TOP | TRANSATLANTIC OUTREACH PROGRAM

TOP Fellow STEM Unit Completion Guide

OBJECTIVE:

Create a problem-based unit plan that will help your students learn STEM content alongside information about contemporary Germany. Your hands-on activities should incorporate STEM content, but the Phenomenon / Main Problem must have a strong connection to contemporary Germany. Use your study tour experiences for inspiration.

EQUITY CENTERED DESIGN:

As you design your inquiry, reflect on the following questions: Who are your students and what are their needs? How might this inquiry impact the following students: students of color, students who speak another language, LGBTQ students, students with disabilities, and undocumented students? Does your inquiry include their multiple perspectives? Whose narratives are missing or silenced? How are race, gender, class, etc. addressed in this inquiry? How can you make this inquiry more equity centered?

If you would like to learn more about Equity Centered Design, the K12 Lab at the Hasso Plattner Institute of Design at Stanford University offers many resources.

https://dschool.stanford.edu/resources/equity-centered-design-framework

Critical Lens Protocol:

https://dschool.stanford.edu/resources/criticallens
https://drive.google.com/uc?export=download&id=1CAW9yShYGVfqvvZMsLee8CopSUAqEguO

FORMATTING:

- Submit as a Word document (TOP Fellow STEM Unit Template).
- Produce one self-contained document that includes all handouts.
- Attach a PowerPoint presentation (optional).
- You are producing a professional document. Please treat it as such in regards to font, font size, and line spacing.
- Your lesson should be of appropriate length and detail so that it can be 'transferable' for use and adaptation by other educators.
- Include modifications that you would recommend to help differentiate for any students with special needs, English language learners, etc.
- Provide additional resources and links so that other educators can access helpful background information about the STEM content and about current-day Germany.
- If any resources, artifacts, materials, etc. are not accessible to all educators, identify alternatives that would allow access to similar resources. This is particularly important if technology is involved. Make sure that teachers who do not have access to those resources can also successfully facilitate this lesson with free or low-cost alternatives.
- All primary and secondary contributions must be properly sourced. Please consult APA Style® or the Purdue OWL: APA Formatting and Style Guide for information on proper citation.

TEMPLATE GUIDE:

Below is an example of the TOP Fellow STEM Unit Template, with instructions for what each element requires. You should use the separately provided TOP Fellow STEM Unit Template Word file to author your inquiry. The template includes all information and criteria necessary for other educators to use or adapt your lesson on contemporary Germany with their students. This template incorporates elements of the Engineering Design Process and the BSCS 5E Model. It will be helpful to know about these as you frame your lesson. **Please remember that the "5 Es" may appear more than once or may appear in a different order based on your specific inquiry.**

Full Name:
School Name and Full Address:
Preferred Email Address: one that you are comfortable with other teachers using if they want to reach out about your lesson.
Target Grade Span: Elementary (K-5), Middle (6-8), Secondary (9-12), or Post-Secondary
Target Grade Level: Please specify the grade level you think this lesson is most appropriate for.
Target Course(s): AP Biology, Physical Science, etc.
Unit Plan Title:
Lesson Overview: Introduce the main focus of this inquiry and how it connects to contemporary Germany. Include the specific phenomenon or scenario for the lesson. Briefly describe what your students will do to **engage** with this content, how your students will **explore** the concept, how your students will **explain** the concepts they explored, what students will do to **elaborate** on the concept, and finally how you will **evaluate** student learning. List specific evidence of student learning including types of assessments and modifications.
Teacher Background Information: Provide any information that would enable a teacher (perhaps unfamiliar with contemporary Germany or particular STEM disciplines) to facilitate this lesson. Briefly share relevant contextual information, list any prerequisite knowledge or concepts, and describe common misunderstandings that students may have about this topic. Be sure to explain how this lesson connects to current-day Germany.
Suggested Time Frame: Time needed for conducting this unit.
Concept List: List any concepts or vocabulary necessary for students to understand the content of the lesson.
Materials Needed: List of essential materials needed to teach the lesson and its components. If any resources, artifacts, materials, etc. are not accessible to all

educators, identify alternatives that would allow access to similar resources. This is particularly important with regard to technology. Suggest low-cost alternatives wherever possible.
Next Generation Science Standards (NGSS) / State Content Area Standards: List relevant content area standards required for your curriculum.
Key Literacy Connections: List corresponding literacy standards. *Example: CCSS.ELA-LITERACY.RH.9-10.9 Compare and contrast treatments of the same topic in several primary and secondary sources.*
Relevant Domain(s) of Disciplinary Core Ideas: Physical Sciences, Life Sciences, Earth and Space Sciences and/or Engineering, Technology and Applications of Science
Science and Engineering Practices: please list relevant science and engineering practices.
Crosscutting Concepts: please list relevant crosscutting concepts.
Outcomes for Student Learning: Include only key content concepts and skills from the lesson.
Germany-related Learning Goals: After students successfully complete this unit, describe exactly what they will be able to do (define, compare, synthesize…) in regard to a specific phenomenon or specific information about contemporary Germany.
Phenomenon / Main Problem: Identify and Define the phenomenon / Main Problem using language you would use with your students. Why is this problem important? (Make sure this problem/phenomenon is in some way connected to or relevant in current-day Germany.)
Engage: students' prior knowledge accessed and their interest engaged in the phenomenon. Introduce students to the Main Problem in a way that generates curiosity in the topic. Allow then to reflect on what they know and ask questions about what they don't yet know.
Anticipated Guiding Questions: Depending on the learning needs of your students you may need to provide these questions to guide their thinking. More advanced students can be prompted to develop their own guiding questions, but please list the questions you anticipate will help them address the phenomenon / main problem.

