Summer isn’t just for suntans. It is for research too!

Marty Buehler, Hastings High School

Connie High, Delton Kellogg High School
Where do you fall on the continuum?
Does your graph look like this?

http://fullonforward.blogspot.com/2013/02/give-shit-vs-age.html
Why do an RET?

Teaching is not just about the kids.

Teaching is also about your passion, your excitement, and leaving a lasting legacy.

Becoming a better classroom teacher.

Brings about a change in focus.
How it is useful for the classroom?

Comfort in Chaos

Students’ differentiation and interests.

Having the right answer is not always necessary.

Being a guide for support rather than the keeper of the knowledge.
Where are you on the progression?

1. Utilizing textbook and worksheets.
2. Demonstrations are done for the students.
3. Students replicate experiments.
4. Students perform investigations to create discoveries.
5. Students perform open-ended investigations to justify generated questions.
6. Students perform open-ended inquiries to answer questions based on
Connie's RET Experience

- Paid research experience lake sampling.
- Litchman Lab at Michigan State University’s Kellogg Biological Station.
- Lake Sampling of Lawrence Lake, Wintergreen and Gull Lake.
- Counting algal samples from Lake Baikal, Russia.
- K-12 Algae STEM Initiative
- Local Algae Identification
- Zooplankton Counts
- Lake Data
- Harmful Algal Blooms
- Research Counts
- Algae Kit Support
Summer Lake Study

Long Lake, Cloverdale, MI
Summer Lake Study

Students sampled twice a month May-September.

- Dissolved oxygen
- Temperature
- Nitrates
- Phosphates
- pH

- Local lake study was linked to local and great lakes issues and allowed students to connect with local lake associations.
Summer Lake Study Sample Data

Table 1: Temperature and depth data for Crooked Lake on 6-30-12.

<table>
<thead>
<tr>
<th>Temperature (C)</th>
<th>Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.5</td>
<td>-0.5</td>
</tr>
<tr>
<td>26.5</td>
<td>-1</td>
</tr>
<tr>
<td>26.5</td>
<td>-2</td>
</tr>
<tr>
<td>26.5</td>
<td>-3</td>
</tr>
<tr>
<td>26.5</td>
<td>-4</td>
</tr>
<tr>
<td>24</td>
<td>-5</td>
</tr>
<tr>
<td>20</td>
<td>-6</td>
</tr>
<tr>
<td>17</td>
<td>-7</td>
</tr>
<tr>
<td>13</td>
<td>-8</td>
</tr>
</tbody>
</table>

Figure 1: Temperature versus Depth graph for Crooked Lake on 6-30-12.
PCCI Watershed Tour

Science Strong by the Pierce Cedar Creek Institute

Starting at the Pierce Cedar Creek Institute, students sampled the water at various sites along the watershed ending at Lake Michigan on GVSU’s D.J. Angus.

* Gave students relevant field experience sampling and being in charge of site data.

* Ownership of site to tell the story of the data.

* Collaboration between students in Barry County.
PCCI Watershed Tour
General data:
- Elevation: 715 ft
- Current speed: 0.77 meters per second
- Cubic feet of flow: 246 cubic ft per second
- Width: ~30 meters
- Depth: ~5 ft

Observations: rocky bottom, accumulation of foam, a mild current, and many trees and vegetation.
## Covered Bridge, Ada

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Water Quality Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Temperature</td>
<td>24 °C</td>
<td>81</td>
</tr>
<tr>
<td>Dissolved Oxygen (%Saturation)</td>
<td>(77%)</td>
<td>85</td>
</tr>
<tr>
<td>Biological Oxygen Demand</td>
<td>4.6 mg/L</td>
<td>60</td>
</tr>
<tr>
<td>Nitrates</td>
<td>3.7 mg/L</td>
<td>55</td>
</tr>
<tr>
<td>Phosphates</td>
<td>0 mg/L</td>
<td>100</td>
</tr>
<tr>
<td>Turbidity</td>
<td>17.5 NTU</td>
<td>65</td>
</tr>
<tr>
<td>E. Coli</td>
<td>$10^3$ FC</td>
<td>22</td>
</tr>
<tr>
<td>pH</td>
<td>8</td>
<td>84</td>
</tr>
<tr>
<td>Total Solids</td>
<td>1,600 mg/L</td>
<td>20</td>
</tr>
</tbody>
</table>
# Data Table

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Q-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Saturation</td>
<td>80%</td>
<td>87</td>
</tr>
<tr>
<td>Nitrates</td>
<td>5.3 (mg/L)</td>
<td>91</td>
</tr>
<tr>
<td>Phosphates</td>
<td>.2 (mg/L)</td>
<td>93</td>
</tr>
<tr>
<td>E. Coli</td>
<td>0</td>
<td>98</td>
</tr>
<tr>
<td>pH</td>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>BOD</td>
<td>4.6 (mg/L)</td>
<td>70</td>
</tr>
</tbody>
</table>
Classroom and Collaboration

- Increase in inquiry.

