Expanding Socio-Environmental Science Investigations with Geospatial Technologies in High Schools

We scaled up a complicated project & it hasn't killed us ...yet

Tom Hammond, *Lehigh University* Kate Popejoy, *PopejoySTEM LLC*

On behalf of...

Curby Alexander, Judy Morrison, Jonah Firestone, Danielle Malone, Megan Richardson ...and far, far more

STELAR ITEST PI conference 3 November 2022



Our themes for today's panel, breakouts

How did you define scaling / expanding / iterating?

How did your project grow due to interaction with program officer?

Timelining our project: Precursor ITEST

August 2016 - July 2019

ITEST: Socio-Environmental Science Investigations (SESI)

1 university + 1 high school

Collaborative design, development, implementation, & refinement of geospatially-enhanced curriculum in 9th grade science & social studies classes

Technology used: Suite of tools built around ArcGIS Online



(for example, a curricular product might look like...)



Data collectors

Maps, data, analysis tools Instructional scaffolds

Macromolecules Dashboard



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→ Teacher professional development
Curriculum development
In-class instructional support for teachers
Outside data-gathering with students
Public presentations of student work

SESI curriculum design principles

- Focus on socioscientific issues--socially relevant, real-world problems
- 2. Engage in place-based education
- 3. Focus on inquiry-driven learning
- 4. Incorporate authentic data collection by students
- 5. Use geospatial technologies to promote geospatial thinking and reasoning
- 6. Require decision-making by students about the local community.

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(Collaborative, emergent curric. dev. process)



[Sample topics addressed thus far]

- Macromolecules investigation
- Invasive species study: Spotted lanternfly
- Trees & carbon investigation
- Classification of life (biotic / abiotic)
- Cultural heritage survey
- Mid-altitude global wind pattern experiment
- Trash investigation

Precursor ITEST \rightarrow **SEI version**

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June 2020 - May 2024

ITEST-SEI: SESI-ExpAND collaborative grant

3 universities: Lehigh, Texas Christian, Washington State Tri-Cities, plus...

6 high schools

...who choose which curricular areas & grade levels will receive geospatiallyenhanced curriculum

Scaling up...just a matter of numbers??



...but more complexity by school type!



comp. magnet



magnet comp.





Scaling / diffusing skill sets?



GIS use, administration geospatial integration in EnvSci tech ed, curriculum development collaborative partnership learning community high trust environment



Timelining: Notification of award



Timelining: Then everything changed...



Keeping the flying circus together

- So many meetings! Monthly cross-1. university, biweekly research team, university-school meetings...
- 2 Infrastructure: Calendars, Google Drives, biweekly cross-site newsletters, Slack
- So many Slack channels! By site, by 3. university, by topic, and by task.
- 4 Centralization of some functions: GIS support, statistician, IRB approval, & external evaluation all through Lehigh
- 5. "Flat" structure / low barriers – for example, leadership roles for doctoral students, teachers
- 6. FLEXIBILITY, GROWTH MINDSET



Psych Robotics CompSci

EnvSci Geography Earth & Space Chem SpEd

Returning to our themes for today

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Quantitative - Reach a 5x or 10x in terms of impact (had to scramble!)

Qualitative - New contexts

- Geographic locales
- School types
- Grade levels
- Curricular contexts

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How did your project grow due to interaction with program officer?

Drew attention to need for Research-Practice Partnership framework

 \rightarrow Conditions for successful collaborative partnerships

→ Attention to universities as contextual variables! Different resources, expectations, constraints