**Karst Connection unit framework**

|  |  |  |
| --- | --- | --- |
| **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 cyclingNutrient cyclingEcological interactionsEnergy flow* Societal concerns

EconomicsPoliticsEnergy production and consumptionAlternative energy sourcesPlanning 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 aquifersSurface and underground connectionsWater cycling* Create opportunities for students to experience the science phenomenon.

Extensive field tripsWatershed modelingWater-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 watershedPre/mid/post water cycle modeling* Encourage students to reflect on their own thinking and practice.

Student learning logsSmall and large group discussions | * Explore content-specific science ideas from *NGSS* related to the ethanol plant proposal.

HS-LS1: Ethanol, water, sugar, chemical structuresHS-LS2: Biodiversity; nutrient, water, energy cyclingHS-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:

PatternsCause and EffectSystems and System ModelsEnergy and MatterStability and Change* Engage in scientific modeling and argumentation practices that facilitates sense making

Model my watershedPre/mid/post water cycle modelingEthanol plant position project | * Understanding of science ideas.

Water CyclingNutrient CyclingEcological InteractionsEnergy 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 scenariosKnow my sources activitiesStakeholder discussionExtensive field trips* Support student reasoning practices.

Student Learning logsSmall and large group discussions* Create opportunities for students to use media as critical consumers and producers.

Research for Summative presentationsKnow 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 SSIAnalyzing issues from multiple perspectivesIdentifying aspects of issues that are subject to ongoing inquiryEmploying skepticism in analysis of potentially biased informationExploring 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 presentationsKnow my sources activitiesStudents reflect upon and refine their own beliefs and positions regarding the issue.Student Learning LogsStakeholder discussionsSocrative 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 ZoningEthanol SubsidiesEminent DomainRural 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 LogsStakeholder discussionsSocrative 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 leadersPosition 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? |