Socio-Environmental Science Investigations Using the Geospatial Curriculum Approach with Web Geographical Information Systems

DRL #-1614216

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About Our Project

High school level socio-environmental science investigations (SESI) in the students' local community using a geospatial curriculum approach with STEM-related mentoring in high school classrooms comprised of under-represented students.

- Inquiry-based investigations
- Map-based mobile data collection
- Analysis with Web-based mapping software
- Pedagogical frameworks of place-based education and socio-scientific investigations
- Local issues & field work in the local setting

Research Goals

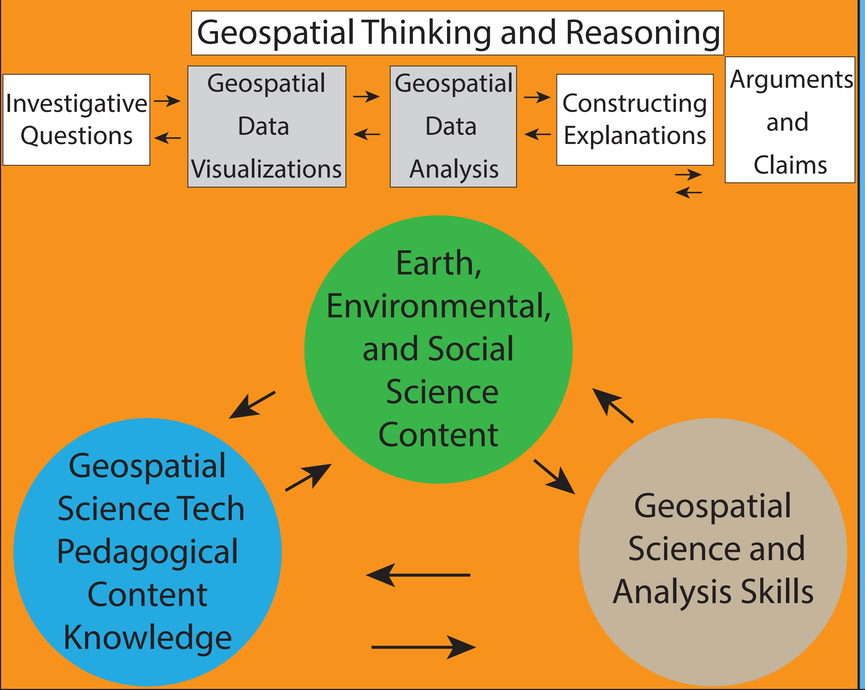
(1) Examine how SESI investigations and mentoring increase students' interest in STEM and their motivation to pursue STEM-related careers

(2) Analyze how the geospatial curriculum approach, when combined with STEM-related mentoring, can improve STEM-related skills with students from groups that are underrepresented in STEM.

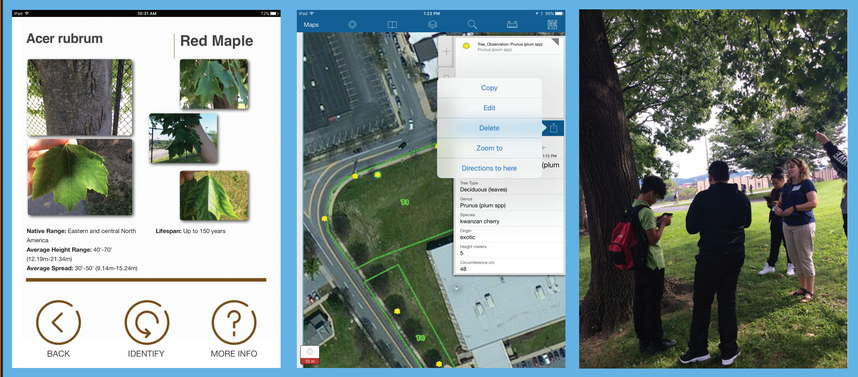
About Our School

- Public, urban high school
- 78% Hispanic or multi-racial
- All students receive free breakfast and lunch
- 44% Do not complete tasks and avoid challenging work, considered "unengaged learners"

