZE the data in ArcGIS Online. Finally, partners will present their ARGUMENT for peer-feedback using the ArcGIS Online presentation tool. After participants have a deeper understanding of risk of natural seismic events, **Session 3** reintroduces the idea of the vulnerable (human) system and the role it plays in disaster risk determination. The foci for geospatial analyses in this session are "*Finding*

Areas of Concentration" and "*Finding What's Nearby".* Participants are tasked with determining the risk of earthquake disaster in particular areas of the world. They will acquire and **ANALYZE AND INTERPRET DATA** related to their assigned regions in order to create an **EVIDENCE-BASED ARGUMENT** in a Story Map about whether significant resources should be devoted to planning for or mitigating the effects of earthquakes in their region. The session ends with **ASKING QUESTIONS** about other problems could be examined using the same data.

In **Session 4**, participants apply their understanding of the relationship between vulnerable systems and natural hazards from the Geospatial Inquiry on earthquakes to determine the risk of their choice of natural disaster in their local regions. Participants will identify the data and geospatial analyses frameworks they need to consider to conduct their own Geospatial Inquiry. They will also choose the best ArcGIS Online geospatial deliverable for their arguments based on their purpose and intended audience.

Earth Science, Geography, and Geospatial Technology Concepts Addressed throughout the Four-Session Geospatial Inquiry

<u>Earth Science:</u>

- Some hazards are preceded by phenomena that allow for reliable predictions and others occur with no notice. Mapping and history in a region combined with understanding geological forces can help forecast future events.
- There are several natural phenomena that can become hazards. Whenever they occur, life or property may be lost. However, not all areas of the world are impacted equally by these natural hazards.
- Some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions. Others, such as earthquakes, occur suddenly and with no notice, and thus they are not yet predictable. However, mapping the history of natural hazards in a region, combined with an understanding of related geological forces

can help forecast the locations and likelihoods of future events. (ESS3.B 6-8)

- Natural hazards can be local, regional, or global in origin, and their risks increase as populations grow. (ESS3.B 9-12)

Geography:

- The effects of physical processes vary across regions of the world and over time.
- Earth's physical processes are dynamic and interactive
- Geographic representations and geospatial technologies can help us investigate and analyze geographic questions and to communicate geographic answers
- Physical systems affect human systems. Humans perceive and react to environmental hazards in different ways.
- Geography can be applied to interpret the past, present, and to plan for the future

Geospatial Technology Skills:

- Spatial Analysis
- Symbolization
- Classification
- Querying datasets
- Presentation and sharing

Geospatial Analysis Frameworks:

- Examining where things are
- Examining most and least
- Finding areas of concentration
- Finding what's inside
- Finding what's nearby
- Examining change over time

Overview of Pedagogical Moves to Support Geospatial Inquiry

The "Pedagogical Moves" strand focuses on strategies to support Geospatial Inquiry. Classroom videos from Talk Science, a program on academically productive talk developed with NSF funding by TERC, are utilized in this strand. The idea of productive talk (discourse) is introduced in the first session of this strand so participants can consider how productive talk and teacher moves can support each phase of Geospatial Inquiry. The scaffolding of communication beyond talk is also emphasized.

Session 1 introduces the idea of academically productive talk, the purposes of talk and how to plan for it, and four types of conversations as they are related to the steps of Geospatial Inquiry.

Session 2 helps teachers establish a culture of productive talk and reflect on what we have done to promote this culture in our workshop thus far. This is a homework assignment.

In Session 3, "Talk Moves" are introduced. These are actions teachers can take to encourage academically productive talk related to learning goals in each step of Geospatial Inquiry.

Finally, teachers explore how talk, participation, and writing are scaffolded throughout the Geospatial Inquiry to ensure equity and access to ideas and to guarantee student success as they develop and demonstrate conceptual understanding.

Overview of Implications for Teaching with Geospatial Inquiry

In this strand, participants consider implications of teaching with Geospatial Inquiry, including potential challenges when teaching with technology and open-ended inquiry and possible benefits for students.

In Session 3, They read interviews from teachers who have implemented Geospatial Inquiry. They attempt to characterize the type of teacher who is likely to succeed with Geospatial Inquiry and the contexts in place that support Geospatial Inquiry, benefits for students who engage in Geospatial Inquiry, and barriers to implementation. They then consider how their individual situation

compares. Participants also consider challenges they may face when implementing Geospatial Inquiry and how they might overcome these challenges.

Geospatial Inquiry hinges on students being able to produce quality evidence of learning via multiple opportunities for presentation and revision. Participants explore the best ways to provide quality feedback to students and challenges with assessment including rubrics in Session 4 and examine student work in session 5.

Overview of Designing Geospatial Inquiry

This strand is intended to provide participants time to develop their own Geospatial Inquiry lessons. When they leave the POD Teacher Workshop, participants should have a Geospatial Inquiry lesson that will enhance a unit they currently teach. They will be expected to implement this lesson with students within 9 months of attending the POD Teacher Workshop.

Participants are guided to complete one small section of a Geospatial Inquiry Template from Session 2 to Session 5. In Session 5, they collect data and save it in their folder in the POD ArcGIS Online Organization account.

Geospatial Inquiry Template

- Big ideas/concepts/guiding questions
- Geospatial Analysis Framework Focus (Foci)
- Guiding question(s)
- What will you assess and when will you provide feedback?
- What evidence will you collect from students that they have developed conceptual understanding?
- How will you assess conceptual understanding?
- Anchoring video and map(s) or dataset(s) to explore
- Lesson progression and summary table to scaffold skills, academically productive talk, support growth and changes in thinking
- Additional lessons beyond geospatial lessons

Overview of Career Spotlight

A main goal of the POD project is to improve student interest, awareness and attitude toward STEM careers. The career spotlight pieces are an opportunity for teachers to engage students in thinking about possible STEM careers that include geospatial technology skills and comparing their own work as a student learner with the work of career professionals in different geospatial technology fields.

In Sessions 2-4, participants are introduced to professionals who use Geospatial Inquiry and geospatial technologies such as geographic information systems (GIS) to solve problems, answer questions, and explain phenomena. After each "spotlight" participants reflect on how the individual's work compares to Geospatial Inquiry they have experienced, and consider ways to expose students to STEM and geospatial careers.

TWO WEEKS PRIOR TO TEACHING A POD TEACHER WORKSHOP

You and the participants will need access to these materials for the entire POD Teacher Workshop.

Technology Checklist

- ☐ Secure a computer lab with computers that allow participants to download files and have a current internet browser (Internet Explorer, Chrome, Firefox, Safari) http://doc.arcgis.com/en/arcgis-online/reference/browsers.htm and projection capabilities
- ☐ At least two weeks prior to the POD Teacher Workshop, send Mark.Manone@nau.edu a list of participants' names and emails so he can invite them to the POD Org
- ☐ Copy the Introductory Crowd Source Story Map app as a new blank layer http://www.pod-stem.org/wp-content/uploads/2016/05/Creating-the-Crowdsource-Story-Map.pdf
- ☐ Email participants. Ask them to:
    - ☐ Complete the pre workshop survey. Links to the survey can be found in Research Kit http://www.pod-stem.org/facilitators-lounge/ Password is imgeospatial
    - ☐ Complete the Memorandum of Understanding and other paperwork from the Facilitator Research Toolkit (access at http://www.pod-stem.org/facilitators-lounge/: Facilitator Research Toolkit
    - ☐ Add to the Story Map prior to attending the Workshop.

Workshop Materials Checklist

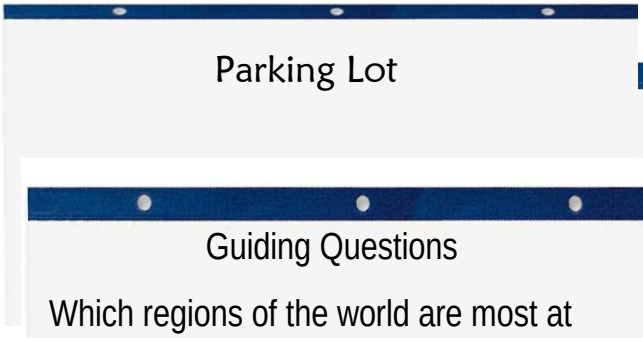
- ☐ Print and prepare Teacher Guide Binders or provide notebooks and have participants access the online Teacher Guide (Online Only is not recommended)
    - Purchase 2" binders with D rings – they hold more and are easier to turn
    - Purchase divider tabs to divide Sessions 1-5 and Research Kit (e.g. http://www.staples.com/Avery-Index-Maker-Clear-Label-Tab-Dividers-5-Tab-White-5-Sets-Pack/product_257360)
    - Download and print the Section Separators on colored cardstock (e.g. Geospatial Inquiry is blue, Pedagogical Moves to Support Geospatial Inquiry is pink, etc. Continue for Career Spotlight, Implications for Teaching with Geospatial Inquiry, Metacognition and Homework, Science Session Review, Geospatial Technology Session Review). Access at http://www.pod-stem.org/facilitators-lounge/
    - Copy the ArcGIS Online Task Card on colored cardstock for easy reference
    - Copy the Geospatial Inquiry and Goals Document on white cardstock in color for easy reference
    - 3 hole punch any additional handouts so they can be placed in binders
- ☐ Print and laminate the Geospatial Inquiry poster if you didn't take one from the Academy – Download at http://www.pod-stem.org/facilitators-lounge/ > Facilitation Resources > Geospatial Inquiry Graphics
- ☐ Print and laminate 3 arrows that can be taped onto Geospatial Inquiry poster and moved as you progress through the session (painter's tape is recommended if the poster is not laminated)
- ☐ Print 5 sets of Role Cards onto cardstock, laminate, and cut http://www.pod-stem.org/facilitators-lounge/ > Facilitation Resources > Resources and Handout Duplication Masters
- ☐ Create nametags or provide cardstock for name tents
- ☐ Create sign in sheet for each Session

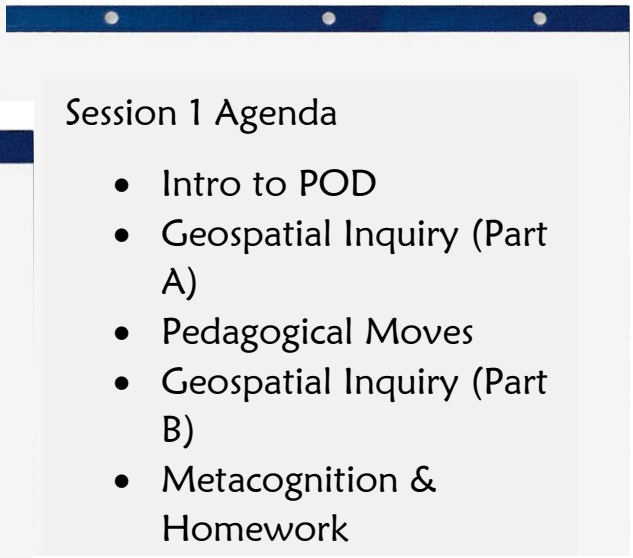
- ☐ Obtain baskets and office supplies for each group of participants (Pens or pencils, Post-it notes, Highlighters, Markers – dark colors)
- ☐ Obtain large chart paper (and tape if not sticky) and dark markers for your use

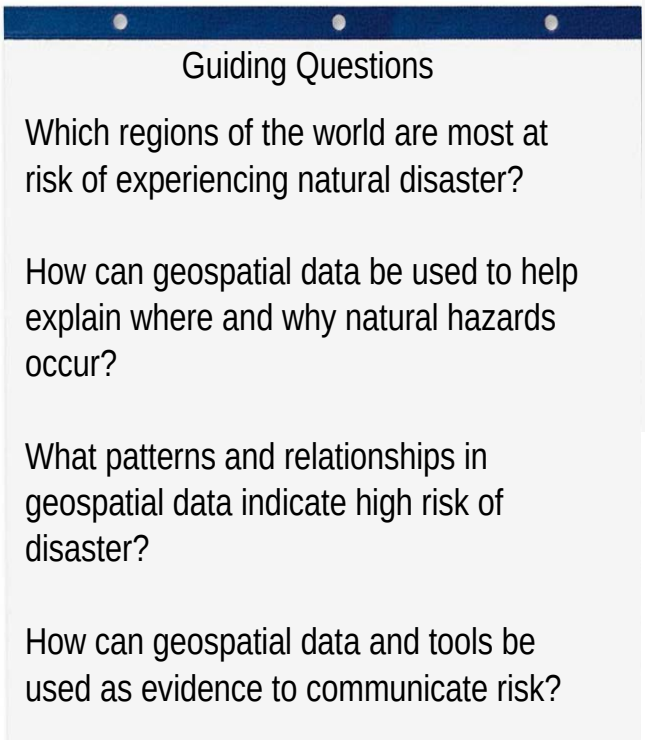
Charts

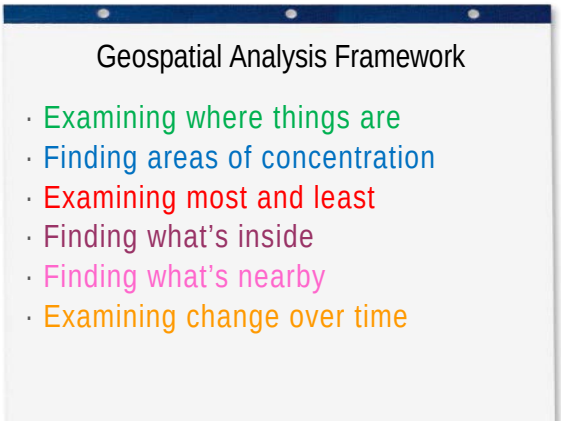
Use chart paper to create the following charts:

- ☐ General agendas for each Session
- ☐ Parking Lot
- ☐ Geospatial Analysis Framework Questions - Use a different color for each one of the bullets on the *Geospatial Analysis Framework* chart. See sample below. You will use the color coding in Session 2.
- ☐ Guiding Questions
- ☐ Summary Table









ARCGIS ONLINE TASK CARDS

Use these cards for easy reference to tasks completed throughout the Workshop.

Task #1: Log-in and Explore the Interface of ArcGIS online

- Go to ArcGIS.com
- Log-in to your account in the POD ORG
- Click on Map to create a new map
- Click on Basemap and click on different options (show "Imagery" and "Oceans")
- Search for location (type in your town/city in the "Find address or place" box) – scroll around, zoom in/out, and return home
- Note that when you zoom in and zoom out with Basemap, scale dependent features show up and disappear depending on how much you are zoomed in or zoomed out.

Task #2 Add a Data Layer

- Add – Search for Layers
- Find: (*enter search term)*
- In: ArcGIS Online – **DO NOT SKIP THIS STEP**
- Uncheck the "Within map area" checkbox
- Examine the metadata for the layer by clicking on the layer title and then "item details"
    - Read the summary and about the source
        - Does this data layer help us answer our guiding question?
        - Is the data layer from a credible source?
- Click Done Adding Layers
- If necessary, click in the box next to the layer (There will be a checkmark in the box when the layer is "on" and visible)
- Examine the Content & Legend icons above the word Contents

Task #3: Create Map Note Layer

- Click on Add button
- Choose Add Map Notes
- Enter an appropriate name for the Map Note but use the standard template for now
- Choose the tool that fits your need (Points, Text, Line, or Area)
- Click on map
- Enter a title and description
- (*Optional*) Add an image link to "Image Link URL"
- Click Close
- When done – Click the Edit button
- In the Contents pane – Hover over the layer name and click on the " … ") – choose "Save Layer"
- In the Contents pane – Hover over the layer name and click on the "…" – choose "Show Item Details". Click on the "Share" button and then click on "Power of Data"

Task #4: Analyze Areas of Concentration (Density)

- Click on the Analysis Button (next to Basemap)
- Select Analyze Patterns
- Select Calculate Density
- Be sure that the layer you are analyzing is selected in Box 1
- The count field should be left as "No count field"
- Enter a new name for the result layer you are creating
- Be sure that the Use Current Map Extent button is unchecked
- Save result in box is to your Org account
- Click on Show credits to review consumption
- Click the RUN ANALYSIS button

Task #5: Table Functions, Symbolizing Data and Thematic Mapping

In the table:

1. Click on the column header
2. Sort by column – ascending or descending

Other table options:

Filter by One Variable (e.g. Earthquake Magnitude)

1. Click on Options - Filter
2. Set Filter Criteria (e.g. Magnitude is greater than 7.9)

Select features from a table:

1. Select multiple rows in table by depressing shift key and clicking
2. Click on Options – Show Selected Records

Change Styles (Symbology):
Copy layer and map different ways (click on "…" and Copy)

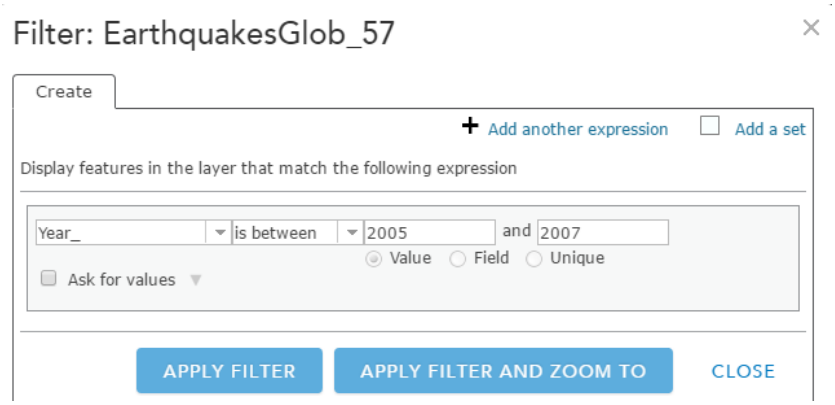
1. Thematic mapping by depth (color)
    a. Hover over the Data layer
    b. Click on Change Style
    c. Choose an attribute to show – (e.g. Depth_km)
    d. Click on Counts and Amounts (Color) Options button
    e. Choose Classify Data
    f. Change classes to 5
    g. Click OK and Done

2. Thematic mapping by magnitude (size)
    a. Hover over Data layer
    b. Click on Change Style
    c. Choose an attribute to show – (e.g. Magnitude)
    d. Click on Counts and Amounts (Size) Options button
    e. Choose Classify Data
    f. Change classes to 5
    g. Change Size – Max from 50 to 25
    h. Click OK and Done

3. Filter
    a. Hover over Data layer
    b. Click on Filter
    c. Create expression using attribute, greater than, less than, is, etc.
    d. Choose value, field or unique numbers
    e. Apply filter

Task #6: Find Nearest and Find Average Distance

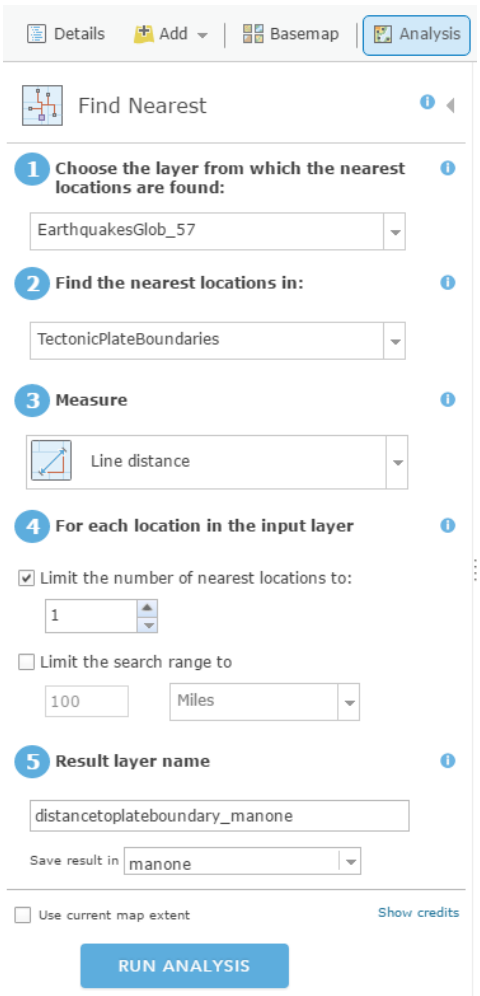
We are going to determine the average distance of earthquakes from plate boundaries for a given time period. To do this we are going to use the Find Nearest tool in the Analysis toolset. This tool can only work with up to 1000 features (points, lines, polygons) and we have over 2000 earthquakes in the EarthquakesGlob_57 layer. So we will filter the *EarthquakesGlob_57* layer to represent earthquakes only from 2005-2007 which will provide a subset of 846 features for our analysis. Once we find the nearest distance, we will summarize the field statistics to find the average distance.



1. In the Contents pane hover over the data layer and select the filter icon
2. In the first box select YEAR_
3. In the second box select IS BETWEEN
4. In the third box enter 2005, and fourth box enter 2007
5. Press APPLY FILTER
6. Select the ANALYSIS button on the top bar next to BASEMAP
7. Select Use Proximity
8. Select Find Nearest
9. In box 1 (the layer from which the nearest locations are found) select EarthquakesGlob_57
10. In box 2 (find nearest locations in) select TectonicPlateBoundaries
11. In box 3 (measure) be sure that it is set to Line Distance
12. In box 4, limit the number of nearest locations to 1 and uncheck the "Limit search range" box

Task #6: Find Nearest and Find Average Distance (continued)

13. In box 5 name your resultant layer



DISTANCETOPLATEBOUNDARY_*YOURNAME*

14. Be sure the Save result in box is your folder in the ORG
15. Be sure that the "Use current map extent" box is unchecked
16. Click on Show credits to review consumption
17. Press RUN ANALYSIS
18. There will be two layers generated, we are interested in the layer that contains the file name followed by "-Connecting Lines"
19. Hover over the "-Connecting Lines" layer and choose SHOW TABLE
20. The second field (column) should be named Straight Line Distance. This is the distance from this earthquake to a plate boundary
21. Click on the field name and Select Statistics

Task #6: Find Nearest and Find Average Distance (continued)

22. View the Average to see the average distance of these earthquakes to plate boundaries

Close table

Task #7 Creating a Presentation

1. Save map
2. Click on Create Presentation
3. Click + button in Slide Properties pane
4. Type in a title for your first slide
5. Choose layers from the list below you wish to show on this slide
6. Change Basemap if you would like
7. Click on any feature on your map to open a data pop-up
8. Click the checkbox to "Include open pop-up in presentation"
9. Click on Slide List to see a list of your slides
10. Click on the Add button to add a new slide
11. Click on Duplicate to duplicate an existing slide
12. Save map after you have finished adding and editing slides
13. Click Play to view your Presentation

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SESSION 1 FACILITATION NOTES FOR POD TEACHER WORKSHOP

Session 1 at a Glance – 7 hours

Intro to POD	Geospatial Inquiry (Part A)	Pedagogical Moves	Geospatial Inquiry (Part B)	Metacognition, Evaluation, & Homework
90 minutes	165 minutes	35 minutes	110 minutes	20 minutes

Visit http://www.pod-stem.org/facilitators-lounge/ to access this Facilitation Guide online. The password is imgeospatial

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1 WELCOME AND INTRODUCTION TO POWER OF DATA TEACHER WORKSHOPS

Intro to POD	Geospatial Inquiry (Part A)	Pedagogical Moves	Geospatial Inquiry (Part B)	Metacognition, Evaluation, & Homework

Summary

Participants are welcomed, introduced to the format and logistics of the workshop, and begin to form a learning community. Working agreements are established, and Geospatial Inquiry is introduced as the basis for the learning together.

Participants get to know one another by viewing the Web Map that you created from the Getting to Know You survey and should have sent prior to the workshop. Working agreements are collaboratively established for the Workshop. Participants preview the agenda, and discuss the two lenses – Teacher and Adult Learner – they will use during the Workshop.

You introduce the terms geospatial data and Geospatial Inquiry, followed by concrete definitions as the POD Project views them. Participants share their expectations for this Workshop.

Finally, teachers will take a Geospatial Technology Performance Pre Test.

