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

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

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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

NSF Awards 1949400, 1949393, & 1949388
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

- ArcGIS Field Maps app
- Survey123
- ArcGIS Online
- Data dashboards
- Story maps
- Instructional scaffolds
- Data collectors
- Maps, data, analysis tools
Data collectors

Maps, data, analysis tools

Instructional scaffolds

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

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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
SESII curriculum design principles

1. 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.
SESI curriculum design → development, implementation

1. Focus on socioscientific issues--socially relevant, real-world problems
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[ 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 → 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 geospatially-enhanced curriculum
Scaling up...just a matter of numbers??

Research-Practice Partnership

RPP 1

RPP 2

RPP 3
...but more complexity by school type!
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

Feb 2020
Timelining: Then everything changed...

Feb 2020

Mar 2020
Keeping the flying circus together

1. So many meetings! Monthly cross-university, biweekly research team, university-school meetings...
2. Infrastructure: Calendars, Google Drives, biweekly cross-site newsletters, Slack
3. So many Slack channels! By site, by 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
Returning to our themes for today

How did you define scaling / expanding / iterating?

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

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

Drew attention to need for Research-Practice Partnership framework

→ Conditions for successful collaborative partnerships

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