Explore: students participate in an activity that facilitates conceptual change.

How will students investigate the problem? What information will need to be gathered?

Design an activity that helps students complete a preliminary investigation of the problem. Provide reproducible activity sheets or graphic organizers that will help students document their learning. Include evaluative criteria for each task (rubrics, sample answers).

Featured Sources (APA citations): List possible data sources that students may reference as they explore and gather evidence that will help them master the content. Each Formative Assessment should have 1-3 disciplinary sources to help students build their understandings. Cite each source in APA format.

Explain: students generate an explanation of the phenomenon.

What are 2-3 possible solutions, including primary and alternative solutions, and the pros and cons of each?

Create a Prototype / Investigating Solutions: Does investigating the solution involve creating a prototype? If so, describe possible prototypes as well as procedures for creating and evaluating prototypes.

Elaborate - students' understanding of the phenomenon is challenged and deepened through new experiences.

Allow students to apply their understanding of the concept by conducting additional activities which connect the concept to other concepts and to themselves.

Design a hands-on activity that students can engage in after the lesson to address a related issue in their own school or community. The three activities described in this space represent a logic that asks students to a) **understand** the issues evident from the inquiry in a larger and/or current context, b) **assess** the relevance and impact of the issues, and c) **act** in ways that allow students to demonstrate agency in a real-world context.

Understand
Assess
Act

Evaluate: students assess their understanding of the phenomenon.

Each investigation ends with students successfully *communicating* and demonstrating their proposed solution to the Main Problem. Students will communicate their findings using *evidence* and *reasoning* to support their claims, or provide specifications to their final design solutions. Allow students to reflect upon and assess (potentially with a rubric) their investigative process.

Virtual Exchange: Propose extensions to this lesson that would enable it to be taught in a "virtual exchange" setting with a class of STEM (MINT) students in Germany.
Career Connection Exploration: Propose activities that would enable students to connect their investigation and solution to relevant career paths. Students should incorporate self- and peer-guided KSA (Knowledge, Skills, and Abilities) and/or SWOT (Strengths, Weaknesses, Opportunities, Threats) analyses into their career explorations. Where possible, students should include documentation of communication / interviews with community members who work in relevant fields. Explore whether job shadowing or 1-5 day mini internships might be possible in a relevant career field.
Modifications for Differentiation: Include modifications that you would recommend to help differentiate for any students with special needs, English language learners, etc.
Reflection on Equity Centered Design: Reflecting back on your finished inquiry, how would you evaluate yourself on the following scale in terms of your efforts to incorporate equity centered design? You may elect to check one of the boxes below or keep the answer to yourself and leave it blank. This question is intended to encourage self-reflection. ☐ 1- Satisfied ☐ 2- Somewhat satisfied ☐ 3- Neutral ☐ 4- Somewhat dissatisfied ☐ 5- Dissatisfied

Scoring Rubrics:

Content Standard

4 Advanced	3 Proficient	2 Partially Proficient	1 Beginning

Science and Engineering Practice

4 Advanced	3 Proficient	2 Partially Proficient	1 Beginning

Crosscutting Concept

4 Advanced	3 Proficient	2 Partially Proficient	1 Beginning

STEM Unit BluePrint:

Once you have completed your inquiry using the TOP Fellow STEM Inquiry Template, you should create a STEM Unit Blueprint to accompany your lesson. The blueprint template is included in the same word document as the inquiry template. Below is a guide for completing the blueprint, but the task essentially requires plugging in relevant elements of your inquiry from the full template to create a quick overview of the lesson that can be viewed on one page.

TITLE OF LESSON/INQUIRY	
Next Generation Science Standards (NGSS):	List all relevant Next Generation Science Standards.
Materials needed:	Briefly list of any materials that are needed (if none, delete this section).
Engage:	State the phenomenon/main problem.
Explore:	Briefly describe how students will investigate the problem.
Featured Sources:	List possible data sources that students may evaluate.
Explain:	List possible solutions to the phenomenon.
Create a Prototype:	Does investigating the solution involve creating a prototype? If so, list possible prototypes.
Elaborate:	Briefly describe the hands-on activity that students will engage in after the lesson to address a related issue in their own school or community. *Understand*: *Assess*: *Act*:
Evaluate:	Briefly describe how students will successfully *communicate* and *demonstrate* their proposed solution to the Main Problem and how students will assess their investigative process.

Parts of this problem-based unit plan format were adapted from the IDM Blueprint Template™ and Inquiry Design Model (IDM) – At a Glance™ (both by C3 Teachers' Grant,

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