Goals

- Develop rapport and trust between facilitators and participants and **establish a learning community**
- Review **goals, expectations, and agenda** for the POD Teacher Workshop
- Collaboratively develop **working agreements** for the POD Teacher Workshop
- Learn the POD definition of Geospatial Inquiry as the foundation of the POD Teacher Workshop
- Explain the crux of Geospatial Inquiry is **purpose.**

POD Principles Emphasized

Geospatial Inquiry requires **purpose.**

Outline (90 minutes)

1. Welcome, Goals, Agenda	10 minutes
2. Process	5 minutes
3. Getting to Know Each Other	35 minutes
4. Working Agreements	10 minutes
5. What is Geospatial Inquiry?	15 minutes
6. Participant Expectations	15 minutes

Preparation and Logistics

Your participants will need:

- ☐ Access to the POD Organization account and computers to take the GST Pre Workshop Performance assessment

As the facilitator you will need:

- ☐ The Web Map you saved from the Getting to Know You survey the teachers completed prior to the POD Teacher Workshop

Charts

- ☐ Agenda for Session 1
- ☐ Working Agreements (blank until you complete with the group)
- ☐ Participant Expectations (blank until you complete with the group)
- ☐ Create this chart and cover until ready to reveal:

Geospatial Data

Geo	*spatial*	*data*
of or pertaining to Earth	*of or pertaining to space*	*Facts and statistics collected together for reference or analysis*

Facilitation Tip:

When returning from lunch or a break, plan an activity such as an individual reflection or small group discussion about prior learning. That way, if participants arrive late, they are not missing critical new pieces of learning.

Facilitation Tip:

Provide an hour lunch around the normal lunch hour, but don't include specific times. You don't want to stop in the middle of learning. Be sure to build in some official breaks during natural transitions.

Facilitation Notes

1. Welcome, goals, structure of the workshop. (10 minutes)

Provide an area where participants can sign in, obtain nametags and materials and invite them to sit. Alternatively, place binders and nametags at computer stations.

Provide directions for logging into computers, if necessary. Note location of restrooms. Explain that the POD Workshops were created to enhance teaching and learning by integrating powerful geospatial technology tools and teaching strategies into classrooms. We call this process Geospatial Inquiry.

Direct participants to view the goals of POD Teacher Workshops in **Teacher Guide, Introduction, page xi.**

TG: page. xi, Introduction

GOALS FOR TEACHERS IN POD TEACHER WORKSHOPS

- Increase understanding of Geospatial Inquiry
- Increase confidence and skills for facilitating Geospatial Inquiry with students
- Identify opportunities to implement Geospatial Inquiry to enhance student learning of key disciplinary concepts
- Increase awareness of careers that could inspire students to enter STEM fields

Direct participants to the Graphic Agenda in their Teacher Guide

Participant Graphic Agenda, pg. VIII

Session 1	Intro to POD	Geospatial Inquiry		Pedagogical Moves	Geospatial Inquiry	Metacognition, Evaluation, & Homework
Session 2	Designing a Geospatial Inquiry	Geospatial Inquiry		Career Spotlight		Metacognition, Evaluation, & Homework
Session 3	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Designing a Geospatial Inquiry	Pedagogical Moves	Metacognition, Evaluation, & Homework
Session 4	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Pedagogical Moves	Designing a Geospatial Inquiry	Metacognition & Evaluation
Session 5	Implications for Teaching with Geospatial Inquiry	POD Research Overview	Designing a Geospatial Inquiry	Celebration	GST Post Assessment	Workshop Evaluation

Explain each of the components of POD Teacher Workshop. You can use Teacher Guide p. ix-x to help with explanation.

- Geospatial Inquiry
- Pedagogical Moves to Support Geospatial Inquiry
- Implications for Teaching with Geospatial Inquiry
- Designing Geospatial Inquiry
- Career Spotlight

Learner Lens, Teacher Lens

Explain that as participants experience the different components of the Workshop, they will be viewing the activities through different lenses. Sometimes they are asked to consider the experience as an adult learner, such as while they work through the example Geospatial Inquiry on Hazard and Risk. Other times, participants will be viewing the experience as a teacher, for example, during Pedagogical Moves to Support Geospatial Inquiry. Explain that you will remind participants of the primary lens they are using at any given time during the Workshop to help them focus their attention.

Draw teachers' attention to the Session 1 agenda you posted and review it with them. Note location of restrooms, how breaks will occur, general plan for lunch, and other logistics.

> Facilitation Tip:
>
> Although the order of these activities may vary on any given session, they are key components to the success of the POD Teacher Workshop.

2. Process the learning so far (5 minutes)

Direct participants to their Teacher Guide Introduction pages vi-ix (What you will experience, What should you expect, Structure of each session) and have them jot down a few notes about what they have heard so far.

> Facilitation Tip:
>
> For every 10 minutes of talking, build in at least 2 minutes for participants to process ideas, talk to a partner, or ask questions.

3. Get to know you (35 minutes)

Your participants should have entered their information on the Introductory Web Application prior to attending the Workshop. You will use this to facilitate a "getting to know you" session.

Explain that this grounding activity serves several purposes.

1. It is geospatial in nature and demonstrates one application of ArcGIS Online.

2. It helps participants get to know one another.

3. Sometimes, when adults enter a new learning situation, they may be anxious about learning. They may feel self-conscious and unsure about their abilities, or they may be distracted by what is happening outside the workshop. This helps them set their worries aside and commit to learning.

4. It provides an opportunity for participants (and facilitators) to see that everyone has something they want to learn and that no one is an expert.

Using the Story Map, fly to each person and allow them to introduce themselves. Post ONE or TWO of these questions:

- Something Fun about Me
- My goals for attending POD
- How I feel about teaching with GIS
- Model the BRIEF process, then ask participants to respond.

Facilitation Tip:

Be very strict about time limits. No more than 1 minute per participant. Alternatively, save time and do this prior to the workshop online or in person. If you skip the whole group activity, be sure to allow participants to greet one another in small groups to share goals or feelings.

4. Working agreements (10 minutes)

Explain that when a new group convenes it is a good idea to develop some working agreements together. This establishes specific agreements for this situation, as opposed to general norms, and can alleviate potential problems before they begin. Facilitate the generation of working agreements for your group. Chart the ideas and keep them posted. If conflicts arise, respectfully ask the group to revisit the working agreements and ask if any changes are necessary.

Example Working Agreements:

- Begin and end on time
- Use technology in "learning mode"
- Respect ideas and disagree respectfully
- Participate fully
- Limit sidebar conversions
- Pay attention to self and others
- Presume positive intentions

5. What is Geospatial Inquiry? (15 minutes)

Ask participants to take a moment to consider the word geospatial. What does it mean? Ask them to individually jot down a quick definition.

After a moment, ask individuals to share their definitions with those at their table to come up with a table definition.

After a few minutes, ask for a volunteer to share their table definition with the whole group.

Introduce the POD definition of geospatial data. Break it down as follows on a chart or board:

Geospatial Data

Geo	*spatial*	*data*
of or pertaining to Earth	*of or pertaining to space*	*Facts and statistics collected together for reference or analysis*

Explain that we analyze geospatial data when we engage in Geospatial Inquiry.

Direct participants to read POD's definition of Geospatial Inquiry in the **Teacher Guide Introduction, page xii**: "What is Geospatial Inquiry?" Ask for questions or comments.

POD defines Geospatial Inquiry as:

> Asking and answering a question through the analysis and communication of data that is linked to a geographic location on, above, or near Earth. These data are often represented visually via maps.

Reveal the Geospatial Inquiry poster.

Explain we will use ArcGIS Online, a geographic information system, to support our Geospatial Inquiry.

Point out the crux of Geospatial Inquiry is **purpose**. If you are clicking buttons in ArcGIS Online without purpose, you are not engaging in Geospatial Inquiry.

Explain that this idea of Geospatial Inquiry will make much more sense after they experience it as an Adult Learner. During Sessions 1-4, they will engage in an example Geospatial Inquiry lesson that can serve as a model for a Geospatial Inquiry lesson they will design for their own instruction. It will be very structured at first, then allow freedom of choice.

6. Participant Expectations (15 minutes)

Ask participants to take a moment to note their expectations from participating in a POD Teacher Workshop, now that they have a sense of the components. Have them turn to a neighbor and share.

Come back as a whole group and create/chart list of expectations for the class.

Facilitation Tip:

Keep participant expectations posted so you can return to them periodically. Make every attempt to meet expectations while keeping the integrity of the Workshop intact.

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1 GEOSPATIAL INQUIRY – SESSION 1A

Intro to POD	**Geospatial Inquiry (Part A)**	Pedagogical Moves	Geospatial Inquiry (Part B)	Metacognition, Evaluation, & Homework

Summary

This strand of the POD Workshops is designed for your participants to experience an example of Geospatial Inquiry. The session activities are designed for teachers and not meant to be replicated with students. The purpose of this strand of the Workshop is to model how Geospatial Inquiry can be added to an existing unit of study to support deeper conceptual understanding.

There are 4 parts to the Geospatial Inquiry. All the sessions focus on the theme of disasters and impact. **In Session 1A**, participants will work together to answer questions about the relationship between natural hazards, disasters, and risk. Participants first explore the ArcGIS Online interface independently and then are guided through the steps of the geospatial analysis framework as through a focus on one type of natural hazard, earthquakes. Participants will Examine Data on where earthquakes occur and analyze the relationship between earthquake factors (such as depth and magnitude) and areas of concentration for earthquake events.

Goals (by the end of 1B)

Provide opportunities for teachers to:

- Retrieve and examine geospatial data for a specific **purpose**
- Use ArcGIS Online as a **tool** to explore **patterns and relationships** in geospatial data
- **Critically analyze and interpret geospatial data** using Geospatial Analysis Frameworks: *Where Things Are, Areas of Concentration* and *Examining Most and Least*
- **Creatively select and display appropriate geospatial data** as evidence to support or refute a claim
- Complete one full cycle of Geospatial Inquiry as an adult learner

POD Principles Emphasized

- Geospatial Inquiry requires **purpose**
- Geospatial technologies are **tools** that support Geospatial Inquiry: to make sense of **relationships and patterns** in data.

Outline (165 minutes)

1. Administer Pre Workshop GST Performance Assessment	30 minutes
2. About the Geospatial Inquiry Strand, Adult Learner Lens & Role Cards	10 minutes
3. Anchoring Video & Guiding Questions	20 minutes
4. Terminology	20 minutes
5. Formative Assessment	10 minutes
6. Introduce Geospatial Analysis Framework	5 minutes
7. Explore ArcGIS Online & Map Notes	30 minutes
8. Examine Geospatial Data	30 minutes
9. Ask Questions	10 minutes

Preparation and Logistics

Your participants will need:

- ☐ To have accepted their invitation to the POD ORG that Mark Manone sent
- ☐ Access to GST Pre-Assessment
  http://pod.maps.arcgis.com/home/item.html?id=5663e5a1c3054e3bb8dec7e24060b9ba

As the facilitator you will need:

Copies

- ☐ Handout 1A Terminology and Representation (1 per participant) http://www.pod-stem.org/wp-content/uploads/2016/05/TG-Handout-1A-Terminology-Representation.pdf

Other materials

- ☐ Anchoring video (see step 4 for details)
- ☐ A Map Notes layer showing predicted density (from the formative assessment section) to compare with actual density (from the ESRI data layer). See Examine Geospatial Data, Step 9 for details

Charts

- ☐ Guiding Questions (cover until ready to reveal
- ☐ Geospatial Analysis Framework (cover until ready to reveal)
- ☐ Write the following on the board and cover:
  - Global earthquakes above 5.7
  - "Earthquakes_Glob5_7" by Esri_TESS
- ☐ Summary Table

Facilitation Notes

1. Administer GST Pre Workshop Performance Assessment (30 minutes)

Explain to participants that the GST Performance Assessment is part of the POD project team research and that "it's okay" if they feel they do not know the answers. That is why they are taking this workshop!

Explain that in this Workshop, we are using a special kind of ArcGIS Online account, called an Organization account. These Organization accounts allow for more powerful analyses and are free for teachers. Everyone has been invited to the POD Organization account, and will need to log in to ArcGIS Online using the POD login to complete the performance assessment.

Let teachers know you will explain how they can obtain Organization accounts for their schools in Session 5.

The GST Performance Assessment lives in the PodDocs Folder in the ArcGIS Online POD ORG. This folder is accessible by all.

Demonstrate how to access the GST Performance Assessment in the POD ORG. Explain the process for completing and saving the assessment in the ORG.

Once logged in, they will access the assessment, complete it, and save their maps as directed, with the following name ***PrePerf<your POD user name>*** *(e.g.: PrePerfPOD3201) and will not share their maps. DIRECTIONS DO NOT SAY TO ADD "PRE" IN FRONT OF THE NAME, BUT PLEASE ASK PARTICIPANTS TO INDICATE IT IS THE PRETEST BY ADDING "PRE" IN FRONT OF THE NAME*

When the teachers are done with the assessment, the web map and Story Map will be saved in their "My Content" section of their individual accounts.

Answer any questions they might have, and write the stop time on the board (allow only 30 minutes).

2. Adult Learner Lens – About the Geospatial Inquiry Strand and Role Cards (10 minutes)

Remind participants that the POD workshops are designed for teachers and not K-12 students. While engaging in the Geospatial Inquiry example, participants should use their adult-learner lens.

Ask participants to read the About Geospatial Inquiry and Disclaimer in their **Teacher Guides**, **page 1-2** and Geospatial Inquiry Part A and B Summary and Goals in their **Teacher Guides, page 1-3** and ask if there are any questions.

Facilitation Tip:

This introduction provides the teachers information about WHAT they will be doing, WHY they are doing it and HOW they will go about it.

Role Cards

Direct Participants to the Role Cards in their baskets (one set per group/table). Explain that for this Session, each person will take on a lens to observe and think about the activities. We will switch cards throughout the session so that everyone gets a chance to examine Geospatial Inquiry activities through multiple lenses.

Roles include: Idea exchanger; Big ideas person; Clarifier; Questioner; Skeptic; Progress Monitor.

3. Anchoring Video (15 minutes)

Play a clip from a news or educational segment on a natural disaster (*see examples in box below*).

Video Examples

Nepal Earthquake 2015 – from 2:15-6:16
http://abcnews.go.com/International/video/nepal-earthquake-time-running-finding-survivors-30740099

Big Idea 8: Natural Hazards Affect Humans, American Geosciences Institute. (4:26)
https://www.youtube.com/watch?v=n73qtEojP_Y

Top Ten Natural Disasters, National Geographic (long. Choose segment)
https://www.youtube.com/watch?v=Kg-6whkbZXs

Earthquake Montage, National Geographic
http://video.nationalgeographic.com/video/earthquake-montage?source=searchvideo

https://www.youtube.com/watch?v=Au-r91sB1r8

Devastating Chile Earthquake, National Geographic (1:45)
http://video.nationalgeographic.com/video/news/chile-earthquake-santa-cruz-vin?source=searchvideo

Ask participants to consider how often they think about this particular hazard (earthquake, tsunami etc.).

Typically, we think and talk about these types of hazards after a devastating event has occurred. Explain that for some geospatial professionals, their job is to think about natural hazards and disaster before they happen so the damage from the events can be minimized.

Facilitation Tip:

This is a good place to make a connection to any local hazards that are relevant to the group.

"Throughout this workshop, we will explore some of the technologies that STEM professionals use to investigate the likelihood of hazards and disasters (such as the ones from the videos)".

4. Guiding Questions (5 minutes)

Uncover the Guiding Questions poster and refer participants to the Guiding Questions listed in their **Teacher Guide page 1-3.**

GUIDING QUESTIONS

Which regions of the world are most at risk of experiencing natural disaster?

i. How can geospatial data be used to help explain where and why natural hazards occur?
ii. What patterns and relationships in geospatial data indicate high risk of disaster?
iii. How can geospatial data and tools be used as evidence to communicate risk?

Ask participants to take 1 minute to read over the questions and then ask them to share their thoughts/ideas. Explain that we will engage in Geospatial Inquiry to determine the answers to these questions.

Facilitation Tip:

Keep the Guiding Questions chart posted where everyone can see it and refer back to it throughout the workshop. This helps to anchor participants' learning.

5. Terminology (20 minutes)

"The Guiding Questions refer to the terms *Hazards, Disaster and Risk*. These terms may not mean the same thing to all of us. In order to share a common understanding of what these terms mean, we are going to examine different ways the terms are represented and defined. First, we will each have a chance to share our own ideas about what these terms mean and then we will compare our ideas to 3 different representations/definitions for the terms."

Ask participants to take a few minutes individually to complete the **Quick Write** in their **Teacher Guide page 1-4.**

Explain what the following terms mean to you:

- Natural Hazard
- Disaster
- Risk

After participants have been able to make a record of their ideas about each of the terms (on their teacher guide) ask them to "Turn and Talk" with someone sitting near them.

Distribute Handout 1A Terminology and Representation

Ask each of the Turn and Talk partners to:

1. Examine the handout 1A Terminology and Representation and the different representations/ definitions
2. Discuss the questions in their teacher guide with their partner
   - What are the similarities and differences in the ways these terms are represented?
   - Which representation/definition do you find most useful and why?

Briefly share-out with the whole group.

"What do our explanations, representations and those on the handout have in common? How are they different?"

In the group discussion, focus on similarities as a means to come to an agreement on what the terms will mean for the purpose of the geospatial inquiry. For example: "*It sounds like one similarity we've noticed is that a disaster involves some type of damage to both the natural and human-built environments. This could mean that when we are considering risk of disaster*

(from our guiding questions) we will need to know about both the natural and social systems involved."

6. Formative Assessment (10 minutes)

"Now that we have a common understanding of the meaning of *risk* and *disaster* we can each share our thinking about which areas of the world are most at risk for a particular kind of disaster – seismic disaster."

Direct participants to their **Teacher Guide page 1-6** and ask them to write their ideas in the space provided. Explain that this formative self-assessment allows us each to keep track of our own thinking about earthquake disasters and monitor if and how our thinking changes throughout the learning sessions.

Let participants know that in the next step they will be using a tool in ArcGIS Online to display their ideas spatially.

7. Introduce the Geospatial Analysis Framework Questions (5 minutes)

Explain that humans naturally look for patterns and relationships in geospatial data, but we are limited. That's where geospatial technology tools, like ArcGIS online can help. They are **technologies that support Geospatial Inquiry.**

Geospatial data can be confusing. It is sometimes difficult to know where to start. To assist us, we will use a Geospatial Analysis Framework."

Refer participants to the Geospatial Analysis Framework poster.

Explain that we will first examine where earthquakes occur (where things are). We might also want to explore areas where earthquakes are concentrated (areas of concentration), and examine where the most earthquakes occur and where the least earthquakes occur (finding most and least). Throughout our investigation, we'll want to consider what's nearby to better assess risk.

8. Explore ArcGIS Online & Map Notes (30 minutes)

Explain in this session, teachers will gather data to help answer the guiding questions and evaluate predictions about areas that are most at risk for seismic disaster. The tool that used to gather and analyze data is called ArcGIS Online.

Explain a key feature of ArcGIS Online is that it is a web application and does not require software. All you need is a log-in and you can access, gather and analyze geospatial data.

Let teachers know they will have a chance to use ArcGIS Online to make a prediction about what areas of the world have the highest likelihood of experiencing seismic disaster. "The "GIS" in ArcGIS Online stands for "Geographic Information System". The format for this geospatial technology that we are using is accessed online.

Ask: What are some other geospatial technologies that you use or are familiar with?
Your cell phone has a mapping application that uses geospatial technology, Google maps, Google Earth.

> Facilitation Tip:
>
> Use examples such as CIS=computer information systems; BIS=Business Information Systems; MIS=Management Information Systems. Make the point that "information systems" implies data and analysis as it relates to computer, business and management. GIS is simply the data and the analysis that relates to geographic locations.

Explain that you demonstrate how to log-in to ArcGIS Online and some basic features. Then, you will demonstrate how to use the Map Notes tool, which allows map annotation.

Point out where to access the ArcGIS Online Task Cards in the front of the **Teacher Guide**. Explain that teachers will reference the Task Cards to complete tasks throughout the Geospatial Inquiry. They may want to pull them out of their binders for easy access.

DEMONSTRATE Task #1: Log-in and Explore ArcGIS Online

Explain to participants that this is Part 1 of their exploration in their **Teacher Guide, page 1-7.**

> Facilitation Tip:
>
> Ask participants to look up at the main screen during the demonstrations. They will have time to explore independently next.

DEMONSTRATE: Task #3 Create Map Notes Layer (Use Map Notes to make a prediction)

Explain to participants that they will have 5 minutes to first Explore ArcGIS Online and then 10 more minutes to make their Map Notes predictions. Refer participants to their **ArcGIS Online Task Cards** for step-by-step instructions. Write the stop time on the board.

Share-out: Briefly share about individual experiences exploring ArcGIS on-line and making Map Notes.

Direct participants to **Teacher Guide, page 1-8** and invite them to record ideas in the chart for what they want to know and data they would want to acquire and explore to evaluate the ideas posed in their Map Notes.

Write a 2-minute stop time on the board. Ask group to share ideas and chart them.

> Facilitation Tip:
>
> The free exploration time combined with the Map Notes tasks allows participants to explore the program at their own pace – some participants may use the majority of the time exploring and getting to know the tool.

SAMPLE CHART

What we need to know	Data we want to acquire and explore?
• *Location, magnitude, frequency, depth of past earthquakes* • *Proximity of humans and natural resources to earthquakes* • *Damage to property, lives lost*	• *USGS earthquake dataset* • *Population data* • *Infrastructure data* • *Land use data*

9. Examine Geospatial Data (30 minutes)

Explain now that we have a **PURPOSE** (looking for areas at risk of seismic disaster), we can begin our Geospatial Inquiry and Examine Geospatial Data. This is the first step toward answering our guiding questions (move the arrow on the Geospatial Inquiry poster).

Tell teachers they have the next 5 minutes to search for and explore different data layers about earthquakes (using their notes from the chart in their **Teacher Guide, page 1-8**).

Refer participants to the instructions in their **ArcGIS Online Task Cards** for **Task #2, Add a Data Layer**. Emphasize that this is a time for independent exploration and you will demonstrate the process step-by-step next.

Share Out/Discuss:

There are many possibilities for data related to earthquakes that participants could have searched for and selected. Allow participants a few minutes to discuss and debrief their process of searching for data layers.

** Let participants know it's "ok" if they did not get very far in their searches. Some may have searched for and added several data layers and others are still just exploring the interface.*

Facilitation Tip:

If you have a volunteer participant willing to share their Map Notes, open their saved layer and use it as part of the share-out discussion.

Ask: What type of data layers did you search for? *Earthquake, vulnerable systems data*

How did you determine which layer to select? *Trusted author (government), looked interesting*

Tell the teachers now we will all look at the same data layer. You will demonstrate the process of searching for and adding a data layer about earthquakes, specifically the location of earthquakes around the world. Ask teachers to first watch as you demonstrate.

Uncover the following that you wrote on the board:

- Global earthquakes above 5.7
- "Earthquakes_Glob5_7" by Esri_TESS

DEMONSTRATE Task #2: Add a Data Layer

- Search ArcGIS Online for *global earthquakes above 5.7*
- Add EarthquakesGlob_57 by Esri_TESS)

Facilitation Tip:

This is a good time to make the linkage to the "table" or "database" behind the symbol.

DEMONSTRATE: opening the data table and how selecting an item in the table also highlights the feature on the map

- Sort magnitude by descending to see the highest magnitude earthquakes to lowest

Ask teachers to work with a partner and spend a few minutes exploring the layer and looking for patterns. Invite them to record patterns in **Teacher Guide page 1-9**.

After 3-5 minutes of exploration – ask participants to share the patterns in data that they noticed.

Ask: What questions do you have after examining the data? *Where are the most high magnitude earthquakes occurring? Why are they occurring in these locations? What is nearby these locations?*

Explain that there is a tool in ArcGIS Online that can help us to better visualize these patterns in the data related to density.