Geospatial Curriculum Framework



Field Data Collection



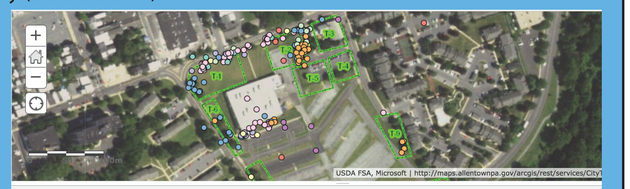
Examples of iPad student interface showing a custom tree identification iBook and Collector app interface. Also shown are students and a mentor collecting data in the field.

Classroom Data Analysis

Students are tasked with analyzing both freely available data and their own collected data. For example, Percent Tree Canopy, shown left, is freely available online.

*Tree Canopy Layers show regions of the city with high percentage of tree canopy (darker colors).

Students' observations create their own data layer. Each dot represents an individual student observation and each color identifies a unique tree species. Classroom cumulative data is displayed in WebGIS (shown above).



Tree Observations Social Studies Block 1 (Features: 68, Selected: 1)

Tree Type	Genus and Species	Common Name	Origin	Height meters	Circumference cm
Deciduous (leaves)	Malus spp.	Crabapple	native	4	54
Deciduous (leaves)	Platanus x acerifolia		native	10	146
Evergreen (needles)	Picea abies	Norway tree	native	16	108

Investigation Features

1) Students collect geospatial data in their local environment.
2) Students analyze data layers (both their own and others), using various tools and features in ArcGIS Online to explore patterns in the data.
3) Students identify and explain changes to the built environment to improve their city.

Findings

Three student attitudes and perceptions surveys were completed after the Trees and Ecological Services (TES), Urban Heat Islands (UHI), and Zoning Investigations.

	TES Average (SD)	UHI Average (SD)	Zoning Average (SD)
The material in the activities was clearly taught.	2.73 (.761)	2.86 (.747)	2.90 (.735)
I was motivated to learn during that investigation.	2.47 (.710)	2.45 (.859)	2.57 (.913)
I succeeded in learning to use the iPad for data collection.	2.90 (.784)	2.98 (.776)	2.93 (.815)
I was successful in learning to use ArcGIS online.	2.83 (.820)	2.88 (.808)	2.83 (.853)
I would like to use more maps and ArcGIS at school.	2.39 (.887)	2.40 (1.012)	2.49 (.948)
I am curious about jobs or careers that use maps and ArcGIS.	2.08 (.829)	1.93 (.849)	2.17 (.928)
The use of ArcGIS helped me to better understand my community.	2.47 (.891)	2.55 (.832)	2.66 (.890)

Note: 5 point Likert Scale survey from 1 = SD to 5 = SA

Students use GIS to develop a proposal to make a ward in their city more environmentally, socially, and economically sustainable.
A valid and reliable rubric was used to assess students' geospatial data analysis and geospatial reasoning skills.

Student Summary: Geospatial Data Analysis

Rating	Range	n (%)
Exemplary	8-9	8 (11.9%)
Proficient	5-7	31 (46.3%)
Adequate	2-4	22 (32.8%)
Needs Improvement	0-1	6 (9.0%)
Submitted Blank		10
Did not Submit		36

Student Summary: Geospatial Reasoning

Rating	Range	n (%)
Exemplary	8-9	6 (9.0%)
Proficient	5-7	14 (20.9%)
Adequate	2-4	30 (44.8%)
Needs Improvement	0-1	17 (25.3%)
Submitted Blank		10
Did not Submit		36

Acknowledgments

We would like to thank William Farina, Joan Fu, Sara Kangas, Robson Junior, Scott Rutzmoser, Dork Sahagian, Shannon Salter Burghardt, Ernesto Lopez, Elainea Horan, and Jim Novak for their assistance with this program. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF.