Participation of K-12 teachers and students in paleontology: Factors impacting effectiveness and sustainability

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Imagine a world in which every child has an experience doing science sometime during their school years....
....and what would be the impact on our field if many of those science experiences were paleontology?
Fossil Finders

...involves teachers and large numbers (~4000 in the testing phase) of students engaged in paleontological research, with scientists, that uses an online database

an education research project on the impact of research on teacher practice
increase human resources for the data-intensive needs of some kinds of paleontological research
students collect information on
- major taxon (brachiopods, bivalves, trilobites, etc.),
- size in two dimensions
- fragmentation & rock color (grayscale)

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<th>Measurements now made using calipers</th>
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Class Name: _____________________
Sample Number: ___________________
Subsample Number: ___________________
Rock Type (Shale/Limestone): ____________
Data Collected by: ___________________

Organism Type: Brachiopod

Length (A) | Width (B) | Coloration (1-5) | Fragmentation (1-5)
---|---|---|---
1 | | | |
2 | | | |
3 | | | |
Fossil Finders: Multiple stakeholders

- teachers
- students
- education researchers
- teacher development educators
- sample curator and distributor
- paleontologist researchers
- external evaluators: helping determine whether teaching practices and learning outcomes improve
Mastodon Matrix Project

Thousands of groups (~60% school classes) engaged in inventorying flora and fauna from site of Hyde Park mastodon excavation
Mastodon matrix project: Simpler, with fewer stakeholders

- teachers
- students
- sample curators and distributor
- paleontologist researchers
What are some of the elements of K-12 citizen science projects that are effective and sustainable?....
.... provide opportunities for student learning science through doing science

- aligned with “National Science Education Standards” inquiry practices (NRC 1996)
- and aligned with the new “Next Generation Science Standards” (NGSS) science practices (NRC 2013)
... facilitate **student learning** beyond that using more traditional approaches

- what learning objectives?
- how is it assessed?
...increase **student engagement** via **intrinsic interest** in fossils & **hands-on approach**

- “affective domain”
- ELL students (Meyer et al 2012)
- classrooms with underrepresented minority audiences (Harnik and Ross 2004)
.... improve **student motivation**, through the perception that they are helping scientists to do real research
satisfy teachers’ existing curricular needs more effectively than other potential activities
provide teacher experiences that foster complex science teaching skills
....verify through evaluation.

“opinionnaires”

interviews and roundtables

measurements

external evaluation
... offer education researcher opportunities to study the relationship between authentic science experiences and student and teacher learning

Capps and Crawford 2013 International J of Sci Ed
... offer paleontologists meaningful collections or data.

That is, paleontologists must:
- care about the data collected;
- be able to access the data easily;
- trust data was collected carefully;
- be able to use data in spite of some error;
- get the specimens back safely.

Data assessment is critical....
comparison median size of brachiopods in seven individual samples

student data give correlated, yet consistently higher, size values than the expert data
bivalve size distribution changes substantially from horizon 1 to 4
...incorporates timely feedback *between teachers and scientists*

- questions for researchers from teachers and students
- analysis of results from researchers
- feedback from researchers
- new research questions posed by teachers and students?
  - iterative process....
To make it work, identify your goals:

**education:**
- to provide an engaging educational experience?
- to meet “standards” or assessment goals?
- to improve teacher practice?

**research:**
- to gather or sort paleontological specimens?
- to collect exploratory scientific data?
- to solve an existing research problem with the collected data?
Resources and research exist....
What would we need to do to work together so that every child has an experience doing paleontology sometime during their school years....