Invite participants to follow the directions on ArcGIS Online Task Cards, Task #4 Analyze Areas of Concentration (Density). Encourage participants to first work through the steps with a partner and you will demonstrate the process for the whole group next.

After a few minutes of independent exploration, Demonstrate and Discuss the areas of concentration.

DEMONSTRATE Task #4: Analyze Areas of Concentration (Density)

Demonstrate how to compare a Map Notes layer showing predicted density (from the formative assessment section) with actual density (from the ESRI data layer). To do this you may choose to add the Map Notes layer you created during your Map Notes demonstration or have a pre-created layer with more detail ready to add. ***Be sure to zoom out to the full extent of the World so your density map shows the larger area.***

10. Ask Questions (10 minutes)

Discuss: Ask participants to share their thinking about what they observed in the density analysis. Explain, that as we examine the areas of concentration in the data, it may bring up additional questions.

ASK QUESTIONS is the second step in the Geospatial Inquiry Cycle.

Move the arrow on the Geospatial Inquiry poster

Guide a discussion of the areas of concentration. Ask questions and prompt participants to share other questions that came up for them as they examined the data.

As participants discuss their ideas about the reasons for the patterns in the data, encourage them to turn their statements into questions. For example:

"I think earthquakes are concentrated in areas where earth's tectonic plates are intersecting" (STATEMENT)

"Is there a relationship between proximity to plate boundaries and concentration of earthquake events?" (QUESTION)

Keep a record of the questions on chart paper or type them into a Google Doc that you share with the group.

Explain to participants that later in the second part of our Geospatial Inquiry Session (Session 1B), we will acquire additional data layers to help us answer some of the questions.

1 PEDAGOGICAL MOVES TO SUPPORT GEOSPATIAL INQUIRY - INTRODUCTION TO ACADEMICALLY PRODUCTIVE TALK

Intro to POD	Geospatial Inquiry (Part A)	**Pedagogical Moves**	Geospatial Inquiry (Part B)	Metacognition, Evaluation, & Homework

Summary

Session 1 introduces academically productive talk (discourse), the importance of talk to support Geospatial Inquiry, and four types of discussions as they are related to the steps of Geospatial Inquiry. We utilize videos and readings from Talk Science, an NSF-funded program by TERC.

Goals

Provide opportunities for teachers to:

- Consider why academically productive **talk between learners** is critical for supporting Geospatial Inquiry
- Consider the relationship between the **four types of discussions** and the steps of **Geospatial Inquiry**
- Discuss how **structures** for academically productive talk can **support Geospatial Inquiry**

POD Principles Emphasized

Geospatial Inquiry is **socially constructed**. It provides opportunities to collaborate, compare ideas with others, and receive feedback on those ideas through productive, equitable and respectful discourse (talk).

Geospatial Inquiry employs technological and communication **scaffolds** to promote **conceptual understanding** of big disciplinary ideas.

Outline (35 minutes)

1.	Set the stage: Excerpt from High School Students Say Student Led Discussions and Group Work Often Go Awry	5 minutes
2.	Introduce 21st century skills aligned with Geospatial Inquiry Cycle	5 minutes
3.	Consider Geospatial Inquiry phases in multiple disciplines	5 minutes
4.	Read Talk Science Primer, react, share	20 minutes

Preparation and Logistics

Your participants will need:

Copies

- ☐ (one per participant) of TERC Talk Science Primer (3 hole punched for easy storage in binders): https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf - Digital access is also an option. Hard copies are recommended in order to use the strategy provided for discussing the article. See step 4 for other options.

> Facilitation Tip:
>
> If you are making hard copies, be sure teachers keep them for Session 3.

Facilitation Notes

Explain to participants this component of the POD Teacher Workshop focuses on teaching strategies, methods and practices to support Geospatial Inquiry so they should be viewing this session through the Teacher Lens.

Refer participants to **Teacher Guide page 1-15**. Invite them to read the summary and goals for the session.

1. Read excerpt from High School Students Say Student Led Discussions and Group Work Often Go Awry (5 minutes)

Ask participants to read the excerpt from the Education Week blog: *HS High School Students Say Student Led Discussions and Group Work Often Go Awry* in their **Teacher Guides page 1-16.**

Encourage small groups to discuss the blog post. After a few minutes, ask – "Why do you think students are dissatisfied? What supports could have been in place to better structure the work?" *Collaboration and discourse don't just happen. We need to plan for it and provide scaffolds that support it.*

Emphasize teachers must **structure the socially constructed learning** that is essential to effective Geospatial Inquiry.

2. Introduce 21st century skills as aligned with Geospatial Inquiry (5 minutes)

Explain that when implementing Geospatial Inquiry, collaboration and communication, both 21st century skills, are critical. Refer participants to the *Geospatial Inquiry Graphic with 21st century skills* in **Teacher Guide page 1-18.**

Provide a few minutes for review, then explain this is how POD sees 21st century skills fitting in with the steps of Geospatial Inquiry. Notice that Collaboration is throughout, because students construct their knowledge together. Emphasize Geospatial Inquiry is **socially constructed.**

Say "So, how do you encourage this and avoid student frustration? We'll explore this further using materials from TERC's Talk Science Primer."

Acknowledge this pedagogy is science focused, but the core practices with which we want students to engage work across disciplines. In the next step we will examine commonalities across disciplines.

3. Consider Geospatial Inquiry phases in multiple disciplines (5 minutes)

Ask participants to view the chart comparing Geospatial Inquiry with core practices in multiple disciplines in **Teacher Guide page 1-19**.

Point out that the last column outlines the phases of Geospatial Inquiry.

After teachers have had a few minutes to review, invite them to discuss in small groups: "Where in a Geospatial Inquiry might there be opportunities for collaboration? In other words, where might students need to talk with others to make sense of information?"

After some sharing, remind them that these conversations are crucial and that they require structure to avoid the frustration students expressed in the blog post.

Explain that now that they have had a chance to explore potential connections between core practices in multiple disciplines and the need for structured collaboration and student discussions, we can go a bit deeper with the Talk Science Primer.

4. Read about academically productive talk, react, share (20 minutes)

Distribute copies or ask participants to access the Talk Science Primer at https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf

Invite teachers to use the annotation strategy listed in **Teacher Guide, page 1-20** as they read, and be prepared to share what they highlighted and why with a partner or small group.

Annotation Mark	Meaning
!	Surprised me
?	Prompted a question for me
✓	Confirmed something I knew

Ask participants to share with a partner what they highlighted and why. As a whole group, invite participants to share ideas they discussed.

Ensure the following ideas have been discussed, or bring them up:

- Academically productive talk **supports reasoning** and d**eepens student understanding** of complex material.
- Teachers must identify **clear academic purposes** for discussions.
- Teachers must provide **structures** to support academically productive talk.

Remind participants of the blog they read about student dissatisfaction with unproductive discussions.

Pose the question: "How might the elements of, and structures for, academically productive talk support student led discussions and collaborative work?" Allow for some sharing.

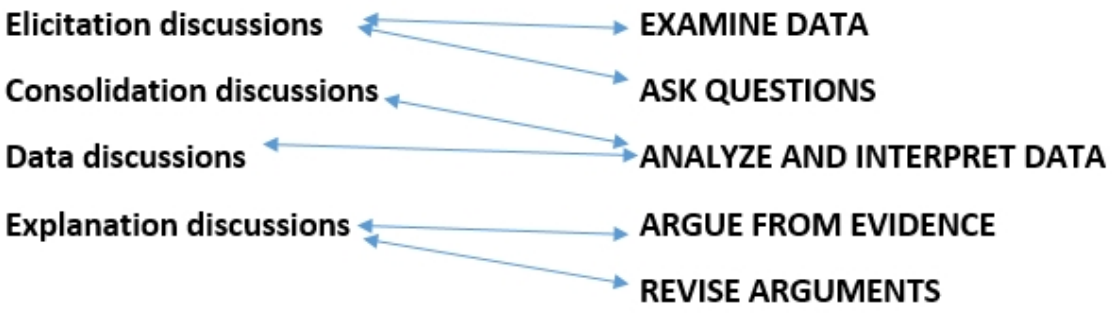
Explain we are going to come back to this and consider the connection between academically productive talk and Geospatial Inquiry during Metacognition at the end of the Session*. Let teachers know that over the next four Pedagogical Moves sessions we will delve deeper into specifics and view some classroom videos to help us consider what academically productive talk might look like in action. Ask teachers to save the copies of the Talk Science Primer for later sessions.

**During Metacognition at the end of Session 1, participants are explicitly asked to consider the relationship between the four types of discussions and Geospatial*

Facilitation Tip:

If you choose not to provide copies of the article, you might use a different strategy to encourage discussion about the reading. See http://www.thinkingcollaborative.com/strategies for ideas.

Inquiry. They are asked to provide examples. Here is an example of how we see the four types of discussion aligning with stages in Geospatial Inquiry:



1 GEOSPATIAL INQUIRY – SESSION 1B

Intro to POD	Geospatial Inquiry (Part A)	Pedagogical Moves	**Geospatial Inquiry (Part B)**	Metacognition, Evaluation, & Homework

Summary

Participants continue to focus on earthquake hazards and risk of seismic disaster. Participants **Examine Data** on where earthquakes occur and **analyze the relationship** between earthquake factors (such as depth and magnitude) and areas of concentration for earthquake events.

Goals

Provide opportunities for teachers to:

- Retrieve and examine geospatial data for a specific **purpose**
- Use ArcGIS Online as a **tool** to explore **patterns and relationships** in geospatial data
- **Critically analyze and interpret** geospatial data using Geospatial Analysis Frameworks: *Where Things Are, Areas of Concentration* and *Examining Most and Least*
- **Creatively** select and display appropriate geospatial data as evidence to support or refute a claim
- Complete one full cycle of Geospatial Inquiry as an adult learner

POD Principles Emphasized

- Geospatial Inquiry requires **purpose**
- Geospatial technologies are **tools** that support Geospatial Inquiry: to make sense of **relationships and patterns** in data.

Outline (110 minutes)

1. Acquire & Analyze Additional Data	30 minutes
2. Argue from Evidence	60 minutes
3. Summary Table	20 minutes

Preparation and Logistics

As the facilitator you will need:

Charts

- ☐ Guiding Questions
- ☐ Geospatial Analysis Framework
- ☐ Summary Table from Session 1A
- ☐ List of Questions from Session 1A

Facilitation Notes

1. Acquire and Analyze Additional Data (30 minutes)

Explain that in Session 1A, we examined areas of concentration for earthquakes and asked questions about these patterns. *(Refer to the chart or Google Doc with the list of questions*)

In order to answer these questions, we will acquire and analyze more data.

Move the arrow on the Geospatial Inquiry poster between Acquire Data and Analyze and Interpret Data.

Acquire Additional Data and **Analyze and Interpret Data** are the third and fourth steps in the Geospatial Inquiry Cycle.

Explain that although Geospatial Inquiry is a cycle it does not always follow a step by step progression. In this part of our session, we will be going back and forth between **Acquiring Data** and **Analyzing and Interpreting Data** before moving on to develop an Argument.

Inform the teachers you have prepared a data layer for us all to examine to test our ideas and about the reason for the areas of concentration.

Direct participants to their **Teacher Guide, page 1-11** Acquire & Analyze Additional Data.

Invite participants to work with a partner to add the layer showing plate boundaries and their motion and then use the discussion questions at the bottom of the page to guide their discussion. They will have about 20 minutes. Answer questions and write the stop time on the board.

Share out as a whole group (10 minutes): Debrief from the partner discussion the patterns and relationships discussed.

2. Argue from Evidence (60 minutes)

Explain they have examined and discussed several characteristics of earthquakes and factors related to earthquake events. Now they will have the chance to make a claim about the relationship between these factors/characteristics of earthquakes. They will work together in teams to develop a claim and gather and analyze data to support their claim.

Refer participants to their **Teacher Guide, page 1-12** for a list of possible factors/characteristics and possible claims that they could make. Their group may choose to make a claim that there is no relationship, a weak relationship, or a very strong relationship.

*****_Encourage groups to acquire and analyze different representations of data (including maps, bar graphs, scatter plots, etc.) to examine the relationship of different factors._

3. Summary Table (20 minutes)

Model how to record what we learned so far about where earthquakes occur (note Geospatial Analyses Framework: where things are, areas of concentration, most and least) and how this information might help the class determine the relative risk of an earthquake disaster in a particular region on the Summary Table. Encourage participants to record these ideas on their summary tables in their Teacher Guides.

*****Be sure to note Geospatial Analyses Framework: where things are, areas of concentration, most and least in the summary table.

Facilitation Tip:

This is a time for groups to explore and investigate some of their ideas. If misconceptions arise (such as weather influencing earthquake frequency), consider it an opportunity to use your learner's ideas as resources. Record ideas in a visible location. Ask others to share thinking about the posted ideas, not the person who raised the ideas (*do you agree or disagree with these ideas and why?*). You may also choose to direct participants to their Science Review, then return to and revise their original explanations.

SAMPLE SUMMARY TABLE

Activity	**What we learned**	**How we learned it**	**How does this help us answer our guiding questions?**
Examine Data on Past Earthquake Events	Most EQs occur along plate boundaries or in regions near plate boundaries.	Examining where things are, areas of concentration (density), most and least.	If a region is on or near a plate boundary it should be prepared for an EQ disaster including planning for evacuation, building codes, and informing the public about what to do in an emergency.
Examine Data on Tectonic Plates	Plates converge, diverge, and horizontally past each other	Examining a map of relative plate motion at plate boundaries	Different types of plate boundaries have different sizes of earthquakes. Knowing the type of plate boundary informs disaster planners of possible earthquake sizes.
Analyze relationships between earthquake factors (depth, magnitude, & proximity to plate boundary)			

Facilitation Tip:

As you complete the summary table, refer to the steps in the Geospatial Inquiry and the geospatial analyses that helped you to come to these conclusions in the How We Learned It column.

Encourage participants to fill in their own charts on their summary tables in their Teacher Guides.

SAVE THE SUMMARY TABLE. YOU WILL REFER BACK TO AND ADD INFORMATION TO THE SUMMARY TABLE THROUGHOUT THIS SESSION.

This summary table is an important way to promote metacognition and keep the focus on the end goals. It also emphasizes Principle 1: Geospatial Inquiry is used for a **purpose**: to provide relevant, engaging, authentic learning experiences through the process of answering a question, solving a problem, or explaining a phenomenon.

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1 METACOGNITION, EVALUATION, HOMEWORK

Intro to POD	Geospatial Inquiry (Part A)	Pedagogical Moves	Geospatial Inquiry (Part B)	**Metacognition, Evaluation, & Homework**

Summary

Participants review learning from the session and consider their own learning experiences and how these experiences might influence their classroom practices. Finally, they provide some informal feedback to the facilitators and learn of the homework assignment.

Goals

Provide opportunities for teachers to engage in **reflective practice:**

- Review Science and Geospatial Technology learning from the session
- Contemplate how Geospatial Inquiry enhanced individual learning
- Consider ways to use Geospatial Inquiry in a classroom to enhance student learning

POD Principles Emphasized

- Geospatial Inquiry involves **reflective practice.** It starts from prior knowledge and experience and requires metacognition to support conceptual understanding.
- Geospatial Inquiry requires **purpose** (embedded in Metacognition questions)
- Geospatial Inquiry promotes **cross-disciplinary practices** and **21st century skills** (embedded in Metacognition questions)

Outline (20 minutes)

1. Intro - What is metacognition?	5 minutes
2. Individual work time	10 minutes
3. Homework, informal evaluation, preparation for next session	5 minutes

Preparation and Logistics

As the facilitator you will need:
A plan for collecting feedback from participants. See Facilitator Community > Facilitation Resources > Resources and Handout Duplication Masters > Informal Evaluation/Feedback Ideas.
https://app.box.com/s/xwrjouu2oy6hn0c1f0akmi1ftcaa75q2

Facilitation Notes

1. What is metacognition? (5 minutes)
Invite participants to read the goals and definitions of metacognition in **Teacher Guide, page 1-21.**

Explain what metacognition is: awareness of one's own thinking and learning processes, or "thinking about thinking".

Tell teachers that each session, provide time to think about what was learned and to process learning for themselves and think about classroom applications.

We provide questions to guide reflection, a Science Review, and a Geospatial Technology Skills Review each session, however this time is theirs to process the learning as they see fit.

Direct their attention to the questions on **pages 1-23 and 1-24**, the **Science Session Review that begins on page 1-25**, and the **Geospatial Technology Session Review on page 1-36**.

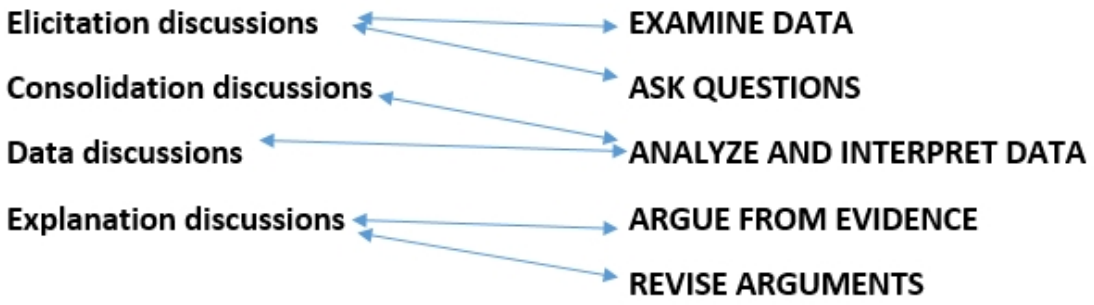
2. Individual work time (10 minutes). Participants may choose to complete the following:

- Science Session Review – Session 1, page 1-25
- Geospatial Technology Session Review – Session 1, page 1-36
- Metacognition
    - Focus on Geospatial Analysis Frameworks
    - Focus on Four Types of Discussions

Facilitation Tip:

Participants are explicitly asked to consider the relationship between the four types of discussions introduced in Talk Science and their connection to Geospatial Inquiry. They are asked to provide examples. If you have time, have the group share their ideas on this.

Here is an example of how we see the four types of discussion aligning with stages in Geospatial Inquiry:



3. Homework, informal evaluation, preparation for next session (5 minutes)
The purpose of informal evaluation is for you to gather feedback on the session to make adjustments as necessary for the next session.

Ask participants to complete your informal evaluation task and invite them to read and review the following for homework.

- Introduction to the Power of Data
- Explore: http://www.pod-stem.org/more/> Examples of Lessons to Modify > Instructional Materials > (direct link: http://www.esri.com/connected > Instructional Materials)
    - Advanced Environmental Science
    - Grade 4 Interdisciplinary
    - US History
    - Earth Science
    - Human Geography
    - Mapping Our World
    - Thinking Spatially Using GIS
- Geospatial Technology Session at a Glance – Session 2 page 1-38

Explain the Sessions at a Glance ensure they are prepared for work in the next session. They provide a preview of vocabulary and concepts so everyone has access to the same information.

Exploring GeoInquiries will help teachers when they brainstorm lesson ideas during *Designing a Geospatial Inquiry Session 2*.

SESSION 2 FACILITATION NOTES FOR POD TEACHER WORKSHOP

Session 2 at a Glance – 7 hours

Welcome	Designing a Geospatial Inquiry	Geospatial Inquiry	Career Spotlight	Metacognition, Evaluation, & Homework
15 minutes	75 minutes	250 minutes	40 minutes	40 minutes

Visit http://www.pod-stem.org/facilitators-lounge/ to access this Facilitation Guide online. The password is imgeospatial

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2 WELCOME – SESSION 2

Welcome	Designing a Geospatial Inquiry	Geospatial Inquiry	Career Spotlight	Metacognition, Evaluation & Homework

Summary

The Welcome is intended to welcome participants to learn, respond to the prior session's informal evaluation, answer questions about the Science and Geospatial Technology Session Reviews, explain the agenda for Session 2 and set a focus for the group's learning.

Goals

Provide opportunities for teachers to:

- Hear group feedback from the prior session's informal evaluation and revisit working agreements as needed
- Ask questions about homework or prior session and draw upon these ideas to **construct meaning together** through **academically productive discourse** (talk)
- Preview the agenda for Session 2

POD Principles Emphasized

- Geospatial Inquiry is a **reflective practice**.
- Geospatial Inquiry is **socially constructed**.

Facilitation Tip:

Invite participants to sit in a new seat and exchange Role Cards to experience a new Role for this Session. This encourages participants to hear and consider new perspectives.

Outline (15 minutes)

1. Summarize comments and concerns from Session 1 and answer questions from homework	10 minutes
2. Preview agenda for Session 2	5 minutes

Preparation and Logistics

As facilitator, you will need:

- ☐ Reflections from informal evaluation – organized by highlights and areas of confusion so you can share with the participants
- ☐ Introduction to the Power of Data (as a reference)
- ☐ Science Session Review – Session 1 (as a reference)
- ☐ Geospatial Technology Session Review – Session 1 (as a reference)
- ☐ Session 2 Agenda and goals

Facilitation Tip:

Invite participants to sit in a new seat and exchange Role Cards to experience a new Role for this Session. This encourages participants to hear and consider new perspectives.

Facilitation Notes

1. Review feedback received from Session 1.
   Address concerns.

2. Ask and answer questions about Science and Geospatial Technology Review readings.

3. Introduce the Session 2 Agenda.
   Give a brief preview of the activities.

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2 DESIGNING A GEOSPATIAL INQUIRY

Welcome	**Designing a Geospatial Inquiry**	Geospatial Inquiry	Career Spotlight	Metacognition, Evaluation & Homework

Summary

This component of the POD Teacher Workshops is designed to help participants plan for one Geospatial Inquiry to supplement an existing lesson. The Geospatial Inquiry Template is introduced and participants choose the big ideas/concepts and possible guiding questions that will guide the Geospatial Inquiry.

Goals

Provide opportunities for teachers to:

- Brainstorm a list of concepts that might be **enhanced** through the exploration of **relationships and patterns** in geospatial data in a Geospatial Inquiry
- Identify a **purpose** to drive a Geospatial Inquiry that can be implemented with students

POD Principles Emphasized

- Geospatial Inquiry requires **purpose**
- Geospatial technologies are **tools** which **enhance** the ability to make sense of **relationships and patterns** in data

Outline (75 minutes)

1.	Brainstorm ways Geospatial Inquiry can enhance existing lessons	30 minutes
2.	Introduce Geospatial Inquiry Template	15 minutes
3.	Begin with the End in Mind	30 minutes

Preparation and Logistics

As the facilitator, you will need:

- ☐ The color coded Geospatial Analysis Framework poster

Your participants will need:

- ☐ Access to Designing a Geospatial Inquiry – Geospatial Inquiry Template (digital copy - http://www.pod-stem.org/teachers-lounge/ > Designing a Geospatial Inquiry)

Facilitation Notes

1. Brainstorm ways Geospatial Inquiry can enhance existing lessons (30 minutes)

Explain, now that participants have experienced one iteration of a Geospatial Inquiry cycle, they may have a sense of how this could benefit something they already teach.

Emphasize Geospatial Inquiry is something to **ENHANCE** existing lessons.

It should not be an add-on or a lesson in and of itself.

Give them a minute or two to think about an EXISTING lesson that could benefit from Geospatial Inquiry. Remind participants of the geospatial analysis framework.

Refer participants to their **Teacher Guide page 2-4** to see an example enhanced Geospatial Inquiry lesson idea. As they view the example, point out the key pieces:

a. The standard, concept, big idea, or **learning goal is identified first** (earthquakes are natural hazards and run the risk of becoming disasters). Teachers may be familiar with this concept of backwards design, in which teachers choose the best path for reaching a learning goal. Emphasize that not all concepts can be taught through Geospatial Inquiry. Explain that although this concept can be **enhanced** through the exploration of

geospatial data, it is not a concept that can be taught through Geospatial Inquiry alone.