- Collaboration between field stations, professors, and researchers.

- Connections for borrowing supplies and helping with materials.
Marty RET Experience

Alaska Toolik Summer Pluck-twice!
Costa Rica-Soils in the Rainforest
MSU- Teacher Plans for Climate change on plants with a Data Nugget

UVA Bellflower Experiments at PCCI.
Genetics Lab/Evolution of Raphanus with Dr. Connor-KBS and MSU

CSU Soil Institutes, Operation Wallacea

K College Teachers Research Associates Program
How it is good for kids

Content knowledge-personally-you bring back content to your classroom.

STORIES!- Example- The day the Earth hit 400. Where were you?

Connections-networking (for them in class and outside of class later opp.)

Get them started. I am able to bring my connections at MSU, CSU, UVA, WMU, Calvin, etc. into play for my students when they need mentoring, help, advice, equipment, etc. for a research project they are working on. Kids doing capstone projects, science fair entries, final AP projects, summer research, college work.......networking pays!
Students doing their own research.

Build a Legacy via your students lives. Your passion and experience can be the difference for their own research. Programs by you or with collaboration of a department can follow several models…..

VARIOUS MODELS

• Small group (1-3 students)
  • After school or meet as needed
• Full Program
  • Dedicated class time
  • Class meets each day for a full teaching period (40-45 min)
  • Teacher meets with each student every 2 weeks for a full period (Biweekly meeting)
• 10 hours of independent work for two weeks minimum
• Honors or AP credit
Science Fairs Can be a logical end goal.

Southwest Michigan Science & Engineering Fair (BCAMSC and KAMSC)
Science and Engineering Fair of Metropolitan Detroit
Flint Regional Science Fair
Michigan Science and Engineering Fair
Berrien County Regional Science Fair

How should a kid prepare? It is a progression.
Progression for a Sophomore (or maybe a junior)

Choose a Project topic, begin to narrow it.

Read literature, begin a notebook with citations

Present literature findings

Search for Mentor (another process!)

Set timeline & goals & hypothesis & maybe poster of proposal

Meet with Mentor, adjust proposal? and create a research start date

Good to complete ISEF forms (run the “wizard”)
YEAR PROGRESSION FOR A JUNIOR (OR SENIOR)

• Quarter 1
  • Analyze data and write results and conclusion
  • Complete paper (get scientist-mentor’s approval)
  • If they have data, enter competitions
  • Present their research to other students in a PowerPoint.

• Quarter 2
  • Work on competition entries
  • Continue to gather data and work with mentor (Juniors)

• Quarter 3
  • Work on competition poster or PowerPoint presentation
  • Gather data (Juniors)

• Quarter 4
  • ISEF forms, and administrative paperwork for summer (Juniors)
  • Present research in local symposium
AP Capstone can be an end goal too

What is it? 2 year program for students to go above and beyond doing research.

https://youtu.be/0aoEXEIQKTM

AP Seminar and AP Research:

AP Capstone™ is a College Board program that equips students with the independent research, collaborative teamwork, and communication skills that are increasingly valued by colleges. It cultivates curious, independent, and collaborative scholars and prepares them to make logical, evidence-based decisions.

AP Capstone is comprised of two AP courses — AP Seminar and AP Research — and is designed to complement and enhance the discipline-specific study in other AP courses. Participating schools can use the AP Capstone program to provide unique research opportunities for current AP students, or to expand access to AP by encouraging students to master the argument-based writing skills that the AP Capstone program develops.
AP Capstone cont.

AP Seminar (Year 1)
- Team Project & Presentation
- Individual Research-Based Essay & Presentation
- End-of-Course Exam

AP Research (Year 2)
- Academic Paper
- Presentation & Oral Defense

4 AP Courses & Exams (Taken at any point throughout high school)
Where do you find an RET/ Summer Program?
Biological Field Stations

http://www.kbs.msu.edu/

http://www.cedarcreekinstitute.org/CurrentResearch.html
Operation Wallacea [https://www.opwall.com/]
Summer Options Continued

Local Nature Centers

Internships paid or unpaid

Teacher development program
Sustain your passion - Where do you want it to be? It’s up to YOU!