**Karst Connection unit framework**

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| **Phases of the SSI instructional framework** | **Ways in which the phases of the SSI framework are enacted** | | **Learning outcomes** |
| **Teacher role** | **Student role** |
| **Encounter focal issue** | * Series of field trips and lessons that allow students to explore the local, place-based, socio-scientific issue (SSI) of a proposal to build a groundwater sourced ethanol plant in a karst ecosystem. Introduce science ideas as well as societal considerations. | * Explore the ethanol plant SSI * Science ideas   Water cycling  Nutrient cycling  Ecological interactions  Energy flow   * Societal concerns   Economics  Politics  Energy production and consumption  Alternative energy sources  Planning and zoning | * Awareness and understanding of the focal issue:   Should a groundwater-based ethanol plant be built in our community? |
| ***NGSS* connections** | * Anticipate, elicit, and address alternative conceptions about ideas:   Groundwater and aquifers  Surface and underground connections  Water cycling   * Create opportunities for students to experience the science phenomenon.   Extensive field trips  Watershed modeling  Water-quality monitoring   * Focus on science practice of modeling for emphasis throughout the unit. Secondary focus on argumentation. * Scaffold student engagement in the practice and support increasing competencies   Model my watershed  Pre/mid/post water cycle modeling   * Encourage students to reflect on their own thinking and practice.   Student learning logs  Small and large group discussions | * Explore content-specific science ideas from *NGSS* related to the ethanol plant proposal.   HS-LS1: Ethanol, water, sugar, chemical structures  HS-LS2: Biodiversity; nutrient, water, energy cycling  HS-LS4 and HS-ESS3: impacts of ethanol plant on karst ecosystem   * Reflect on broad, recurrent science ideas (i.e., crosscutting concepts) related to the focal issue:   Patterns  Cause and Effect  Systems and System Models  Energy and Matter  Stability and Change   * Engage in scientific modeling and argumentation practices that facilitates sense making   Model my watershed  Pre/mid/post water cycle modeling  Ethanol plant position project | * Understanding of science ideas.   Water Cycling  Nutrient Cycling  Ecological Interactions  Energy flow   * Students gain familiarity with modeling as a tool for their own sense-making as well as how they may be able to use this practice in conjunction with argumentation for communicating their ideas |
| **Socioscientific Reasoning**  **(SSR)** | * Create opportunities for students to confront issue complexity, multiple perspectives, needs for inquiry, bias, and the contributions and limitations of science.   SSR scenarios  Know my sources activities  Stakeholder discussion  Extensive field trips   * Support student reasoning practices.   Student Learning logs  Small and large group discussions   * Create opportunities for students to use media as critical consumers and producers.   Research for Summative presentations  Know my sources activities   * Scaffold media literacy practices among students. * Encourage students to consider how their emerging science ideas, science practices, and socio-scientific reasoning practices interact with their own beliefs and positions regarding the issue. * Create opportunities for students to consider their own beliefs and positions regarding the position. | * Engage in socioscientific reasoning, including:   Accounting for the inherent complexity of SSI  Analyzing issues from multiple perspectives  Identifying aspects of issues that are subject to ongoing inquiry  Employing skepticism in analysis of potentially biased information  Exploring the contributions and limitations of science relative to issue negotiation.   * Students use current media and information technologies to access, analyze, and share information and perspectives on the issue.   Research for summative presentations  Know my sources activities  Students reflect upon and refine their own beliefs and positions regarding the issue.  Student Learning Logs  Stakeholder discussions  Socrative Discussions | * Competencies for socio-scientific reasoning. * Competencies in media literacy. * Employing skepticism in analysis of potentially biased information |
| **Societal issues** | * Create opportunities for students to consider interconnections between the science surrounding the ethanol plant proposal with:   Planning and Zoning  Ethanol Subsidies  Eminent Domain  Rural Poverty | * Explore societal issues that shape decisions around the ethanol plant proposal * Utilize socio-scientific reasoning around the societal issues shaping the ethanol plant proposal. * Students reflect upon and refine their own beliefs and positions regarding the issue.   Student Learning Logs  Stakeholder discussions  Socrative Discussions | * Awareness and understanding of the focal issue. * Understandings of societal issues intertwined with science content and practices. * Competencies for socio-scientific reasoning. |
| **Synthesize ideas, practices and reasoning through an issue-focused culminating activity** | * Create an end-of-unit experience that challenges students to synthesize the science ideas they have learned while using scientific practices and socio-scientific reasoning. | * Synthesize and employ science ideas, scientific practices and socio-scientific reasoning in the creation of a product (e.g., poster) or performance event (e.g., public presentation).   Summative presentation to parents, administration, city leaders  Position statement on ethanol plant proposal | Use understandings of karst topography, hydrology, water and nutrient cycling, and ecological principals in conjunction with scientific modeling and argumentation to address our guiding question: Should a groundwater based ethanol plant be built in our community? |