Geospatial Inquiry requires **PURPOSE**. The guiding question "*Does San Francisco, CA have a higher risk of seismic disaster than other large international cities?"* provides a reason for learning about the concept identified and for engaging in the Geospatial Inquiry. Emphasize that this question also lends itself well to students **making a claim or arguing** a position, which could require them to display geospatial data as **visual evidence** for these claims.

b. Geospatial Inquiry involves finding **RELATIONSHIPS and PATTERNS** in geospatial data. The types of **geospatial analyses** that might help students answer the guiding question include examining:

    i. where major earthquakes are (where things are)

    ii. what's nearby these major earthquakes, both in the natural and the human system (what's nearby)

    iii. Areas where major earthquakes are concentrated, where populations are concentrated (areas of concentration)

Explain they will now work through some ideas for Geospatial Inquiry lessons. They can draw upon some of the Instructional Materials they reviewed for homework to complete this task.

Invite individuals to spend 5 minutes recording their ideas on **Teacher Guide page 2-5** using one or more of the geospatial analysis frameworks (e.g. *I could enhance my lesson on water resources by having students examine what's nearby our local water supply; I could enhance my lesson on migration by having students find areas of concentration of immigrants in the US during the Gold Rush*).

Provide 5 minutes for small group sharing. Invite teachers to record each big idea/concept on chart paper (*e.g. natural hazards become disastrous when they occur near densely populated areas or critical infrastructure; Ecosystems are dynamic and fluctuate depending on changes to the environment and in populations of various species).*

You should have created the Geospatial Analysis Framework Poster with colors - blue for where things are, red for what's nearby, green for what's inside, etc.

Share this code with the teachers. Invite them to color code each big idea they recorded by which types of analyses students might conduct using your color code (*e.g. put a blue dot if the concept would be best explored by examining what's nearby*).

Ask them to be prepared to share an example of the types of data students might explore (*e.g. If they indicated finding areas of concentration would be the best way to understand this concept, they should be prepared to share why/how*).

They will have 5 minutes to complete the task. Ask what questions they might have about this task. Write the stop time on the board.

Invite teachers to do a Gallery Walk.

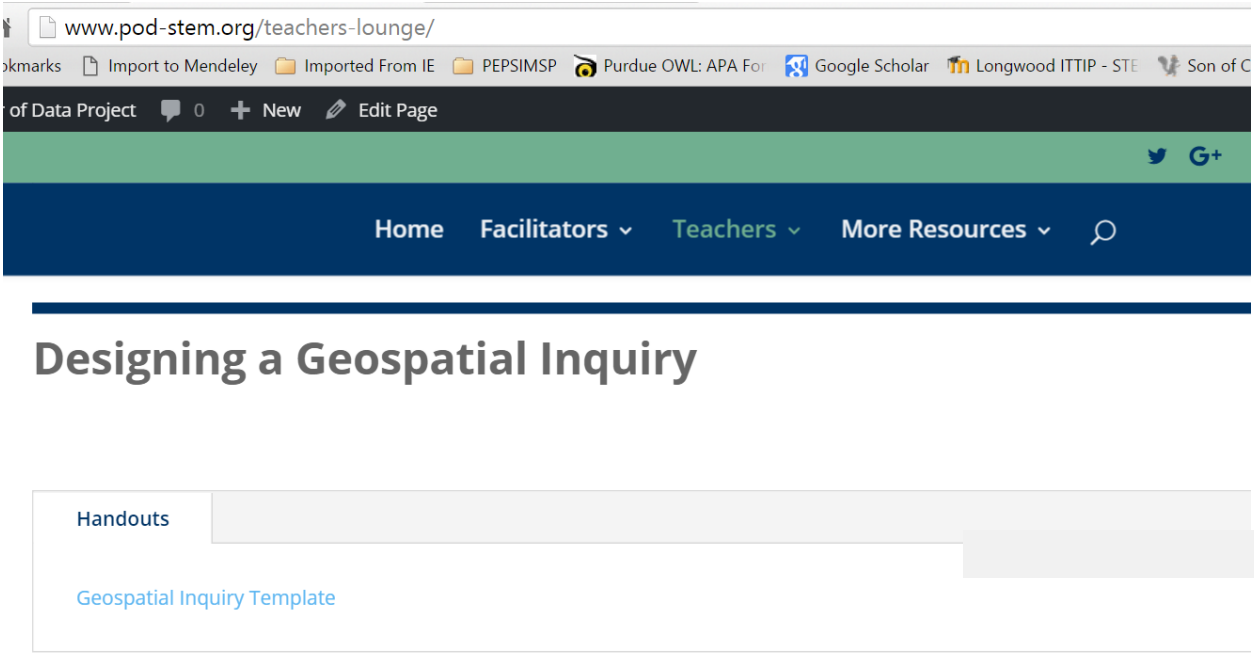
Facilitate a discussion:

Do any of the analyses seem to be more prevalent than others? What about disciplines? Are there some disciplines that lend themselves better than others to Geospatial Inquiry? (*Life sciences, Earth sciences, environmental sciences, history, literature, humanities, civics, geography, religion, language concepts)*

2. Introduce the Geospatial Inquiry Template (15 minutes)

Ask participants to reference the Geospatial Inquiry Template in their **Teacher Guides page 2-6**. Explain that throughout the workshop they will complete portions of the Template for a lesson they will teach within 6 months.

Demonstrate how to download the file from The Teacher Community: http://www.pod-stem.org/teachers-lounge/ . The password is imgeospatial2


www.pod-stem.org/teachers-lounge/
Import to Mendeley
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Purdue OWL: APA For
Google Scholar
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Home
Facilitators
Teachers
More Resources
Designing a Geospatial Inquiry
Handouts
Geospatial Inquiry Template

Direct participants to the Template, Begin with the End in Mind in their **Teacher Guide page 2-7**. Ask, what is your purpose for your overall lesson/unit? What should students understand better as a result of engaging in this Geospatial Inquiry-enhanced lesson/unit?

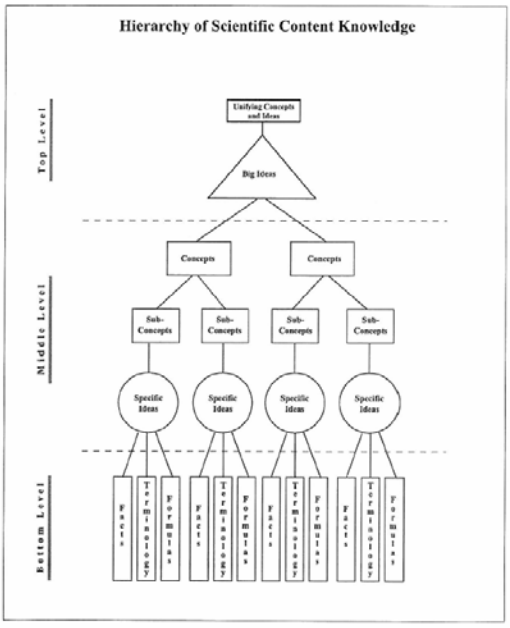
Emphasize POD Principle 1: Geospatial Inquiry is used for a **purpose**: to answer a question, solve a problem, or explain a phenomenon.

Direct participants to the **Teacher Guide, Template, Ask Questions, page 2-8**. Here they will consider what guiding question will drive the Geospatial Inquiry and/or unit/lesson (*e.g. When we don't see our source of water, how does this change our use of water? How does the source of our water and our usage impact the region we live in?*).

3. Begin with the end in mind (30 minutes)
Provide time for teachers to record their thoughts on the Template. At the end of the session, explain how to save in a location you can access so you can review and provide feedback. Close with a whole group discussion about the process thus far.

Facilitation Tip:

This historically has been very difficult for teachers. Focus on the difference between facts and concepts. If your participants are struggling, we have found this (Mundry, Keeley, & Landel, 2009) to be a helpful illustration.



Facilitation Tip:

Demonstrate how to save documents in a shared folder you have created in the POD Organization or other location for easy access each session. You will need access to their lesson templates in order to provide feedback.

2 GEOSPATIAL INQUIRY – SESSION 2

Welcome	Designing a Geospatial Inquiry	**Geospatial Inquiry**	Career Spotlight	Metacognition, Evaluation & Homework

Summary

In this session, participants continue to examine the relationship between earthquake characteristics and factors and refine their claims from Session 1B. Working with a partner, participants ACQUIRE ADDITIONAL DATA to determine if it supports their claim. The learn how to ACQUIRE additional data from external sources and ANALYZE the data in ArcGIS Online. Finally, partners present their ARGUMENT for peer-feedback using the ArcGIS Online presentation tool.

GOALS

Provide opportunities for teachers to:

- Retrieve and examine geospatial data for a specific **purpose**
- Use ArcGIS Online as a **tool** to **critically analyze and interpret patterns and relationships** in geospatial data
- **Creatively** select and display appropriate geospatial data to serve as visual **evidence for written arguments**
- **Communicate** ideas and engage in **collaborative**, academically productive talk to deepen conceptual understanding for all learners
- Complete a full cycle of Geospatial Inquiry as an adult learner

POD Principles Emphasized

- Geospatial technologies are **tools** which enhance the ability to make sense of **relationships and patterns** in geospatial data and to create **visual evidence** to support written arguments.
- Geospatial Inquiry **promotes cross-disciplinary practices and 21st century skills**
- Geospatial Inquiry is **socially constructed**. It provides opportunities to collaborate, compare ideas, and receive feedback on those ideas through productive, equitable and respectful discourse.
- Geospatial Inquiry is **iterative** and **sequenced over time** to promote **conceptual understanding** of big disciplinary ideas

Outline (250 minutes)

1. Geospatial Analysis Framework	5 minutes
2. Refine your Claim	20 minutes
3. Acquire and Analyze Data	45 minutes
4. Symbolize & Display Patterns and Relationships	60 minutes
5. Prepare a Presentation	50 minutes
6. Peer Feedback	50 minutes
7. Summary Table	20 minutes

Preparation and Logistics

Your participants will need to download data from USGS. See Step 3 for details.

We suggest a one-hour break prior to presentations, feedback, and processing.

Facilitation Notes

(5 minutes) Remind teachers to use their Adult Learner Lens. Remind everyone of our posted guiding questions and let them know that in this session we will focus primarily on the bolded questions:

- **How can we predict if an area is at high risk for natural disaster?**
  - **How can geospatial data be used to help explain where and why natural hazards occur?**
  - What patterns and relationships in geospatial data indicate high risk of disaster?
  - How can geospatial data and tools be used as evidence to communicate risk?

Refer back to learning from Session 1 and the summary table.

1. Geospatial Analysis Framework (5 minutes)

Refer participants to the Geospatial Analysis Framework poster. Ask participants to recall which of the frameworks they used in Session 1 (*finding what's nearby, finding areas of concentration*). Encourage participants to consider which of the framework prompts they are using when analyzing data throughout Session 2.

2. Refine your Claim (20 minutes)

Explain our PURPOSE for this Geospatial Inquiry session is to refine the claims they made in Session 1B. Ask participants to share a few claims they are working on. Invite participants to work with a partner to refine one claim.

*****You may also suggest the participants group together based on the characteristics in their claim (e.g. if focused on magnitude/depth or plate boundary/magnitude).*

Refer participants to their **Teacher Guide page 2-14** and the Refine your Claim section. Ask participants to use the guiding prompts to help refine their Claim.

Facilitation Tip:

Re-emphasize that our exploration of "why" earthquakes occur is only a brief introduction into plate tectonics and the goal of this session is to experience how to use Geospatial Inquiry to ENHANCE science learning concepts.

3. Acquire and analyze data (45 minutes)

After partners have refined their claim in writing, explain their next task is to Acquire and Analyze additional data to see if it supports their claim. Ask participants to explore the USGS earthquake Hazards program data to see if

the patterns they identify (in the 1997-2007 data layer examined in session 1) are consistent with patterns in more recent earthquake data (from USGS earthquake Hazards program).

Refer participants to Refer to **Teacher Guide, page 2-15** for instructions on how to add earthquake data from USGS. On this site, participants can choose time period, location, magnitude range and many other factors to download in a spreadsheet and then upload to ArcGIS Online.

For each new set of data they upload, ask them to consider if this data supports their claim.

> Facilitation Tip:
>
> Remind participants to use their role cards.

4. Symbolize and Display Patterns & Relationships; Analyze and Interpret Patterns in Data (60 minutes)

Ask teachers to describe how the data they have acquired so far has been presented visually (coded by color, shape, etc.). Explain they will now have the chance to explore some different ways to symbolize and display the data they have been examining to determine if the data is displayed in a way that supports or refutes their claims.

Ask: How was the data you examined displayed? What do the symbols represent? Ask for some examples. Why do you think the data was displayed in this way? What is the value in displaying data in different ways? *Symbolizing data in particular ways can make it easier to identify patterns and relationships.*

> Facilitation Tip:
>
> When participants think about how they want to present their argument and display these data, they are also thinking more deeply about the data and the relationships. This metacognition promotes learning.

Refer participants to **Teacher Guide page 2-16**. These are ways they might use ArcGIS Online to display data for examining patterns and relationships. They should choose the best way to display and symbolize data for the claim they are making.

Encourage participants to make notes about themes and patterns they notice as they continue to analyze and interpret data to see if it supports their claim.

Ask participants to be prepared to share if and how the different representations of data help them to support their claim.

Ask participants to work with a partner. Tell them they have 40 minutes. Write the stop time on the board. Answer questions as needed.

Bring the group back together to discuss their process of symbolizing the data. After walking through the entire task – ask – What is the value in symbolizing this data in this way? If/how does this help us answer our questions?

Emphasize the POD Principle: Geospatial technologies are **tools** that **make sense of relationships and patterns in geospatial data** and to create **visual representations** which can be used as evidence to support written arguments.

Facilitation Tip:

This is a good place to take a break. If you are following our agenda, we insert a one-hour lunch here, then present after lunch.

5. Prepare a Presentation (50 minutes)
Refer teachers to **Teacher Guide, page 2-17.** They will PREPARE a PRESENTATION of their refined CLAIM, supported by EVIDENCE about patterns and relationships in data sets and REASONING why these patterns exist.

They will have 40 minutes to work with a partner or small group to craft their arguments and begin their presentations. Each team will present to another team for peer feedback. Each presentation should be no more than 2 minutes long. Ask what questions they might have about the task at hand, then write the stop time on the board.

6. Peer Feedback (50 minutes)
Direct participants to pair up with two other teams. Each team must have an opportunity to present, receive feedback, and consider how they might revise their presentations based on that feedback.

Refer participants to Peer Feedback in their **Teacher Guide page 2-18**. Invite them to take notes during the presentations on sticky notes and place on the chart. Each of the quadrants is a place to provide feedback on the following:

1. ____ was interesting (!)
2. _____raised a question or was unclear (?)
3. _____extended findings that we discussed about ____ (+)
4. _____was in contrast to the findings that we discussed about___ (-)

Emphasize that feedback should focus on the content of the presentation and not the presenters. Also explain that they will use their feedback comments to construct the key points (what we learned) for the summary table.

Explain they will have 30 minutes total. Ask for questions and write the stop time on the board.

(20 minutes) Facilitate a brief share-out/discussion of the peer feedback process. Ask participants how they might revise their presentations based on peer feedback. After all groups have presented, discuss the feedback comments. Through a discussion with the group, address any points that were raised that were unclear or drew from misconceptions.

If misconceptions arise, consider it an opportunity to use your learner's ideas as resources. Write down their ideas in a visible location on chart paper. Ask other participants to share their thinking about the ideas, not the person who raised the ideas (*Do you agree or disagree with these ideas and why?*). You may also choose to direct participants to their Science Notes, then return to and revise their original explanations at a later time.

"Throughout the Geospatial Inquiry there are many junctures where more information is needed. These are jumping off places for deeper lessons into the concepts addressed. These lessons could pertain to earth science, mathematics, geography or social studies." Ask for participant input on ideas, and refer to resources provided.

Based on the presentations and arguments, direct participants to work in small groups to complete the summary table for this Session on the chart in their Teacher Guides. Briefly share out and record ideas on the chart.

7. Sample Summary Table (20 minutes)

Activity	**What we learned**	**How we learned it**	**How does this inform whether particular regions of the world are more at risk for particular natural disasters? How does this help us mitigate the impact of potential future events?**
Where do EQs occur?	Most large EQs occur along convergent or continental transform plate boundaries.		If a region is near one of these types of plate boundaries it should be prepared for an EQ disaster including planning for evacuation, building codes, and informing the public about what to do in an emergency.
Why do EQs occur?	Most major EQs occur along or near plate boundaries. EQs release built up stress due to plate motion. The largest tend to occur where 1) one plate subducts beneath another, or 2) where two continental pieces of plates slide past one another. Shallow EQs result in more damage and can occur at all three types of boundaries. Deep EQs have their hypocenter (focus) 100s of kms beneath the epicenter, occur only at convergent boundaries, and the intensity of shaking is less		Knowing why EQs occur can help us to more accurately predict which areas are likely to have the greatest concentration of EQs and how far away from the plate boundary EQs might occur. This helps us predict which areas might be at risk for large EQs and where EQ intensity is likely to be large. This helps quantify future impacts

	than would occur for an EQ with the same magnitude occurring at a shallow depth.		

Instruct participants to make note of this and any personal lingering questions, aha moments, what was important for learning, or areas that were confusing.

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2 CAREER SPOTLIGHT

Welcome	Designing a Geospatial Inquiry	Geospatial Inquiry	**Career Spotlight**	Metacognition, Evaluation & Homework

Summary

A main goal of the POD project is to improve student interest, awareness and attitude toward STEM careers. This goal aligns with the purpose of the NSF ITEST grants (which support the POD project). These grants are intended to inspire more individuals to pursue STEM careers. As part of the POD project, we will be asking students about their Geospatial Career awareness and interest. The career spotlight pieces are an opportunity for teachers to engage students in thinking about possible STEM careers that include geospatial technology skills and comparing their own work as a student learner with the work of career professionals in different geospatial technology fields.

This spotlight introduces Rohini Saminathan. After experiencing the 2004 tsunami in South India, she became a Geomatics engineer. She currently works with UNOSAT, the Operational Satellite Applications Programme of UNITAR, the United Nations Institute of Training and Research. She is working toward faster, more efficient, more informed humanitarian action and disaster risk reduction.

GOALS

Provide opportunities for teachers to:

- Experience a diversity of careers that use geospatial technologies
- Discover how professionals in STEM fields engage in Geospatial Inquiry and for what purposes
- Consider how STEM Professionals' work is similar to the Geospatial Inquiry in the POD Teacher Workshop, and the Geospatial Inquiries in which students might engage
- Consider how to introduce geospatial careers to students and inspire them to enter these fields

POD PRINCIPLES EMPHASIZED

- Engaging in Geospatial Inquiry and seeing how Geospatial Inquiry is used by professionals provides inspiration to enter **STEM careers.**

Outline (40 minutes)

1.	Introduce and show video	15 minutes
2.	Small group sharing	10 minutes
3.	Whole group sharing	15 minutes

Preparation and Logistics

As the facilitator you will need:

- ☐ Access to Rohini Saminathan's TED X Talk (YouTube video) https://www.youtube.com/watch?v=h7fbfZxoWlY
- ☐ Speakers
- ☐ Projector

Facilitation Notes

1. Introduce goals of Career Spotlight session and show the video (15 minutes)
Explain the goals of the Career Spotlight (see Teacher Guide page 2-21).

Introduce the video. Ask participants to consider:

- How does Rohini use the steps of Geospatial Inquiry in her work?
- How could you use this piece with your students to inspire them to pursue a STEM career?

2. Small group reaction to video (10 minutes)

Ask participants to share their answers to the questions on **Teacher Guide page 2-22** in small groups.

3. Whole group share out (15 minutes)
Ask for volunteers to share what they discussed in small groups.

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2 METACOGNITION, EVALUATION, HOMEWORK

Welcome	Designing a Geospatial Inquiry	Geospatial Inquiry	Career Spotlight	**Metacognition, Evaluation & Homework**

Summary

Participants review learning from the session, consider their own learning experiences, and how these experiences might influence their classroom practices. Finally, they provide some informal feedback to the facilitators and learn of the homework assignment.

Goals

Provide opportunities for teachers to engage in **reflective practice:**

- Review Science and Geospatial Technology learning from the session
- Contemplate how Geospatial Inquiry enhanced individual learning
- Consider ways to use Geospatial Inquiry in a classroom to enhance student learning

The purpose of informal evaluation is for you to gather feedback on the session to make adjustments as necessary for the next session.

POD Principles Emphasized

- Geospatial Inquiry involves **reflective practice**. It starts from prior knowledge and experience and requires metacognition to support conceptual understanding.

Outline (40 minutes)

1.	Introduction	5 minutes
2.	Metacognition, Homework, Informal evaluation	35 minutes

Preparation and Logistics

As the facilitator you will need:

- ☐ A plan for collecting feedback from participants. See Facilitator Community > Facilitation Resources > Resources and Handout Duplication Masters > Informal Evaluation/Feedback Ideas. https://app.box.com/s/xwrjouu2oy6hn0c1f0akmi1ftcaa75q2

Your participants will need:

- ☐ Access to the internet to view videos
- ☐ Headphones, if completing homework in the lab space (optional – can use closed captions)

Facilitation Tip:

Alternatively, invite participants to read Part 3: Establishing a Culture of Productive Talk, https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf pages 6-7

Facilitation Notes

Ask participants to think about what they learned and process that learning for themselves.

Invite participants to read the following and respond to the prompts in their **Teacher Guides**

- Metacognition
- Science Session Review – Session 2
- Geospatial Technology Session Review – Session 2

Ask participants to complete the following for homework:

- Pedagogical Moves to Promote Geospatial Inquiry – Session 2
- Geospatial Technology Session at a Glance – Session 3

Homework, informal evaluation and preparation for next session

Refer teachers to their **Teacher Guide page 2-33**, Homework: Pedagogical Moves to Promote Geospatial Inquiry - Establishing a Culture of Productive Talk.

Goals for this homework include:

- **Geospatial Inquiry** requires **structure** to promote a **culture** of **collaborative learning**.

Explain the Pedagogical Moves homework requires them to view some videos online and respond. They may want to complete their homework during this extended time. If they do so, encourage them to use the Closed Captioning system on the videos or use headphones.

Invite them to read the Session at a Glance to ensure they are prepared for our work in the next session. Remind participants that these provide a preview of vocabulary and concepts so everyone has access to the same information for our work in Session 3.

Informal Evaluation

Invite participants to complete your informal evaluation.

Facilitator Homework

Review Geospatial Inquiry Lesson Templates submitted and provide feedback. THIS IS HOW YOU KNOW IF TEACHERS ARE BEGINNING TO UNDERSTAND THE PRINCIPLES OF GEOSPATIAL INQUIRY.

Common pitfalls to look for:

- ☐ Designing a lesson they have never taught before. This process is new enough. We don't want to add novelty to the content on top of the Geospatial Inquiry approach. Ask questions about how it went the last time they taught the lesson. If they can't answer, encourage them to reconsider. Provide guidance about how to add geospatial analyses to enhance something they already teach. Contact the POD Team or reach out to other facilitators if you are stuck.

- ☐ Teaching the technology, not teaching <u>with</u> the technology.
    - *Is there a clear **PURPOSE** for engaging in Geospatial Inquiry?*
    - *Is the purpose aligned with core content knowledge in the discipline identified (i.e. does the purpose require students to apply a broad idea in multiple contexts to explain and/or predict outcomes)?*
    - *Must students learn or apply core content knowledge to answer the driving question?*

Facilitation Tip:

If you see a potential problem, consider this an opportunity to use the teacher's ideas as resources. Ask questions that will guide teachers to make changes. This template is revisited in each of the next three sessions so there is time for **REVISION**.

- No geospatial analyses required. Students put points on a map.
    - *Are quality geospatial analyses identified, appropriate to the learning goal listed?*
    - *Are students asked to find **PATTERNS AND RELATIONSHIPS** in data?*
    - *Are students required to **ARGUE** using geospatial data as visual **EVIDENCE**?*
- They are so excited by the potential of the tools they bite off more than they can chew.
    - *Is this a lesson they know well and can implement within 6 months?*
    - *Is data going to be easily available?*
    - *What smaller lessons can build student skills and knowledge to contribute to this eventual larger project?*

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SESSION 3 FACILITATION NOTES FOR POD TEACHER WORKSHOP

Session 3 at a Glance – 7 hours

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Designing a Geospatial Inquiry	Pedagogical Moves	Metacognition, Evaluation, & Homework
15 minutes	185 minutes	60 minutes	30 minutes	60 minutes	60 minutes	10 minutes

Visit http://www.pod-stem.org/facilitators-lounge/ to access this Facilitation Guide online. The password is imgeospatial

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3 WELCOME – SESSION 3

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Designing a Geospatial Inquiry	Pedagogical Moves	Metacognition, Evaluation & Homework

Summary

This session is intended to welcome participants to learn, answer questions posed from the prior session's informal evaluation, answer questions about the Science and Geospatial Technology Session Reviews, and explain the agenda for Session 3.

Goals

Provide opportunities for teachers to:

- Hear group feedback from the prior session's informal evaluation and revisit working agreements as needed
- Ask questions about homework or prior session and draw upon these ideas to **construct meaning together** through **academically productive discourse** (talk)
- Preview the agenda for Session 3 and set a focus for this session's learning: Geospatial Inquiry promotes **cross-disciplinary practices** and **21st century skills**

POD Principles Emphasized

- Geospatial Inquiry is a **reflective practice**.
- Geospatial Inquiry is **socially constructed**.

Facilitation Tip:

Invite participants to sit in a new seat and exchange Role Cards to experience a new Role for this Session. This encourages participants to hear and consider new perspectives.

Outline (15 minutes)

1.	Summarize comments and concerns from Session 2 and answer questions from homework	10 minutes
2.	Preview agenda for Session 3	5 minutes

Preparation and Logistics

Your participants will need:

- Science Session Review – Session 2
- Geospatial Technology Session Review – Session 2

As facilitator, you will need:

- Reflections from informal evaluation – organized by highlights and areas of confusion so you can share with the participants
- Science Session Review – Session 2
- Geospatial Technology Session Review – Session 2
- Session 3 Agenda and goals

Charts

- Agenda for the Session
- Parking Lot for questions

Facilitation Tip:

Invite participants to sit in a new seat and exchange Role Cards to experience a new Role for this Session. This encourages participants to hear and consider new perspectives.

Facilitation Notes

1. Review feedback received from Session 2.
   Address concerns.

2. Ask and answer questions about Science and Geospatial Technology Review readings.

3. Introduce the Session 3 Agenda.
   Give a brief preview of the activities. Explain they will discuss the edagogical Moves homework later in the agenda.

3 GEOSPATIAL INQUIRY - SESSION 3

Welcome	**Geospatial Inquiry**	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Designing a Geospatial Inquiry	Pedagogical Moves	Metacognition, Evaluation& Homework

Summary

In this session, small groups will be responsible for developing a risk determination for one of three cities. Groups will use their previous analyses of earthquake characteristics and factors and ACQUIRE and ANALYZE ADDITIONAL DATA about the human systems impacted by these events. Each of the groups will present their findings to one another through a jigsaw presentation. The jigsaw group will then make an overall determination as to which of the cities is at most risk for experiences seismic disaster.

Goals

Provide opportunities for teachers to engage in **cross disciplinary practices:**

- **Collaboratively develop an argument** about a relationship in geospatial data for a defined purpose
- **Engage in argument** using geospatial data as **evidence** with appropriate **reasoning**
- **Communicate** an evidence-based argument to an audience, receive feedback and revise as needed
- Engage in **academically productive talk** to further understanding of **big disciplinary ideas**

POD Principles Emphasized

- Geospatial Inquiry **promotes cross-disciplinary practices and 21st century skills**
- Geospatial Inquiry is **socially constructed.**
- Geospatial Inquiry is **iterative** and **sequenced over time** to promote **conceptual understanding** of big disciplinary ideas

Outline (185 minutes)

1. Summarize & Review	10 minutes
2. Determine Seismic Risk (for one city)	40 minutes
3. Jigsaw – Share findings	30 minutes
4. Argue from Evidence	25 minutes
5. Present your Argument in a Story Map	20 minutes
6. Peer Feedback	30 minutes
7. Summary Table	20 minutes

Preparation and Logistics

Your participants will need:

- ☐ Handout 1A Terminology and Representation
- ☐ Sticky notes for providing feedback

Facilitation Notes

1. Summarize and Review (10 minutes)

Remind teachers to use their Adult Learner Lens and Role Cards. Invite them to read the goals in **Teacher Guide page 3-3.**

Remind everyone of our posted guiding questions and let them know that our **PURPOSE** in this session will be to predict risk of earthquake disaster in three different regions of the world using our data and information from the past session. We will focus on the overarching question for this unit of Geospatial Inquiry (in bold) and patterns in relationship in the data that indicate that risk (in bold).

- **Which regions of the world are most at risk of experiencing natural disaster?**
    - How can geospatial data be used to help explain where and why natural hazards occur?

- **What patterns and relationships in geospatial data indicate high risk of disaster?**
- How can geospatial data and tools be used as evidence to communicate risk?

Refer participants to the Geospatial Analysis Framework on the chart. Ask participants to reflect on which of the analysis frameworks they have used so far and remind them to continue to consider the framework as they develop their analysis.

Refer to **Teacher Guide page 3-5**. They will have 10 minutes to complete the task. Answer questions and write the stop time on the board.

2. Determine Seismic Risk (for one city) (40 minutes)
Explain they will consider the relative risk of seismic disaster in one of three cities: Los Angeles, USA; Tokyo, Japan; or Reykjavik, Iceland.

N*umber off table groups 1-3 to correspond to each city. Make sure that each of the four cities has at least one table group working on it, and that each table group has at least 3 teachers sitting at the table. This is critical because in step 3, each teacher at the table forms a new group with two other teachers assigned to the other two cities, and each teacher becomes an expert for their assigned city (e.g. 1 Tokyo expert, 1 LA expert, 1 Reykjavik expert).*

Refer to **Teacher Guide page 3-6**. Invite table groups to acquire, analyze and interpret data about the natural system and the vulnerable system (human-built system) for their assigned areas.

Refer them to the **Geospatial Analysis Framework page 3-4** and **ArcGIS Online Task Cards** for ways they might analyze the data.

Refer participants to **Searching Risk Determination Data** in their **Teacher Guides page 3-7** and walk through key points.

Facilitation Tip:

Explain they should use the pre-determined search terms to minimize frustration and maximize time. They will get to do open ended searching later.

Ask for questions about the task. Write the stop time on the board. Circulate and help with GIS analysis as needed.

3. Jigsaw – Share Findings (30 minutes)
Invite participants to form groups of three in which there is at least 1 Tokyo expert, 1 LA expert, and 1 Reykjavik expert.

** Depending on your group size, each jigsaw group may have more than one from each city.*

Ask participants in the jigsaw groups to share their findings with the rest of their group. Explain that they will use the information they present to one another to develop their recommendation for which area is most at risk of seismic disaster (in the next step).

4. Argue from Evidence (25 minutes)
Explain to participants, that in their jigsaw group, they now have information about each of the cities. Their task is to consider how limited funding and resources should be allocated towards earthquake preparedness. Their groups are tasked with developing an argument for one of the cities to receive the resources.

Explain to groups that they should first develop their argument (using the prompts in their **Teacher Guide page 3-9**). The argument should present a claim as to which city they selected, what evidence they have for the risk of seismic disaster, and their reasoning for why this risk is greater or more serious than other selected areas.

Facilitation Tip:

Remind teams of time remaining throughout this exercise.

5. Present you Argument in a Story Map (20 minutes)
Explain that now that they have developed a well written argument supported by geospatial evidence (maps) they can begin to create their presentation. For this task, they will use a Story Map to communicate their argument with the audience.

Refer participants to their **Teacher Guide page 3-10** for guidance in creating a Story Map.

6. Peer Feedback (30 minutes)

Direct participants to pair up with two other teams. They will have 20 minutes total. Each team must have an opportunity to present, receive feedback, and consider how they might revise their presentations based on that feedback.

Refer participants to their **Teacher Guide, page 3-12**. Ask participants to take notes on sticky notes using the Story Map Peer Feedback chart while listening to their peers' presentations.

Tell participants that after the presentations we will debrief both the content of the Story Maps and our process for putting them together in the argumentation format. When we debrief the content of the Story Maps we will use the argumentation categories and focus on the questions listed in the feedback column and examples from the map presentation.

Ask for questions and write the stop time on the board.

Debrief the process of creating an argument using a story map. Ask participants to share what they found most challenging and most helpful about these categories and in general their process of creating a story map using the argumentation rubric.

Facilitation Tip:

If you are short on time, you can divide the categories between the groups. Assign each group to a different category on the rubric upon which to focus for feedback.

Facilitation Tip:

Circulate as the teams present and listen so you can address possible misconceptions when you debrief.

6. Summary Table (15 minutes)

Based on the presentations and arguments, direct participants to work in small groups to complete the summary table for this Session on the chart in their teacher guides. Briefly share out and record a few ideas on the class chart.

SAMPLE SUMMARY TABLE

Activity	**What we learned**	**How we learned it**	**How does this inform whether particular regions of the world are more at risk for particular natural disasters? How does this help us mitigate the impact of potential future events?**
Session 3	Los Angeles and Tokyo are most at risk for a large earthquake.	Examining where things are, areas of concentration (density), most and least, and the map legend for earthquake magnitude.	If a city is very close to a plate boundary it should be prepared for an EQ disaster including planning for emergency operations, passing and enforcing pertinent building codes, and informing the public how to prepare for a geologic disaster.
	All three locations are at risk from shallow earthquakes. For Tokyo, some shallow earthquakes will occur relatively far away and those will pose less risk than nearer, shallow earthquakes.	Examining where things are, areas of concentration (density), most and least, and the map legend for earthquake depth.	If a city is likely to experience large, shallow earthquakes it should be prepared for extensive surface damage in some neighborhoods.

	Large earthquakes are frequent near Los Angeles and Tokyo, not very frequent near Reykjavik.	Examining where things are, areas of concentration (density), most and least, and data for earthquakes for a given time interval.	Cities can use information about the frequency of large earthquakes to inform spending and regulatory decisions on the degree of preparedness. If large earthquakes are not frequent, then cities may decide to spend less on preparedness and devote the funds to other quality-of-life initiatives.

Invite participants to make note of any personal lingering questions, aha moments, what was important for learning, or areas that were confusing.

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3 IMPLICATIONS FOR TEACHING WITH GEOSPATIAL INQUIRY

Welcome	Geospatial Inquiry	**Implications for Teaching with Geospatial Inquiry**	Career Spotlight	Designing a Geospatial Inquiry	Pedagogical Moves	Metacognition, Evaluation & Homework

SUMMARY

Participants "jigsaw" interviews from teachers who have implemented Geospatial Inquiry to identify skills and dispositions that lead to successful facilitation of Geospatial Inquiry, the contexts in place that support Geospatial Inquiry, benefits of Geospatial Inquiry for students, and ways to overcome barriers. They then compare patterns to their own situations.

GOALS

Provide opportunities for teachers to:

- Explore aspects of well-facilitated Geospatial Inquiry:
    - Providing a **purpose** for engaging in Geospatial Inquiry
    - Planning Geospatial Inquiry over an appropriate amount of **time** to promote **conceptual understanding** of big disciplinary ideas
    - Providing multiple opportunities for students to **collaborate**, compare ideas, and receive **feedback** from peers, teachers, and stakeholders
- Highlight benefits of Geospatial Inquiry for students:
    - Geospatial Inquiry promotes **cross-disciplinary practices** and **21st century skills**
    - Engaging in Geospatial Inquiry and seeing how Geospatial Inquiry is used by professionals provides inspiration to enter **STEM careers**.

POD PRINCIPLES EMPHASIZED

- Geospatial Inquiry promotes **cross-disciplinary practices** and **21st century skills**
- Geospatial Inquiry is **iterative and sequenced over time** to promote **conceptual understanding** of big disciplinary ideas
- Engaging in Geospatial Inquiry and seeing how Geospatial Inquiry is used by professionals provides inspiration to enter **STEM careers.**

Outline (60 minutes)

1. Introduce interviews and directions for jigsaw.	5 minutes
2. Individually read and identify characteristics and contexts OR benefits and barriers.	15 minutes
3. Work with your team to identify trends	15 minutes
4. Partner up to share and whole group summary	20 minutes
5. Individual reflection	5 minutes

PREPARATION AND LOGISTICS

As the facilitator you will need:

- Copies – 2 or 3 of each (15 total), stapled, back to back, 3 hole punched (or provide one so participants can punch the copies and insert into their binders) for the jigsaw. Access at http://www.pod-stem.org/facilitators-lounge/ >Implications for Teaching with Geospatial Inquiry > Session 3:
    - Implications for Teaching with Geospatial Inquiry Interview Handout 3A (4 pages)
    - Implications for Teaching with Geospatial Inquiry Interview Handout 3B (4 pages)

- Implications for Teaching with Geospatial Inquiry Interview Handout 3C (4 pages)
- Implications for Teaching with Geospatial Inquiry Interview Handout 3D (4 pages)
- Implications for Teaching with Geospatial Inquiry Interview Handout 3E (4 pages)
- Implications for Teaching with Geospatial Inquiry Interview Handout 3F (7 pages – multiple short comments)
- Implications for Teaching with Geospatial Inquiry Interview Handout 3G (2 pages)

☐ Review the interviews so you are somewhat familiar with them

Your participants will need:

☐ Chart paper and markers

Facilitation Notes

1. Introduce the teacher interviews (5 minutes)

Remind teachers to be using their Teacher Lens. Refer teachers to the **Teacher Guide, page 3-14.**

Explain to participants that the POD Project has been working with teachers over the past 7 years. During this session, they will have an opportunity to read one teacher's story.

Ask teachers to work in pairs and decide who will be person A and who will be person B (if you have 15 teachers, one group will have two A s).

There should be 7 pairs and one additional person. Pass one copy of the same interview to each pair or trio (e.g. pair 1 each gets a copy of interview A, pair 2 each gets a copy of Interview B, etc.). Explain they will all read the interview they have individually, but they will be reading for different information.

Refer to the **Teacher Guide, page 3-15** *Characteristics and Contexts to Support Geospatial Inquiry* and *Benefits and Barriers to Geospatial Inquiry*, **page 3-16**.

Explain each pair (or trio) will read the same interview, but person A will look at Characteristics and Contexts that support Geospatial Inquiry and person B will look for benefits to students who participate in Geospatial Inquiry, barriers teachers have faced, and how they have overcome them.

They will have 15 minutes to read and respond individually. Then, all the A's will get together and all the B's will get together in groups. These groups will spend 15 minutes together to distill the general trends from the interviews. Next, they will return to their original partners to teach one another what they learned for 10 minutes, and finally they will reflect individually for 5 minutes.

Facilitation Tip:

Give directions before a break so teachers can read individually when they return.

Ask what questions they might have about the task. Clarify, then note the end time of the individual work (15 minutes), the end time of the group work (15 minutes), and the end time of the partner work (10 minutes) on the board.

2. Read and identify characteristics and contexts OR benefits and barriers (15 minutes)

Allow participants to individually read and identify characteristics and contexts OR benefits and barriers.

3. Work with other A's and B's to identify trends in the interviews (15 minutes)

Invite all of the A's to convene to identify and chart trends in the characteristics and contexts that support Geospatial Inquiry. Meanwhile, invite the B's to get together to identify and chart common benefits for students, barriers that teachers faced, and ways they overcame the barriers.

4. Partner up to share and whole group summary (20 minutes)

Ask participants to pair back up, one A and one B (one group will have 3 people). Invite them to teach one another what they learned. After about 15 minutes, come back as a whole group to share observations and view the charts from the groups. Use the following sample charts as a guide.

Sample Charts

Characteristics	Contexts
Those with higher technological, pedagogical, and content knowledge had the most success.	*Flexibility in curriculum*
Willingness to change/learn alongside students/take risks and give up control	*Supportive administrator*
Willingness to improve practice and learn new skills and knowledge	*Access to reliable technology*
Willing to get help from others	*Time – longer class periods yielded more success and time for projects*
Recognized benefits for students. These provided a desire to continue, persevere	*Teams of teachers at a school or community partner to support students*
Recognized need to change teaching when students are not learning	
Considered themselves facilitator of learning vs. deliverer of knowledge	

Benefits for Students	Barriers
• *Opportunity to engage in relevant, authentic, investigations*	• *Takes time*
• *Geospatial Inquiry helps students learn content better*	• *Technology access*
• *Opportunity to engage in science and engineering practices*	• *Lack of curricular flexibility*
• *Opportunity to engage in 21st century workforce skills*	• *Assessing authentic projects is challenging*
• *Opportunity to present/work alongside stakeholders*	• *High stakes testing*
• *Opportunity to gather and/or analyze data they curated or gathered in the field*	• *Administrators don't know where GIS fits in the curriculum*
• *Higher student engagement*	• *Teachers lack technology skills*

Ideas to overcome barriers

- Educate administrators on the benefits of Geospatial Inquiry – see resources on www.pod-stem.org
- Commit to practicing GIS once a month. See resources http://www.pod-stem.org/more/
- Engage help from other teachers and community members on an authentic joint project
- Invite parents, administrators, teachers, and community members to your classroom to see benefits for students
- Host student presentations
- Crowdsource funding for computers – see resources on www.pod-stem.org

References:

http://www.pod-stem.org/publications-and-presentations/

5. Individual reflection (5 minutes)

Invite participants to reflect on this discussion on **page 3-17 of the Teacher Guide.**

3 CAREER SPOTLIGHT

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	**Career Spotlight**	Designing a Geospatial Inquiry	Pedagogical Moves	Metacognition, Evaluation & Homework

Summary

This spotlight is an interview with Jessica Block, a Research Analyst at University of California San Diego specializing in the use of sensor networks, remote sensing, and geospatial visualization tools for disaster response, natural resource management, policy decision-making, and sustainability.

GOALS

Provide opportunities for teachers to:

- Experience a diversity of careers that use geospatial technologies
- Discover how professionals in STEM fields engage in Geospatial Inquiry and for what purposes
- Consider how STEM Professionals' work is similar to the Geospatial Inquiry in the POD Teacher Workshop, and the Geospatial Inquiries in which students might engage
- Consider diverse ways to introduce geospatial careers to students and inspire them to enter these fields

POD PRINCIPLES EMPHASIZED

- Engaging in Geospatial Inquiry and seeing how Geospatial Inquiry is used by professionals provides inspiration to enter **STEM careers**.

Outline (30 minutes)

1.	Introduction and reading	15 minutes
2.	Small group sharing	10 minutes
3.	Whole group sharing	5 minutes

Preparation and Logistics

As the facilitator you will need:

- ☐ Read the Spotlight

Facilitation Notes

1. Introduce the reading and allow participants time to read (15 minutes)

Explain that this Spotlight differs from the last session. It is an interview. Preview the reading. Refer participants to their **Teacher Guides, page 3-18**. Ask them to consider the questions as they read, then discuss the questions in small groups.

- How does Jessica use the steps of Geospatial Inquiry in her work?
- How does Jessica's work compare with Rohini's?
- How could you use this piece with your students to inspire them to pursue a STEM career?
- How does the interview format compare with the video format?

2. Small group sharing (10 minutes)

Invite participants to share their answers to the questions in small groups.

3. Whole group share out (5 minutes)

Ask for volunteers to share what they discussed in small groups. Highlight the pros and cons to using video vs. using the reading, and emphasize the steps of geospatial inquiry across the two Spotlights along with the potential for these examples to inspire students to enter geospatial careers.

3 DESIGNING A GEOSPATIAL INQUIRY

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	**Designing a Geospatial Inquiry**	Pedagogical Moves	Metacognition, Evaluation & Homework

Summary

Participants revisit their Geospatial Inquiry Templates to consider what products they will assign students in order to a. provide feedback for revision and b. collect evidence of student learning throughout the Geospatial Inquiry. Finally participants will identify criteria against which they can assess student products.

Goals

Provide opportunities for teachers to continue planning for Geospatial Inquiry to supplement an existing unit:

- Identify opportunities for students to use technology to make sense of **relationships and patterns** in geospatial data and to create **visual evidence** to support written **arguments**.
- Identify an appropriately timed **sequence of activities** to promote conceptual understanding of big disciplinary ideas
- Identify opportunities for students to collaborate, compare ideas, and **receive feedback** on those ideas
- Define criteria to determine **evidence** of student **conceptual understanding**

POD Principles Emphasized

- Geospatial **technologies are tools** which enhance the ability to make sense of **relationships and patterns** in geospatial data and to create **visual** evidence to support written arguments.

- Geospatial Inquiry is iterative and **sequenced over time** to promote conceptual understanding of big disciplinary ideas
- Geospatial Inquiry is **socially constructed**. It provides opportunities to collaborate, compare ideas, and receive feedback on those ideas through productive, equitable and respectful discourse.

Outline (60 minutes)

1.	Introduce lesson sequence, critical junctures, formative feedback, and criteria for quality evidence of learning	20 minutes
2.	Individual work time	40 minutes

Preparation and Logistics

As the facilitator, you will need:

- ☐ Prior to this session you should have reviewed the lessons submitted thus far and provided **FEEDBACK**.

Your participants will need:

- ☐ Designing a Geospatial Inquiry – Geospatial Inquiry Template (digital copy saved in Session 2)

Facilitation Notes

1. Introduce critical junctures, formative feedback, and criteria for quality evidence of learning (20 minutes)

Remind participants this is a Teacher Lens activity. Direct teachers to *Designing a Geospatial Inquiry,* **page 3-23 in the Teacher Guide** and provide time to read the goals.

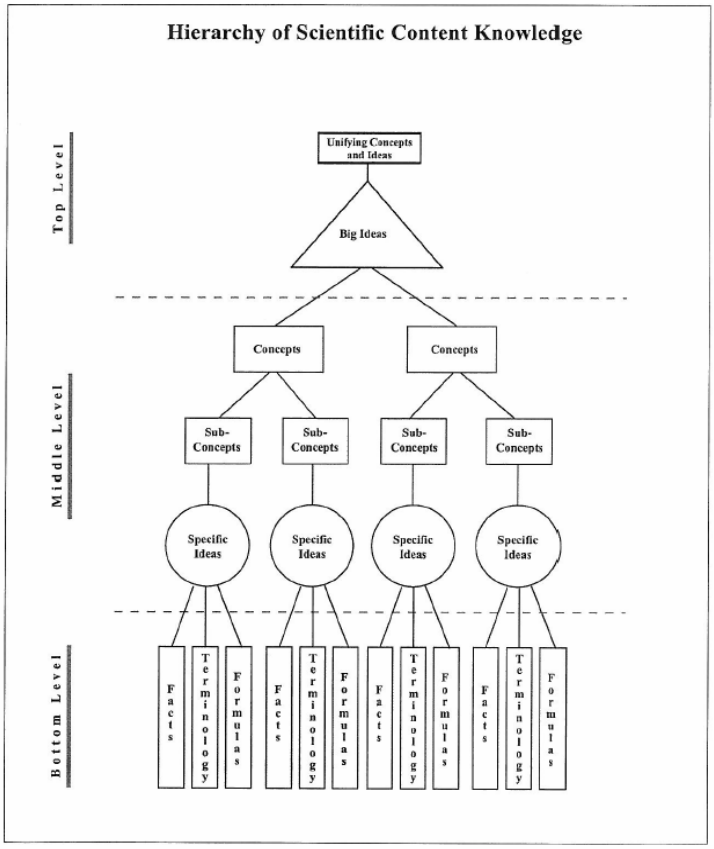
Explain that we will return to the Geospatial Inquiry Template and focus on Evidence of Student Learning and Quality of Evidence.

Explain that now that learning goals have been identified, they can start to think about an appropriate sequence of smaller concepts that will guide students toward conceptual understanding of these goals.

Facilitation Tip:

It might be helpful for teachers to sketch out a sequence of ideas that build toward conceptual understanding before thinking about products. This is why we recommend teachers modify a lesson they know well. Again, this illustration (Mundry, Keeley, & Landel, 2009) has been helpful to teachers in the past.

Highlight that it is likely that students will need to work through multiple iterations of a Geospatial Inquiry cycle, just as they have experienced in this Workshop. Direct teachers to *Designing a Geospatial Inquiry,* **page 3-24 in the Teacher Guide.** Invite teachers to outline a lesson sequence.



Invite participants to read **Teacher Guide page 3-25**, *Critical Junctures and Feedback*. Invite them to discuss in small groups and share ideas with the whole group.

Direct participants' attention to Evidence of Student Learning in **Teacher Guide, page 3-26.** When they return to the Template they saved in Session 2, they can note critical junctures and products that will serve as evidence that students are ready to progress to the next lesson in this section.

Evidence of Student Learning

Define the student products for the Geospatial Inquiry-enhanced lesson/unit.

Which of these (or other products) will you assess? Which products require feedback to enable students to refine their thinking?

Early on:

In the middle:

Final product:

Do students have multiple opportunities to ask questions, analyze and interpret geospatial data, argue from evidence, present their arguments, and revise their thinking?

Consider ways to assess content knowledge and skills, communication skills, and process. Consider both formal products and informal assessments (conversations, observations, etc.).

Explain that for each product identified, they must delineate **criteria** for success, so this can clearly be communicated to students. This is to be noted under Quality of Evidence.

Quality of Evidence

State the criteria for exemplary performance for each product:

Product:

Criteria:

Do the products and criteria align with identified outcomes? Do the products and tasks give all students the opportunity to demonstrate what they have learned not only through visual representations, but also through writing and speaking? Do assessments enable you to determine how well a student understands? Do formative assessments reveal student thinking behind mistakes so you can intervene?

2. Individual work time (50 minutes)
Tell participants they have 40 minutes to complete the Template through *Quality of Evidence* individually. Ask for questions they might have about the task. Write the stop time on the board.

Circulate and offer feedback as needed. Be sure to stress the importance of feedback for students and many opportunities for revision.

*** CAUTION ***

Keep an eye out for overly ambitious lessons, knowing that they must implement within 6 months and will need to find data at the appropriate scale. You should have reviewed the lessons submitted from Session 2. As needed, gently guide participants toward lessons with existing data that is easily accessible. This is why we encourage them to bring an existing lesson they know well. Explain that it's best to start small and build up to the long term projects involving data mining or collecting.

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3 PEDAGOGICAL MOVES TO PROMOTE GEOSPATIAL INQUIRY – HOW TO SUPPORT ACADEMICALLY PRODUCTIVE TALK

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Designing a Geospatial Inquiry	**Pedagogical Moves**	Metacognition, Evaluation & Homework

Summary

In this session, we discuss what it takes to promote a culture of academically productive talk, then consider some specific teaching strategies. We introduce Talk Moves aligned with goals related to different steps in Geospatial Inquiry and view classroom videos of these Talk Moves in action.

Goals

Provide opportunities for teachers to:

- Consider **structures** which promote a **culture** of **collaborative learning** in the **Geospatial Inquiry**
- Explore teaching strategies (Talk Moves) which support academically productive talk in real classrooms

POD Principles Emphasized

Geospatial Inquiry is **socially constructed**. It provides opportunities to collaborate, compare ideas with others, and receive feedback on those ideas through productive, equitable and respectful discourse.

Outline (60 minutes)

1. Debrief homework	15 minutes
2. Four corners to set the stage	15 minutes
3. Talk Moves videos and reflection	30 minutes

Preparation and Logistics

Your participants will need:

- ☐ Computers with internet connection and speakers
- ☐ Access to videos: https://inquiryproject.terc.edu/prof_dev/library.cfm.html > Talk Strategies
- ☐ Earphones (or use closed captioning)

As the facilitator you will need:

- ☐ Print the 4 goals of productive talk http://www.pod-stem.org/wp-content/uploads/2016/05/Goals-for-Productive-Discussion-POD.pdf on separate pages of card stock
- ☐ 4 corners goals, one posted in each corner of the room
- ☐ Prior to this session, review Productive Talk Moves video > Talk Strategies so you are somewhat familiar

Facilitation Tip:

Facilitation Tip – these examples are from 4-5 grade classrooms. They are excellent, and accompany the goals, but we have also provided other examples. https://app.box.com/s/1zu6ho7rg3nlf5khi5ifwc8a16b4huot If you choose other examples, you will need to edit the teacher guide accordingly.

Facilitation Notes

1. Review homework – Promoting a culture of academically productive talk (15 minutes)

Remind participants of the videos they viewed for homework which outlined ways to promote a culture of academically productive talk (valuing student talk, setting, clarifying and enforcing expectations, including all students). Invite participants to discuss ways the POD Workshop has supported or hindered academically productive talk so far.

2. Four goals of academically productive talk, four corners (15 minutes)

Ask teachers to use their Teacher Lens. Point out the goals of productive talk posted in the corners of the room.

Ask participants to stand by the goal they feel most comfortable with in the classroom. When they get there, ask them to have a conversation with others in that corner.

Call the attention of the group. Explain that we know academically productive talk is important. We all feel most comfortable facilitating certain kinds of talk in the classroom. In this session we will explore some specific teaching strategies that will encourage productive talk in Geospatial Inquiry related to these goals.

Facilitation Tip:

At this point, we inject a little energy booster using 4 corners. Feel free to skip this if you are behind schedule. If, during 4 corners, no one stands with a participant, ask them if you can join them and have a conversation or ask them to converse with another "lone wolf" if needed.

3. View Talk Moves videos in small groups (30 minutes)

Ask if anyone has heard of Talk Moves before. Allow them to expound – have they used them? What have the results been? Might these help you reach the goals you felt less confident in?

Explain we will go into depth by goal on two that seem particularly aligned to Geospatial Inquiry. We will view classroom examples.
Start Productive Talk Moves video. Be sure to enable full screen and captions. Stop video at 2:38.

Explain that Talk Science has provided some classroom videos of Talk Moves in action. Directions for accessing the videos are in their Teacher Guides. Note

these are 4th and 5th grade science classrooms, but the strategies for Talk Moves can work, independent of grade level or discipline.

Direct participants to their **Teacher Guides page 3-28**. Invite each small group to choose two videos to view. As they view the videos, invite participants to take notes in their Teacher Guides. For each goal and video they viewed, ask participants to consider what the teacher is doing to promote academically productive talk and how they might use these to promote academically productive talk during a Geospatial Inquiry lesson.

Facilitation Tip:

Alternatively, ask participants to read pages 10-11 in the Talk Science Primer. https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf#Part4

Provide time for participants to view and discuss videos of specific examples by goal (Talk Strategies) https://inquiryproject.terc.edu/prof_dev/library.cfm.html

- Goal 1: Share, expand, clarify (intro) 1:47
  - Time to think (partner talk, stop and jot, wait time) – 7:04
- Goal 2: Listen carefully- 4:11
- Goal 3: Deepen Reasoning (intro, pressing/probing for evidence/evidence, challenge/counterexamples)– 5:06
- Goal 4: Think with others – 2:56
  - Agree/Disagree/Why – 2:28

Facilitation Tip:

All videos can be found by visiting this library of resources

https://inquiryproject.terc.edu/prof_dev/library.cfm.html

Ask for volunteers to share the videos they viewed and their answers to the questions in the Guide with the whole group.

3 METACOGNITION, EVALUATION AND HOMEWORK

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Designing a Geospatial Inquiry	Pedagogical Moves	**Metacognition, Evaluation & Homework**

Summary

Participants review learning from the session, consider their own learning experiences, and how these experiences might influence their classroom practices. Finally, they provide some informal feedback to the facilitators and learn of the homework assignment.

Goals

Provide opportunities for teachers to engage in **reflective practice:**

- Review Science and Geospatial Technology learning from the session
- Contemplate how Geospatial Inquiry enhanced individual learning
- Consider ways to use Geospatial Inquiry in a classroom to enhance student learning

The purpose of informal evaluation is for you to gather feedback on the session to make adjustments as necessary for the next session.

POD Principles Emphasized

Geospatial Inquiry is a **reflective practice**. It starts from prior knowledge and experience and requires metacognition in order to develop conceptual understanding.

Outline (10 minutes)

1. Individual reflection time	5 minutes
2. Explain homework, informal evaluation, preparation for next session	5 minutes

Preparation and Logistics

As the facilitator you will need:

- ☐ A plan for collecting feedback from participants. See Facilitator Community > Facilitation Resources > Resources and Handout Duplication Masters > Informal Evaluation/Feedback Ideas. https://app.box.com/s/xwrjouu2oy6hn0c1f0akmi1ftcaa75q2

Your participants will need:

- ☐ Access to the internet to preview natural hazard data

Facilitation Notes

Metacognition

Ask participants to think about what they learned and process that learning for themselves. Invite participants to read the following and respond to the prompts in their **Teacher Guides, page 3-29** and

- Science Session Review – Session 3
- Geospatial Technology Session Review – Session 3

Homework, Informal Evaluation and Preparation for Next Session

- Review Natural Hazard Data, page 3-37
- Geospatial Technology Session at a Glance – Session 4

Refer participants to **Teacher Guide page 3-37**. To prepare for Session 4, when they will choose a natural hazard of their choice, they should briefly preview some available data but not spend too much time on this.

Invite them to read the Session at a Glance to ensure they are prepared for our work in the next session. Remind participants that these provide a preview of vocabulary and concepts so everyone has access to the same information for our work in Session 4.

Informal Evaluation

Invite participants to complete your informal evaluation of the session. The purpose of informal evaluation is for you to gather feedback on the session to make adjustments as necessary for the next session.

Facilitation Tip:

If you see a potential problem, consider this an opportunity to use the teacher's ideas as resources. Ask questions that will guide teachers to make changes. This template is revisited in each of the next three sessions so there is time for **REVISION**.

Facilitator Homework

Review Geospatial Inquiry Lesson Templates submitted and provide feedback. THIS IS HOW YOU KNOW IF TEACHERS ARE BEGINNING TO UNDERSTAND THE PRINCIPLES OF GEOSPATIAL INQUIRY.

Common pitfalls to look for in addition to those listed previously:

- Products not aligned to skills or knowledge necessary for completing the final product
- Not enough opportunities for iterative Geospatial Inquiry, feedback, and time for revision

- Products and criteria are not aligned with learning outcome (i.e. lists of things that must be included in a presentation such as "four slides in the Story Map" vs. criteria for quality analysis such as "chooses appropriate data as evidence to support claims and provides reasoning why this data counts as evidence for each claim")

SESSION 4 FACILITATION NOTES FOR POD TEACHER WORKSHOP

Session 4 at a Glance – 7 hours

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Pedagogical Moves	Designing a Geospatial Inquiry	Metacognition & Evaluation
15 minutes	200 minutes	70 minutes	35 minutes	60 minutes	30 minutes	10 minutes

Visit http://www.pod-stem.org/facilitators-lounge/ to access this Facilitation Guide online. The password is imgeospatial

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4 WELCOME – SESSION 4

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Pedagogical Moves	Designing a Geospatial Inquiry	Metacognition & Evaluation

Summary

The Welcome is intended to welcome participants to learn, respond to the prior session's informal evaluation, answer questions about the Science and Geospatial Technology Session Reviews, and explain the agenda for Session 4.

Goals

Provide opportunities for teachers to:

- Hear group feedback from the prior session's informal evaluation and revisit working agreements as needed
- Ask questions about homework or prior session and draw upon these ideas to **construct meaning together** through **academically productive discourse** (talk)
- Preview the agenda for Session 4 and set a focus for this session's learning: Engaging in Geospatial Inquiry and seeing how Geospatial Inquiry is used by professionals provides inspiration to enter **STEM careers**.

Facilitation Tip:

Invite participants to sit in a new seat and exchange Role Cards to experience a new Role for this Session. This encourages participants to hear and consider new perspectives.

POD Principles Emphasized

- Geospatial Inquiry is a **reflective practice**.
- Geospatial Inquiry is **socially constructed**.

Outline (15 minutes)

1.	Summarize comments and concerns from Session 3 and answer questions from homework	10 minutes
2.	Preview agenda for Session 4	5 minutes

Preparation and Logistics

Your participants will need:

- Science Session Review – Session 3
- Geospatial Technology Session Review – Session 3

As facilitator, you will need:

- Reflections from informal evaluation – organized by highlights and areas of confusion so you can share with the participants
- Science Session Review – Session 3
- Geospatial Technology Session Review – Session 3
- Familiarity with Natural Hazard Data
- Session 4 Agenda and goals

Charts

- Agenda for the Session
- Parking Lot for questions

Facilitation Tip:

Invite participants to sit in a new seat and exchange Role Cards to experience a new Role for this Session. This encourages participants to hear and consider new perspectives.

Facilitation Notes

1. Review feedback received from Session 3.

Address concerns.

2. Answer questions about Science and Geospatial Technology Review readings and homework.

3. Introduce the Session 4 Agenda.

Give a brief preview of the activities.

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4 GEOSPATIAL INQUIRY – SESSION 4

Welcome	**Geospatial Inquiry**	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Pedagogical Moves	Designing a Geospatial Inquiry	Metacognition & Evaluation

Summary

Participants apply their understanding of the relationship between vulnerable systems and natural hazards from the Geospatial Inquiry on earthquakes to determine the risk of their choice of natural disaster in their local regions. Participants identify the data and geospatial analyses they need to consider to conduct their own Geospatial Inquiry. They also choose the best ArcGIS Online geospatial deliverable for their arguments based on their purpose and intended audience.

Goals

Provide opportunities for teachers to engage in **cross-disciplinary practices** and **21st century skills**:

- **Collaboratively ask questions** and **critically analyze and interpret** geospatial data for a defined **purpose**
- **Creatively select and display** appropriate geospatial data as **evidence** to support an **argument**
- **Communicate** an **evidence-based argument** to an audience, receive feedback and revise as needed

POD Principles Emphasized

- Geospatial Inquiry promotes **cross-disciplinary practices** and **21st century skills**
- Geospatial Inquiry is **iterative** and **sequenced over time** to promote **conceptual understanding** of big disciplinary ideas

Outline (200 minutes)

1. Introduction	5 minutes
2. Ask Questions	15 minutes
3. Acquire & Analyze Data	40 minutes
4. Argue from Evidence and Craft Presentation	85 minutes
5. Peer Presentation & Feedback	45 minutes
6. Debrief	10 minutes

Preparation and Logistics

As the facilitator you will need:

- Review Buckets of Data – Natural Hazards Data https://docs.google.com/spreadsheets/d/199sS0hj9-Mmn5PvWTGv1WrMmj9OorpUc5PVYlNruizc/edit#gid=0
- Extreme weather https://www.ncdc.noaa.gov/climate-information/extreme-events
- Climate https://www.ncdc.noaa.gov/climate-monitoring/
- Colorado River drainage basin
  - https://www.usbr.gov/
  - https://www.nae.edu/Publications/Bridge/55183/55194.aspx
- Hurricanes http://www.nhc.noaa.gov/
- Flooding https://water.usgs.gov/floods/
- Fires http://www.firescience.gov/

Facilitation Notes

1. Introduction (5 minutes)

Remind teachers to use their Adult Learner Lens and Role Cards.

Invite participants to read the summary and goals in **Teacher Guide page 4-3**.

Explain: In the sessions so far, teachers have explored where earthquakes occur and analyzed patterns in the data about earthquake events. They used their interpretations of what the data means to assess the risk of seismic disaster in particular areas of the world. Now it's their turn to choose a natural hazard to explore.

Refer to **Teacher Guide page 4-4**. In this Geospatial Inquiry, the PURPOSE is to apply their understanding of the relationship between vulnerable systems and natural hazards to determine the risk of natural disaster for a particular region.

Explain: They will work with a small group or partner to first choose a hazard to investigate and a particular region to focus upon. They will determine if significant resources should be devoted to planning for or mitigating the effects of their chosen natural disaster in their identified region and create a presentation to advise the general public or help communities to share their findings.

Refer participants to the guiding questions in the **Teacher Guide page 4-4**. Point out that through the session so far we have been able to answer these questions for earthquakes. In their inquiry they should focus on answering these same questions for the hazard of their choice.

2. Ask Questions (10 minutes)

Refer participants to **page 4-5 in their Teacher Guides**. Move the arrow on the Geospatial Inquiry poster to Ask Questions.

- What information do you need to make a risk determination for _____ (hazard) in the _____ (city/region)?
- What data do you need to acquire?
- How will you analyze and interpret the data?

Explain the importance of developing a plan for their inquiry before starting to look through data.

Remind participants to consider which of the geospatial analysis frameworks is most appropriate for the analysis portion of their inquiry.

Remind participants they will be using this data to develop an argument using evidence, similar to what they did with earthquakes but this time with a hazard and location of their choosing. They should identify their audience for this argument. Will they present to a city council to affect policy? Will they be communicating directly with citizens? These decisions will drive their analysis and communication plans.

Provide 10 minutes for small groups or partners to complete the chart. Ask for questions about the task and write the stop time on the board.

4. Acquire and Analyze Data (40 minutes)

Move the arrow on the Geospatial Inquiry poster to between the Acquire and Analyze Data

Remind participants that during our earthquake inquiry we went back and forth between acquiring data and analyzing that data as part of the Geospatial Inquiry Cycle. Explain that they should now go through a similar process with their group as they follow their data plan for their hazard and city.

Tell participants they should use their analysis plan to complete the data acquisition chart in their **Teacher Guide page 4-6.** The chart asks participants to consider data categories and corresponding search terms that could be used to acquire data in these categories.

Highlight the importance of developing a plan before beginning to search for data. Ask questions about the chart task and then write a 10 minute stop time on the board.

Facilitation Tip:

CAUTION & SUGGESTIONS: We do not recommend an open-ended exploration of data.

Explain with this in mind, we have collected and provided sets of data for participants that include appropriate scale.

Discussion of Scale:

After participants have completed their data acquisition charts, engage in a brief discussion about issues of scale. Refer them to Discussion of Scale in **Teacher Guide page 4-6**.

Taking into consideration the scale of the map you will create, you might not be able to get data on the whole city, but you should be able to find it for more local data using the search terms and methods described above. In addition to searching data in ArcGIS Online, we have provided Power of Data resource folders or "buckets" of data to assist you in creating your map.

Demonstrate how to access the data buckets that are located in the Power of Data Organization account and respond to questions. https://docs.google.com/spreadsheets/d/199sS0hj9-Mmn5PvWTGv1WrMmj9OorpUc5PVYlNruizc/edit#gid=0

Some of the vulnerable systems data provided include:

- Extreme temperature
- Precipitation
- Climate
- Weather U.S. focused data here
- Colorado River drainage basin (Water usage and how it's changed over time – How do you solve that problem or is there a solution)
- Drainage basin
- Water data
- Hurricanes – Land value data, race, demographics,
- Flooding
- Elevation
- Surface – impervious surface how much development over time
- Population density
- Drought
- Fires
- Vegetation – types
- Development

Facilitation Tip:

Explain they can use any of these data in their projects but remember to pay attention to the metadata as they shop for the data.

Explain they should spend 1hr just acquiring and analyzing data. In the next step they will work on crafting their argument and creating a presentation. Ask for any questions about the task. Write the stop time on the board.

5. Argue from Evidence and Craft Presentation (85 minutes)
Move the arrow on the Geospatial Inquiry poster to Argue from Evidence.

Explain to participants they should now focus on crafting a well-written argument based on the data they have acquired and analyzed. Refer participants to the **Teacher Guide page 4-8** and **Argumentation Rubric on page 4-9**. Encourage participants to spend this time crafting an argument and organizing their maps and data before starting to work on a presentation.

Facilitation Tip:

Note the significant data prep that went into this session. Explain that these data are available for their Geospatial Inquiry lessons and that we will share some other existing data sources and 6-12 grade geospatial lessons they can modify rather than starting from scratch and re-creating the wheel.

When their argument is solid and their data is organized, they will choose an appropriate deliverable. Direct them to review the deliverables and consider which is best for the information they are presenting and for their intended audience.

They will have 85 minutes to develop an argument and create a presentation of their choosing. Ask for questions about the task and write the stop time on the board.

6. Peer Presentation & Feedback (45 minutes)
Invite groups to present their arguments to the whole group. As they present ask listening (non-presenting groups) to focus on one particular category of the argument rubric (focus, controlling idea, research and development). Ask participants to record sticky notes on the elements of this category. At the end of each presentation, ask participants to provide their feedback sticky notes to the presenting group.

7. Debrief (10 min)

Facilitate a whole group sharing of the overall On Your Own Geospatial Inquiry process. What went well? Where did they encounter difficulties?

Instruct participants to make note of any personal lingering questions, aha moments, what was important for learning, or areas that were confusing during the entire Geospatial Inquiry.

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4 IMPLICATIONS FOR TEACHING WITH GEOSPATIAL INQUIRY

Welcome	Geospatial Inquiry	**Implications for Teaching with Geospatial Inquiry**	Career Spotlight	Pedagogical Moves	Designing a Geospatial Inquiry	Metacognition & Evaluation

Summary

Participants read an interview highlighting the conundrum a pair of teachers face when assessing Geospatial Inquiry. They consider ways to provide feedback that is helpful to students and provides opportunities for revision.

Goals

Provide opportunities for teachers to:

- Consider the importance of clear **expectations**, regular **feedback** and opportunities for **revision** in Geospatial Inquiry
- Consider the need for **scaffolds**, such as instructional rubrics, to support student success
- Consider how planning an **iterative** Geospatial Inquiry lesson over time with opportunities for regular **feedback** can guide instruction and ensure student success

POD Principles Emphasized

- Geospatial Inquiry is **iterative and sequenced over time** and employs technological and communication **scaffolds** to promote conceptual understanding of big disciplinary ideas.
- Geospatial Inquiry provides opportunities to collaborate, compare ideas, and **receive feedback** on those ideas

Outline (70 minutes)

1. Consider the difference between assessment and grading	10 minutes
2. Providing valuable feedback	15 minutes
3. Jigsaw readings on assessment	30 minutes
4. Whole group sharing and application to Geospatial Inquiry Lessons	15 minutes

Preparation and Logistics

Your participants will need:

- ☐ Instructional Rubrics (Andrade, 2000) http://www.ascd.org/publications/educational-leadership/feb00/vol57/num05/Using-Rubrics-to-Promote-Thinking-and-Learning.aspx
- ☐ Attributes of Effective Formative Assessment (CCSO, 2008). https://web.archive.org/web/20160417100159/https://ccsso.org/Documents/2008/Attributes_of_Effective_2008.pdf

As the facilitator you will need:

- ☐ Read Teacher Guide, Implications for Teaching with Geospatial Inquiry, Providing Valuable Feedback;
- ☐ Read Instructional Rubrics (Andrade, 2000)
- ☐ Read Attributes of Effective Formative Assessment (CCSO, 2008)

Facilitation Notes

1. Consider the difference between assessment and grading (10 minutes)

Remind teachers to use their Teacher Lens. Ask teachers to individually jot their answer to the question in their **Teacher Guides page 4-11**– what is the difference between assessment and grading?

Explain they will now read an interview of teachers who struggled with this idea when implementing Geospatial Inquiry.

2. Providing Valuable Feedback (15 minutes)

Direct participants to read Providing Valuable Feedback in their **Teacher Guides page 4-12**. Invite them to highlight a few lines as they read and be prepared to share why they highlighted the lines with their small group. They will have 5 minutes to read and highlight and 10 minutes to share. Write the stop time on the board.

Ask participants to record their thoughts in their **Teacher Guide on page 4-14** following their small group discussion. How does this influence their Geospatial Inquiry Lesson?

3. Jigsaw readings on assessment (30 minutes)

Explain that it might be helpful to review some research on assessment to add to the group's thoughts thus far. Refer to directions in **Teacher Guide page 4-15**.

Invite participants to pair up and decide who is A and who is B. Explain:

- The A's will read about instructional rubrics (Andrade, 2000)
- The B's will read about effective attributes of formative assessment (CCSO, 2008).
- Individuals will have 10 minutes to read and identify key ideas.
- All the A's will convene and all will to convene to agree on the key points from each article.
- Teachers will find their original partners (to include one A and one B). Each will have 5 minutes to teach the key ideas from the articles to their partners, for a total of 10 minutes together.

Answer questions and write the stop times for individual reading, group sharing, and pair sharing on the board.

4. Whole group sharing and application to Geospatial Inquiry lessons (15 minutes)

Spend a few minutes sharing as a whole group. Record big ideas. Provide participants some time to record any thoughts they would like to capture that might impact their Geospatial Inquiry lessons in their **Teacher Guides on page 4-16.**

Notes on key ideas raised in the articles

Instructional Rubrics (Andrade, 2000):

- Instructional rubrics include two common features: a list of criteria and gradations of quality. Teachers often confuse checklists with rubrics. Checklists only detail criteria for an assignment.
- There are purposes and reasons to justify using instructional rubrics. Rubrics are: easy to use and explain, make expectations clear to students, provide students with formative feedback, support learning, skill development, understanding, and support good, critical thinking.
- Andrade (2000) suggests steps for creating an instructional rubric: 1. Examine previous student work models, 2. List criteria, 3. Pack and unpack criteria, 4. Articulate quality gradations, 5. Create a draft rubric, and 6. Revise the draft.
- Including students in designing rubrics, using thinking-centered criteria, and engaging students in self–and peer assessment can enhance student learning.

Attributes of Effective Formative Assessment (CCSO, 2008):

- Formative assessment should be organized to support a learning progression of sub goals toward conceptual understanding of a large learning goal
- Learning goals and criteria for success should be identified and communicated to students
- Teachers should provide descriptive, evidence-based feedback linked to outcomes and criteria for success
- Self and peer assessment promotion of metacognition
- Collaboration – partners in learning

4 CAREER SPOTLIGHT

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	**Career Spotlight**	Pedagogical Moves	Designing a Geospatial Inquiry	Metacognition & Evaluation

Summary

For this spotlight choose from a series of videos from ESRI and/or highlights from an interview with Sean McCartney, the Center lead of the NASA Develop program at Goddard Space Flight Center.

The videos and interview highlight spotlight how different career professionals use GIS technology for their work. The video and interview highlights are an opportunity to identify steps in the Geospatial Inquiry cycle in the workflow of GST professionals.

GOALS

Provide opportunities for teachers to:

- Experience a diversity of careers that use geospatial technologies
- Discover how and why professionals in STEM fields engage in Geospatial Inquiry
- Consider how they might introduce geospatial careers to students.

POD PRINCIPLES EMPHASIZED

- Engaging in Geospatial Inquiry and seeing how Geospatial Inquiry is used by professionals provides inspiration to enter **STEM careers**.
  - Highlight similarities between GIS Professionals' real life work, the Geospatial Inquiry participants experience, and the Geospatial Inquiries in which their students might engage

Outline (30 minutes)

1. Watch Video and/or read interview highlight	15 minutes
2. Small group sharing	10 minutes
3. Whole group sharing	10 minutes

Preparation and Logistics

As the facilitator you will need**:**

- ☐ Post the Geospatial Analysis Framework Chart
- ☐ Choose and prepare a video or prepare to use the Interview Highlight Reading (alternatively, allow participants to pair up and choose)

Video Links

ESRI Video Examples

Disaster Preparedness at the New Madrid Fault (3:00)

One of the largest regional exercises in the U.S., CAPSTONE 14 involved eight states exercising their preparedness to respond to a catastrophic disaster. Built on an actual historical event, the scenario centered around a massive earthquake on the New Madrid Fault in the nation's heartland.

http://www.esri.com/videos/watch?videoid=pZLgsGoksso&channelid=UCJ203R9PsZn6wF_zYfsp1SA&title=esri-case-study:-capstone-14

Lalitesh Kattragadda: Making Maps to Fight Disaster, Build Economies (5:26)

As of 2005, only 15 percent of the world was mapped. This slows the delivery of aid after a disaster -- and hides the economic potential of unused lands and unknown roads. In this short talk, Google's Lalitesh Katragadda demos Map Maker, a group map-making tool that people around the globe are using to map their world.

https://youtu.be/p_p-Ex5KR4g

Walgreens Case Study (4:44)
Learn how Walgreens uses a strategic geo-centric approach to think locationally.

http://www.esri.com/videos/watch?videoid=4630&channelid=LegacyVideo&isLegacy=true&title=walgreens

Bay Area Rapid Transit (BART) Case Study (3:52)
Leaders at California's Bay Area Rapid Transit (BART) describe how they move 450,000 commuters a day, safely and efficiently with GIS.

http://www.esri.com/videos/watch?videoid=I_8trRIzPlk&channelid=UCZTiOg3nopqUDSatq7mS2PA&title=esri-case-study:-bay-area-rapid-transit-(bart)

National Audubon Society Case Study (3:37)
The Audubon Society with State & Local Partners discuss their advanced collaboration for birds and for people.

http://www.esri.com/videos/watch?videoid=g8jVS19_1GA&channelid=UCZTiOg3nopqUDSatq7mS2PA&title=esri-case-study:-national-audubon-society

YouTube Video Examples

Bill Davenhall: - Where you Live (9:25)

Where you live impacts your health as much as diet and genes do, but it's not part of your medical records. In this TEDMed Video, Bill Davenhall shows how overlooked government geo-data (from local heart-attack rates to toxic dumpsite info) can mesh with mobile GPS apps to keep doctors in the loop. Call it "geo-medicine."

https://www.youtube.com/watch?v=62cNtvx6P8E&feature=youtu.be

Bernhard Seefeld – History and Future of Mapping (13:48)

Google Maps is aiming to publish the world's most comprehensive map. In this video, Bernhard Seefeld talks about how this enterprise is evolving and shares his thoughts on who will be doing the mapping in the future and what is driving that.

https://youtu.be/qtv69GRizl4

Greg Anser: Ecology from the Air: What are our Forests Really Made Of? (13:50)

From the air, ecologist Greg Asner uses a spectrometer and high-powered lasers to map nature in meticulous kaleidoscopic 3D detail -- what he calls "a very high-tech accounting system" of carbon. In this fascinating talk, Asner gives a clear message: To save our ecosystems, we need more data, gathered in new ways.

https://youtu.be/qCrVpRBBSvY

Facilitation Notes

1. Watch the video/ engage with the reading

(15 minutes)

Choose one of the videos and/or the interview in the Teacher Guide with highlights from an interview with Sean McCartney. The videos and interview highlight how different career professionals use GIS technology for their work. The video and interview selection are an opportunity to identify steps in the Geospatial Inquiry cycle in the workflow of GST professionals.

Ask participants to consider these questions as they view the video/read:

- How do the steps of the Geospatial Inquiry process compare to the workflow of these individuals/organizations?
- Can you identify any of the Geospatial Analysis Framework in the work of these individuals/organizations?
- How could you use this piece with your students to inspire them to pursue a STEM career?

2. Small group sharing (10 minutes)

Ask participants to share their answers to the questions in small groups.

3. Whole group share out (10 minutes)

Ask for volunteers to share what they discussed in small groups.

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4 PEDAGOGICAL MOVES TO SUPPORT GEOSPATIAL INQUIRY – SCAFFOLDING

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	**Pedagogical Moves**	Designing a Geospatial Inquiry	Metacognition & Evaluation

Summary

Effective Geospatial Inquiry requires thoughtful scaffolding to ensure student access to knowledge, and equity of ideas and participation. Presentation of concepts, technology skills, communication (talk and writing), and participation structures must be scaffolded. Participants consider ways we have scaffolded skills and knowledge throughout the Geospatial Inquiry.

Goals

Provide opportunities for teachers to:

- Consider the **scaffolds** provided throughout the Geospatial Inquiry which supported writing, academically productive talk, technology use, and participation in learning during the POD Teacher Workshop

POD Principles Emphasized

- Geospatial Inquiry is **iterative and sequenced over time** and employs technological and communication **scaffolds** to promote **conceptual understanding** of big disciplinary ideas.
- Geospatial Inquiry is **socially constructed**.

Outline (45 minutes)

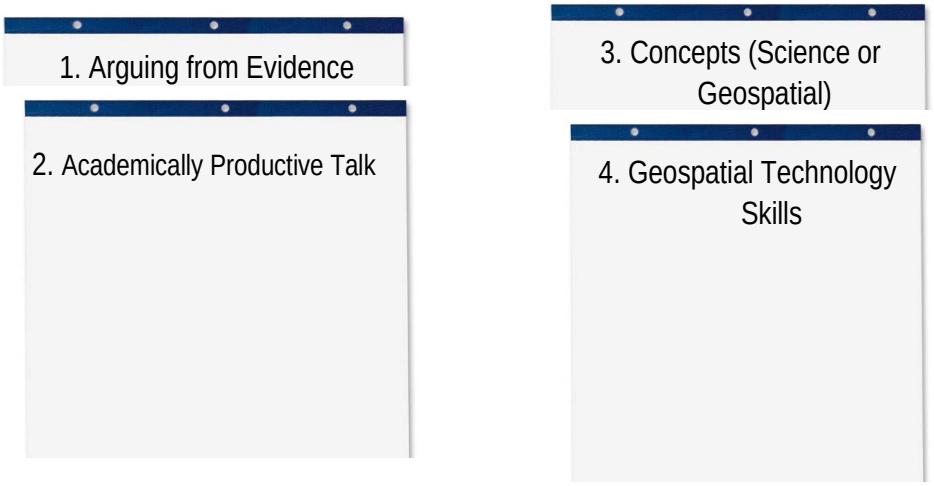
1.	Individual review and notation of scaffolding	10 minutes
2.	Discuss ideas at posters	15 minutes
3.	Visit remaining posters	15 minutes
4.	Whole group share out	5 minutes

Preparation and Logistics

As the facilitator you will need:

Charts

Create the following four charts on four large sheets of chart paper and post:



Facilitation Notes

1. Individually review and note scaffolding in POD Teacher Guide (10 minutes)
Remind participants to use a teacher lens.

Explain that effective Geospatial Inquiry requires thoughtful scaffolding to ensure student access to knowledge, and equity of ideas and participation. Throughout the workshop we have tried to model this.

Ask participants to count off around the room, 1-4 (e.g. 1, 2, 3, 4, 1, 2, 3…). Invite participants to remember their numbers. Point out the posters around the room that correspond with each number.

1. Arguing from Evidence
2. Academically Productive Talk
3. Science or Geospatial Concepts
4. Geospatial Technology Skills

Explain that based on their number, participants will individually spend 5 minutes reviewing the Teacher Guide and agenda to identify specific examples of how/when we have scaffolded, or supported, our presentation of science or geospatial concepts, geospatial technology skills, academically productive talk, or argument from evidence. They will jot these ideas on post it notes. Explain that after they have individually recorded ideas, they will join others with the same number at the appropriate poster. Ask for questions about the task. Write the stop time for individual work on the board.

2. Discuss ideas at posters. (15 minutes)

Call the attention of the group. Invite participants to join others with the same number at the appropriate poster. They will have 10 minutes to share their lists and record the ideas on the chart. Ask for questions about the task. Write the stop time for group work on the board.

3. Visit other posters. (15 minutes)

Call the attention of the group. Ask each group to move to the next poster in the room, clockwise. Explain they will have 3 minutes to read the list, discuss what others have posted and add at least one additional idea. Explain you will signal when to move to the next poster. They will end at their original poster so they can see what others added. Ask for questions about the task. Signal participants to shift. After 3 minutes, signal participants to shift. Repeat until groups are back at their starting poster.

4. Whole group share out (10 minutes)

Invite the group to share patterns they noticed or ideas that they found interesting. Were there any areas we could improve the scaffolds we provided?

<u>Scaffolds we intentionally provided/modeled throughout the workshop (not exhaustive):</u>

- Consistent structure of the Geospatial Inquiry process: predict, check, revise
- Claims, evidence, and reasoning (CER) prompts
- Rubrics for presentation and feedback (Literacy Design Collaborative -LDC)
- Role cards
- Technology use – easiest to more technical, Task Cards for reference
- Making thinking visible on posters
- Summary tables
- Geospatial Technology Session at a Glance
- Geospatial Technology and Science Review readings
- Varied participation structures (individual, team, small group, whole group)
- Talk Moves

4 DESIGNING A GEOSPATIAL INQUIRY

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Pedagogical Moves	**Designing a Geospatial Inquiry**	Metacognition & Evaluation

Summary

In light of this session's learning about assessment and scaffolds, participants return to their Geospatial Inquiry lessons and continue to revise.

Goals

Provide opportunities for teachers to continue planning for Geospatial Inquiry implementation to supplement an existing unit:

- Consider feasibility of teaching this unit within 6 months of the POD Teacher Workshop with data that is available
- Add technological and communication **scaffolds** to the Geospatial Inquiry lesson
- Revisit formative and summative assessments to ensure students receive **feedback** on ideas as they build **conceptual understanding**

POD Principles Emphasized

- Geospatial Inquiry is **iterative and sequenced over time** and employs technological and communication **scaffolds** to promote **conceptual understanding** of big disciplinary ideas.
- Geospatial Inquiry is **socially constructed**.

Outline (30 minutes)

1. Reminders of learning from the session	5 minutes
2. Individual work time to revise Geospatial Inquiry lessons	25 minutes

Preparation and Logistics

Your participants will need:

- Designing a Geospatial Inquiry – Geospatial Inquiry Template (digital copy saved in Session 2)

Facilitation Notes

1. Reminder of assessment, scaffolds, directions (5 minutes)

Explain that in light of this session's discussions on formative assessments, instructional rubrics, and scaffolds to support students, participants are encouraged to return to their Geospatial Inquiry templates and modify as needed. Encourage them to begin crafting a rubric.

Remind participants they will be expected to teach this lesson within 9 months of attending the POD Teacher Workshop. Ask them to reflect upon the challenges of finding appropriate data for their Geospatial Inquiry today. Encourage them to think about the feasibility of finding appropriate data to teach the lesson within 9 months. Explain we will provide time to search for existing data to support their lessons during Session 5, but they may need to modify their lessons if they experience challenges with data. Flexibility is key.

Invite participants to view the completed Geospatial Inquiry template for the POD Geospatial Inquiry on Hazard and Risk in their **Teacher Guide page 4-24** as an example.

2. Individual work on Geospatial Inquiry lessons (25 minutes)

Circulate and help as needed.

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4 METACOGNITION, EVALUATION & HOMEWORK

Welcome	Geospatial Inquiry	Implications for Teaching with Geospatial Inquiry	Career Spotlight	Pedagogical Moves	Designing a Geospatial Inquiry	**Metacognition Evaluation & Homework**

Summary

Participants review learning from the session, consider their own learning experiences, and how these experiences might influence their classroom practices. Finally, they provide some informal feedback to the facilitators and learn of the homework assignment.

Goals

Provide opportunities for teachers to engage in **reflective practice:**

- Review Science and Geospatial Technology learning from the session
- Contemplate how Geospatial Inquiry enhanced individual learning
- Consider ways to use Geospatial Inquiry in a classroom to enhance student learning

The purpose of informal evaluation is for you to gather feedback on the session to make adjustments as necessary for the next session.

POD Principles Emphasized

Geospatial Inquiry involves **reflective practice.** It starts from prior knowledge and experience and requires metacognition to support conceptual understanding.

Outline (10 minutes)

1. Individual reflection time	5 minutes
2. Explain homework, informal evaluation, preparation for next session	5 minutes

Preparation and Logistics

As the facilitator you will need:

- ☐ A plan for collecting feedback from participants. See Facilitator Community > Facilitation Resources > Resources and Handout Duplication Masters > Informal Evaluation/Feedback Ideas. https://app.box.com/s/xwrjouu2oy6hn0c1f0akmi1ftcaa75q2

Facilitation Notes

Ask participants to think about what they learned and process that learning for themselves.

Invite participants to read the following and respond to the prompts in their **Teacher Guides page 4-23**

- Science Session Review – Session 4
- Geospatial Technology Session Review – Session 4

There is no participant homework for Session 4. Ask participants to complete your informal evaluation task.

Facilitator Homework

Review Geospatial Inquiry Lesson Templates submitted and provide feedback.

Common pitfalls to look for in addition to those listed previously:

Activities included that are not directly related to helping a student address the guiding questions. Facilitation Notes

SESSION 5 FACILITATION NOTES FOR POD TEACHER WORKSHOP

Session 5 at a Glance – 7 hours

Welcome	Implications for Teaching with Geospatial Inquiry	POD Resources and Research Overview	Designing a Geospatial Inquiry	Celebration	GST Post Assessment	Final Workshop Evaluation
15 minutes	95 minutes	30 minutes	150 minutes	30 minutes	60 minutes	40 minutes

Visit http://www.pod-stem.org/facilitators-lounge/ to access this Facilitation Guide online. The password is imgeospatial

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5 WELCOME – SESSION 5

Welcome	Implications for Teaching with Geospatial Inquiry	POD Resources and Research Overview	Designing a Geospatial Inquiry	Celebration	GST Post Assessment	Final Workshop Evaluation

Summary

The Welcome is intended to welcome participants to learn, respond to the prior session's informal evaluation, answer questions about the Science and Geospatial Technology Session Reviews, and explain the agenda for Session 5.

Goals

Provide opportunities for teachers to:

- Hear group feedback from the prior session's informal evaluation and revisit working agreements as needed
- Ask questions about homework or prior session and draw upon these ideas to **construct meaning together** through **academically productive discourse** (talk)
- Preview the agenda for Session 4

POD Principles Emphasized

- Geospatial Inquiry is a **reflective practice**.
- Geospatial Inquiry is **socially constructed**.

Outline (15 minutes)

1.	Summarize comments and concerns from Session 4	10 minutes
2.	Preview agenda for Session 5	5 minutes

Preparation and Logistics

As facilitator, you will need:

- Reflections from informal evaluation – organized by highlights and areas of confusion so you can share with the participants
- Session 5 Agenda and goals

Charts

- Agenda for the Session
- Parking Lot for questions

Facilitation Tip:

Invite participants to sit in a new seat and exchange Role Cards to experience a new Role for this Session. This encourages participants to hear and consider new perspectives.

Facilitation Notes

1. Summarize comments and concerns from Session 4.
Review feedback received from Session 4. Address concerns.

2. Preview agenda.
Introduce the Session 5 Agenda. Give a brief preview of the activities.

5 IMPLICATIONS FOR TEACHING WITH GEOSPATIAL INQUIRY

Welcome	**Implications for Teaching with Geospatial Inquiry**	POD Resources and Research Overview	Designing a Geospatial Inquiry	Celebration	GST Post Assessment	Final Workshop Evaluation

Summary

Participants examine student work samples and reflect on important questions about teaching, learning, and assessment during a Geospatial Inquiry.

Goals

Provide opportunities for teachers to:

- Collaboratively examine student work to consider implications for teaching, learning, formative and summative assessment

POD Principles Emphasized

- Geospatial Inquiry is iterative and sequenced over time to promote **conceptual understanding** of big disciplinary ideas.
- Geospatial Inquiry is a **reflective practice.** It starts from prior knowledge and experience and requires metacognition in order to develop conceptual understanding.

Outline (95 minutes)

1.	Introducing the protocol	15 minutes
2.	Begin examining student work	70 minutes
3.	Share Implications, Reflect on the process	10 minutes

Preparation and Logistics

Your participants will need:

- ☐ Student work samples and teacher assignments –access in POD Organization

Pathogen Assignments and Student Work

- http://pod.maps.arcgis.com/home/item.html?id=df2618c1db104b9cb309a7f192751969
- http://pod.maps.arcgis.com/home/item.html?id=4ed67f53ff2c4e07892c20d1055821ec
- http://pod.maps.arcgis.com/home/item.html?id=0bb3740864ee4726bf66648ec054718b
- http://pod.maps.arcgis.com/home/item.html?id=063a2c66edcb413787eb90baf70f1afe
- http://pod.maps.arcgis.com/home/item.html?id=69f56e1447a741699a1dcc8f87a52909
- http://pod.maps.arcgis.com/home/item.html?id=34c8aa6726654c9db36b444aef83583f
- http://pod.maps.arcgis.com/home/item.html?id=87d8e04de1e94d239146be9dbc5da0f1

Power Plant Siting Assignment and Student Work

- http://pod.maps.arcgis.com/home/item.html?id=b09b24b3ef6f4dda882186945bd5b04d
- http://pod.maps.arcgis.com/home/item.html?id=d76255461e0a42b282c9bf5635a1a975
- http://pod.maps.arcgis.com/home/item.html?id=9dd7c65ed6554c609f04b8feb9ea5566
- http://pod.maps.arcgis.com/home/item.html?id=761cd1057c294a4492e6dea00b119b49

As the facilitator you will need:

- ☐ Prior to the workshop – review student work samples and Protocol process so you are somewhat familiar.

Facilitation Notes

1. Introducing the protocol – Looking at Student Work. (15 minutes)
Remind teachers to be using their Teacher Lens. Remind teachers of the difficulties surrounding assessment and the role of formative assessment from Session 4.

By looking at examples of student work, some of the challenges in assessing products of Geospatial Inquiry become evident.

Seeing student products can help us to reflect on the initial assignment given to students, the expectations and criteria for quality products, effective use of Geospatial Inquiry, and ways to assess student conceptual understanding.

Explain they will be using a protocol to examine some student work samples.

Explain there are two high school level assignments to choose from - a pathogen project with five student work samples, and a power plant siting project with three student work samples.

In the pathogen assignment, students investigated weather and climate conditions in different cities to study the spread of an unknown pathogen. In the power plant siting assignment, students were tasked with choosing the best site for a fossil fuel power plant.

Tell them that first you will share more information about the process, then you will demonstrate how to access the student work samples in the POD ORG. Then they will look at student work in small groups, and finally they will consider how they might revise their Geospatial Inquiry lessons in light of the experience.

Facilitation Tip:

It is ok if all groups choose the same example. The point is for them to examine real student work to generate discussions around teaching and learning. Feel free to bring in other examples if you have them.

Demonstrate how to access Student Work Samples in the POD Org and invite each small group to choose either the pathogen or power plant examples to examine. Provide 5 minutes for participants to read the description and the protocol steps in the Teacher Guide, page 5-4.

Remind teachers that regardless of the student work they choose to review, based on the protocol, they should all view all student work samples FIRST. They will view the Assignment(s) LAST, in Step 4. This may be a bit uncomfortable for teachers. Explain:

The structure is based on a Collaborative Assessment Conference (Seidel, 1998). They explain the ideas upon which the conference steps evolved:

- Students engage in problems based on their interests. Sometimes they interpret the problems the way the teacher has, but sometimes their interpretation differs.
- If we view the assignment prior to the work samples, it might influence what we notice in the student work.
- It is good for teachers to hear interpretations from those who are unfamiliar with their students and their learning goals. These outside perspectives help teachers reflect on teaching and learning.

Explain that you will serve as the facilitator for the process, so you will set a timer for each part of the protocol. Ask what questions they may have about the task.

> Facilitation Tip:
>
> Alternatively, ask one member of each small group to serve as the facilitator to keep the group on track and write the total time on the board.

2. Begin using the protocol to examine student work. (70 minutes)

Step 1. Explain that you will provide 10 minutes for individual silent review of the work. Encourage them to take notes as they review. Write the stop time on the board.

Call attention of the group and ask them to proceed with Step 2, describing the work. Remind participants to suspend judgment and if a judgment emerges, the group should ask for evidence from the work to support the judgment. Explain they will have 20 minutes to describe the work. Ask "what do you see?" and write the stop time on the board.

Call attention of the group and ask them to proceed with Step 3, speculating about what the student is working on. Invite them to make suggestions about the problems or issues that the student might have been focused on in carrying out the assignment. Write the stop time on the board.

Call attention of the group and ask them to proceed with Step 4, individually reviewing the assignment and criteria for success that are posted. Invite them to discuss in their small group. Write the stop time on the board.

Call attention of the group and ask them to proceed with Step 5, discussing implications for teaching and learning.

3. Share implications, reflect on the Collaborative Assessment Conference experience and consider how it may influence your Geospatial Inquiry lesson (10 minutes)

Reconvene as a whole group. Invite groups to share what they discussed regarding implications for teaching and learning with Geospatial Inquiry. Chart the big ideas. Encourage participants to consider how this experience will influence their Geospatial Inquiry lessons, if at all. If the ideas on sample chart have not been addressed, bring them up.

Sample Chart:

Implications for Teaching and Learning with Geospatial Inquiry

- *Geospatial Inquiry should be conducted for a purpose: to solve a problem, explain a phenomenon or answer a question – students should know their goal*
- *Students need clarity – provide expectations and examples so students can produce quality evidence of learning*
- *Feedback should be provided early and often to check student understanding and help them revise their ideas (peer and teacher)*
- *Maps and visual representations are not enough. The visuals should support a written argument or explanation.*
- *Geospatial technologies should only be used if they add value to the lesson*
- *Looking at student work helps craft clear assignments and rubrics for assessment*

5 POD RESEARCH OVERVIEW

Welcome	Implications for Teaching with Geospatial Inquiry	**POD Resources and Research Overview**	Designing a Geospatial Inquiry	Celebration	GST Post Assessment	Final Workshop Evaluation

Summary

Teacher participation is essential to meeting the research goals of the POD project. Meeting these goals will help the POD team measure student interest, awareness, and attitude toward STEM careers as it exists before and after participating in Geospatial Inquiry lessons implemented by the teachers from your Teacher Workshops.

Goals

Provide opportunities for teachers to:

- Recognize the importance of researching the factors that help students develop interest in and/or awareness of STEM and geospatial technology careers.
- Clarify their role in the research portion of the POD project
- Clarify the research timeline and responsibilities for implementation and data collection

Outline (30 minutes)

1. Walk through the Teacher Research Kit	30 minutes

Preparation and Logistics

Your participants will need:

- ☐ POD Research Kit for Teachers, http://www.pod-stem.org/teachers-lounge/ password is imgeospatial2 >Teacher Research Toolkit Resources > Files http://www.pod-stem.org/wp-content/uploads/2016/06/Teacher-Research-Kit.pdf

As the facilitator you will need:

- ☐ Access to YouTube
- ☐ Projector
- ☐ Before you begin this session, please familiarize yourself with the **POD Research Kit for Teachers.** Part of your responsibility as facilitator is to be certain teachers are aware of the requirements and final deadlines for what is required of teachers before stipends will be distributed.
- ☐ POD Story Map http://arcg.is/2hG3jKL
- ☐ Video from the Research POD Team

Facilitation Tip:

Consider how your teacher workshop participants will be viewing the document.

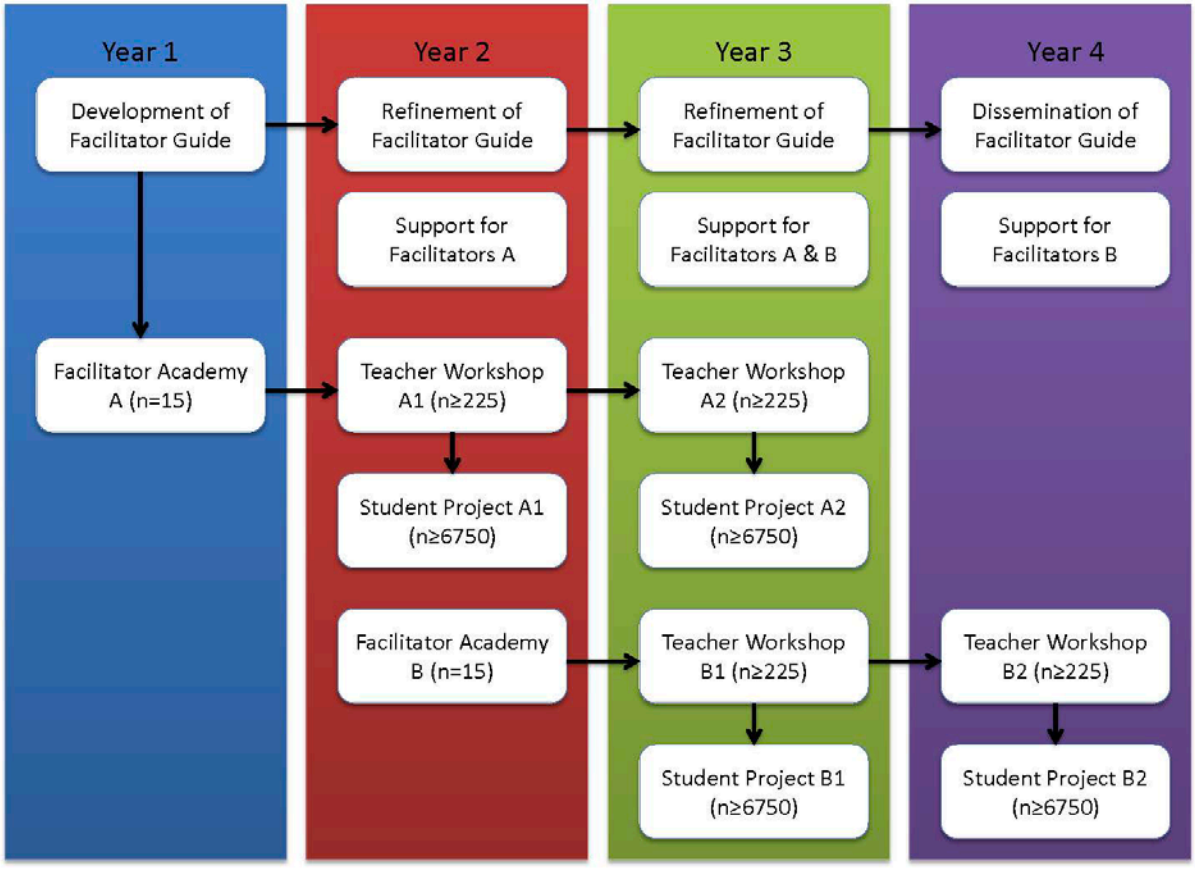
- Will they have a paper copy of the **POD Research Kit for Teachers**?
- Will they be looking at this document in a digital format?

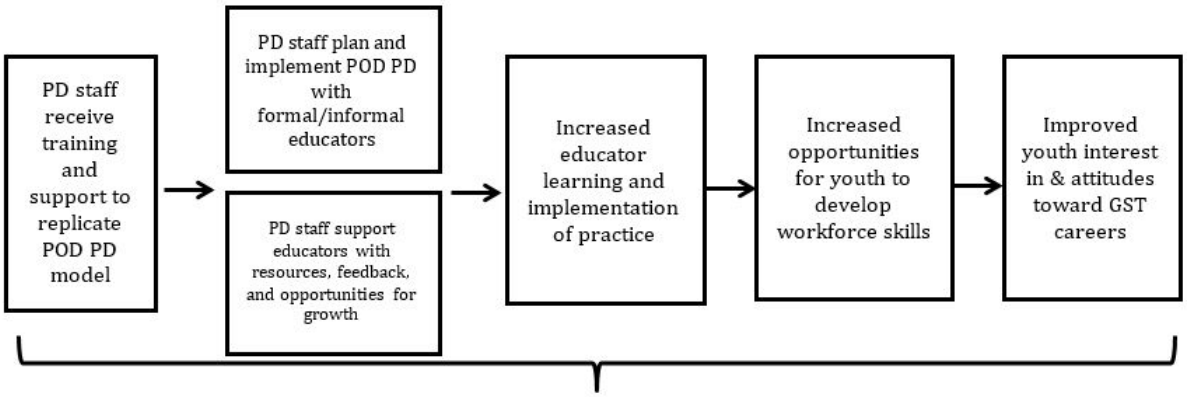
Facilitation Notes

1. Teacher Research Kit (30 minutes)

Explain that NSF funded the POD project so we could conduct research on the transferability of the POD PD model to new contexts. During the next 30 minutes, you will go over the expectations for implementation and data collection, collect required paperwork.

You may choose to explain the research by displaying the following visual representations.





Proposed model for investigating the links between professional development and student interest and attitudes in GST careers.

Additionally, you may choose to show the POD story map to reinforce definition of Research Role of Teachers.

Direct participants attention to the **POD Research Kit for Teachers** (www.pod-stem.org> Current POD Teachers >Teacher Research Toolkit Resources > Files; http://www.pod-stem.org/wp-content/uploads/2016/06/Teacher-Research-Kit.pdf). Go over each step, and encourage participants to highlight or circle the column headers as you review the schedule table.

Demonstrate where participants can find the Research Kit at http://www.pod-stem.org/teachers-lounge/ >Teacher Research Toolkit Resources > Files, and the parent email forms in both English and Spanish, copies of handouts, and links to online surveys.

Note the following:

- Direct special attention to the *Time Point*, *Final Deadline*, and *Who Submits* columns.
- Go over payment details and dates.
    - Be certain to clarify that stipends will be processed and distributed upon receipt of data collected within the timeframe listed in the final deadline column of the schedule for teacher data collection.

- It is a good idea to use language like, "Your second stipend will not be distributed until…"

- If teachers have questions or need support, they may contact you or the POD team directly.

- Explain that the POD project received exempt status from our university's Institutional Review Board (a committee formally designated to approve, monitor, and review research involving humans). Unless required by the school or district, attaining permission for participation from students and parents is NOT required. However, some schools and districts have their own policies. If teachers are working in districts or schools that require their own Intuitional Review Board approval for student participation, they should let you know ASAP so that you can provide the POD Team with contact information for that site.
  - Keep a list of schools/districts that will need follow-up in this area and let us know so that we can assist in the process (use template below).

List of teachers working in districts that require IRB for student participation in data collection.

Facilitator Name:		
Teacher Name	**District Name**	**District Contact Phone Number**

  - Parents must be sent an email from the teacher notifying them of the study and giving them the option to opt-out their student. A copy of the text for these emails is provided in both

English and Spanish in http://www.pod-stem.org/teachers-lounge/ > Teacher Research Toolkit > Files.

- Only one source of data, a retrospective survey, will be collected from the students. A link to the survey is provided in http://www.pod-stem.org/teachers-lounge/ > Teacher Research Toolkit > Files. As part of the survey students will also be given the option to opt-out of the study. Students will enter their teacher name, their own initials, and their birth date as an identifier. Following completion of the survey, students will be assigned a code and the surveys will be blinded.
- A small portion (10%) of teachers will be video-taped. These videos are to focus on the teacher during the lesson and will be blinded and stored securely once received.

Finally, take some time to answer questions from your POD Teacher Workshop participants.

5 DESIGNING A GEOSPATIAL INQUIRY

Welcome	Implications for Teaching with Geospatial Inquiry	POD Resources and Research Overview	**Designing a Geospatial Inquiry**	Celebration	GST Post Assessment	Final Workshop Evaluation

Summary

Participants finalize their Geospatial Inquiry Templates in light of the four sessions of learning. This session is intended to introduce resources and provide teachers time to plan how they will integrate Geospatial Inquiry into an existing class.

Goals

Provide opportunities for teachers to:

- Become familiarized with resources on www.pod-stem.org
- Compile a list of useful search terms from ArcGIS Online, Living Atlas, etc. for the Geospatial Inquiry lesson
- Curate geospatial data layers and maps students can analyze in the Geospatial Inquiry lesson in a personal folder on POD Organization Account

POD Principles Emphasized

- Geospatial technologies are **tools** which enhance the ability to make sense of **relationships and patterns** in geospatial data and to create **visual** evidence to support written arguments.
- Geospatial Inquiry employs **technological scaffolds** to promote **conceptual understanding** of big disciplinary ideas.

Outline (150 minutes)

1.	Reviewing Lesson Resources	15 minutes
2.	Other Resources	30 minutes
3.	Individual Work Time	105 minutes

Preparation and Logistics

Your participants will need:

- ☐ Designing a Geospatial Inquiry – Geospatial Inquiry Template (digital copy saved in Session 2)
- ☐ Teacher Resources on POD-STEM.org - http://www.pod-stem.org/more/

As the facilitator you will need:

- ☐ Familiarize yourself with Teacher Resources on POD-STEM.org - http://www.pod-stem.org/more/
- ☐ Note these are subject to change

Facilitation Notes

1. Reviewing Lesson Resources (15 minutes)

Explain that they have spent the workshop planning a Geospatial Inquiry and may be worried about data. You will share with them resources that already exist that they can borrow to use in their lessons, and identify datasets using the tools they have learned for any lessons that do not already exist.

Explain we started our entire Geospatial Inquiry on Hazards and Risk with Cracked Plates from GeoInquiries. It was originally a 15 minute lesson. We expanded from there. They can do the same.

Explain you will do an overview of the resources that will support them as they plan and implement Geospatial Inquiry lessons, then they will have the remainder of time to plan.

Demonstrate of the **Examples of lessons to modify** section of http://www.pod-stem.org/more/ and briefly summarize what they contain.

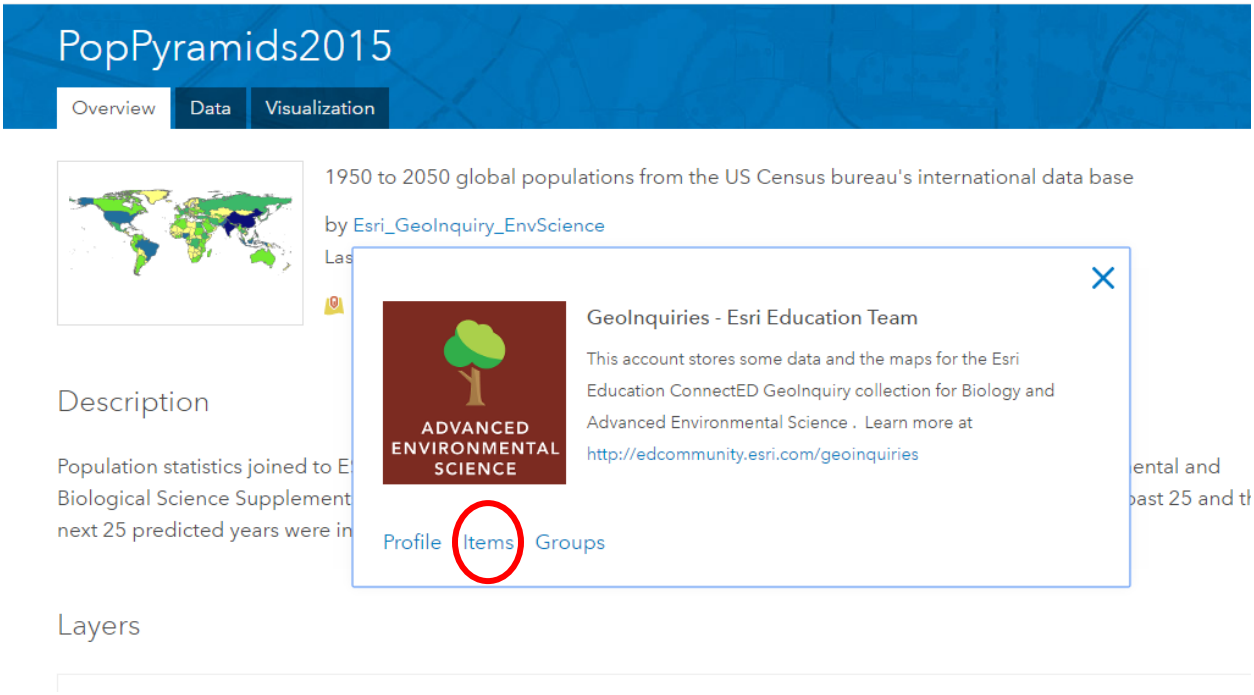
- GeoInquiries http://gisetc.com/geoinquiries/ - visit site to show titles under each category
    - AP Environmental Science
    - AP Human Geography
    - Earth Science
    - Grade 4 Interdisciplinary
    - US History
- Thinking Spatially using GIS http://gisetc.com/geoinquiries/
- Mapping Our World http://edcommunity.esri.com/Resources/Collections/mapping-our-world

Explain that although some of these are geared toward elementary students, the datasets are fantastic resources and can be used and modified to meet a teacher's needs.

Demonstrate by opening this GeoInquiry map:

http://education.maps.arcgis.com/home/webmap/viewer.html?webmap=c813649a1dae4ecbb7e6a51af015b0c9. Demonstrate how to view the author of the data.

- Click on "…" next to a layer listed in the Content Tab and select "Show Item Details"
- In our example, the first layer, *Annual % Growth Rate 2015* was authored by "Esri_GeoInquiry_EnvScience"
- Click on the author name next to "By" to display the author's Profile.
- Click on "Items" to view all Items by this author.



Here is a direct link to all items from Esri_GeoInquiry_EnvScience

http://education.maps.arcgis.com/home/search.html?q=owner:Esri_GeoInquiry_EnvScience

Here is a direct link to all items from Mapping Our World
http://www.arcgis.com/home/search.html?q=owner:MappingOurWorld

These were obtained using the process described above.

2. Other Resources (30 minutes)
Preview the following resources not directly related to planning lessons on http://www.pod-stem.org/more/

1. New to GIS In Education?

- **Sign up** for a powerful FREE ArGIS Online Organization Account here!

Explain that this link takes participants to Esri's site where they can obtain a free Organization Account. Remind participants they have been using the POD Organization account and will continue to use it for this project. Why might they want their own Organization accounts eventually? They will explore the benefits now.

Invite participants to read *Overview on ArcGIS Online Public and Organization Accounts*, in their **Teacher Guide page 5-10**. Spend a few moments discussing highlights below. Demonstrate if you have time and feel this is important for your group.

- Unique **SECURE LOGINS**
- Ability to create **CUSTOM APPLICATIONS** and Story Maps
- Create and manage **GROUPS** within the organization
- **HIGHLIGHT DIFFERENT SHARING PERMISSIONS (PUBLISHER, USER, ETC.).** Management capabilities allow an administrator to control the power of individual users and also limit the amount of data usage that users are allotted.
- **SPATIAL ANALYSIS FUNCTIONS** such as proximity, distance, find locations and density. There is also the ability to perform data enrichment which utilizes current demographic data to enrich data about certain locations.
- Access to "**PREMIUM CONTENT**", which includes various Esri hosted searchable map layers and Esri Living Atlas layers.
- **CUSTOM PORTAL** allows you to introduce your organization (your school, a specific project, or your school district) in a graphic way. The **HOME PAGE** serves as a starting point for your members.

Demonstrate where to find information and request an ORG for their school: http://www.esri.com/industries/education/software-bundle#

2. New to GIS in Education?

- **Getting Started with Online GIS for Educators:** A sequenced set of resources and activities from the Esri Education Team for those interested in teaching with GIS (https://esri.app.box.com/v/gettingstartedforeducators).

Point out the following resources related to Organization Accounts:

- #12, AGO Use Strategies
- #13, AGO Orgs for Schools
- #14, Request an ArcGIS Online Organization Account for the School

3. Esri Resources for ArcGIS Online and Esri ArcGIS Tutorials

Explain these are resources teachers can use to brush up on ArcGIS Online technology skills. They will change as new resources become available.

- ArcGIS Book, is available in several formats. Anyone may download the interactive PDF (no charge).
- ArcGIS Online Organizations for Schools: A presentation describing ways K12 schools can set up free organizational accounts.
- GIS Dictionary: Definitions for GIS terms related to operations such as analysis, GIS modeling and web-based GIS, cartography, and Esri software.
- How to Teach with the ArcGIS Platform: Webinar demonstrating how to teach using the ArcGIS platform.
- Learn ArcGIS: guided lessons on real world issues.
- Learn the basics of GIS (For Secondary Students): Work with ArcGIS Online to interact with GIS maps, explore real world problems, and tell a story. Find out how workers use GIS and what it takes to become a GIS professional.

4. Other Resources

Explain there are many other resources including mobile apps, videos, career resources, GeoMentor programs, and general teaching resources on this site. We will continue to add them as we find them. Invite teachers to explore during their work time.

3. Individual work time (105 minutes)
Direct participants to work on their Geospatial Inquiry Templates. Help as needed. They should leave with data and maps in their folders in the POD Org.

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5 CELEBRATION

Welcome	Implications for Teaching with Geospatial Inquiry	POD Resources and Research Overview	Designing a Geospatial Inquiry	**Celebration**	GST Post Assessment	Final Workshop Evaluation

Outline (30 minutes)

1. Present Certificates	30 minutes

Preparation and Logistics

As the facilitator you will need

- ☐ Certificate paper
- ☐ Print certificates – one per participant.
    - o If you send us your list of participants at least two weeks prior to your POD Teacher Workshop we will send you a PDF of certificates you can print on certificate paper.
- ☐ Start with a pile of certificates. Flip one over. On the back of the certificate, place a post it note with the name of the next participant, not the person named on the certificate. Repeat with all certificates. Note: The last participant should have the first participant's certificate.

Facilitation Notes

Our friends at WestEd have a fun way to celebrate. You might like to use it. It's a nice way to honor the professional relationships and the learning community established throughout the Workshop.

Pass out certificates to the people **named on the post it notes**. They will not have their own certificates.

Facilitation Tip:

Don't let anyone leave! They will not be paid a stipend if we do not get their GST Post Assessment and Final POD Workshop Evaluation.

Model this process with a co-Facilitator if possible:

Say something about the person who will receive the certificate and present their certificate to them (*e.g. a specific encounter, how you enjoyed learning with them, a fun anecdote from the Workshop, etc.*).

Invite someone to begin. The volunteer will present the certificate to the participant named on the certificate. The participant receiving their certificate will then present the next certificate until all are distributed.

5 POST GST ASSESSMENT

Welcome	Implications for Teaching with Geospatial Inquiry	POD Resources and Research Overview	Designing a Geospatial Inquiry	Celebration	**GST Post Assessment**	Final Workshop Evaluation

Outline (60 minutes)

1. Complete Post Assessments 60 minutes

Preparation and Logistics

Your participants will need:

- ☐ Copies
  - 1 per person GST Post Assessment (www.pod-stem.org > Facilitation Resources > Resources and Handout Duplication Masters > Teacher Post GST Performance Assessment

Facilitation Notes

Explain to participants that they likely have increased their geospatial technology skills throughout the POD Teacher Workshop. We would like to capture that learning by re-administering the Geospatial Technology Performance Assessment they took during Session 1.

Explain that participants have 1 hour to complete the Post Assessment. They may use any resources they wish to complete the assessment including the internet, their teacher guides, and resources on pod-stem.org, but they must work alone. Whatever is finished at the end of the hour will be collected.

Provide one hour to complete the Post Assessment. Write the stop time on the board.

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5 FINAL EVALUATION – POST-WORKSHOP SURVEY

Welcome	Implications for Teaching with Geospatial Inquiry	POD Resources and Research Overview	Designing a Geospatial Inquiry	Celebration	GST Post Assessment	**Final Workshop Evaluation**

Outline (40 minutes)

1.	Thank you and next steps	10 minutes
2.	Administer Post Workshop Survey	30 minutes

Preparation and Logistics

Your participants will need:

- ☐ Post Workshop Survey: https://www5.nau.edu/selectsurvey/TakeSurvey.aspx?SurveyID=TWpost

Note: Links to all Online Surveys: http://www.pod-stem.org/wp-content/uploads/2016/05/Online-Data-Collection-Links-1.pdf

Facilitation Notes

1. Thank participants and next steps (10 minutes)

Ensure you have collected any forms you still need from your participants such as memoranda of understanding and stipend forms.

Thank participants for all their work. Remind them of your procedures for communicating with and supporting them as they implement their lessons.

2. Administer Post Workshop Survey (30 minutes)

Please administer the final POD Teacher Workshop evaluation. Provide 30 minutes for participants to compete the evaluation before they leave.

Thank you for all your hard work! You deserve a break. Take care of yourself!

Refer to Facilitator Research Kit for other tasks:

http://www.pod-stem.org/wp-content/uploads/2017/02/A-Facilitators-Research-Kit_2.15.2017.pdf