



Divestment of College STEM Topics to High School Curriculum

Everett George (25-Apr-24)

card #1

Summary: Update high schools for computers on-line & in-class usage. Divest traditional college material for inclusion in high school curriculum.

- Eliminate compass & protractor Geometry; Add 1st year Calculus in 12th Grade.
- In Physical Sciences, add factor-label method of unit conversion calculations.
- Teach computer applications: coding, code modeling, web page design, CAD usage.
- Include Galileo Measurement of Gravitational Acceleration.
- Include lab experimental evaluations of Maxwell's Equations.
- Include lab experimental evaluation of Absolute Zero.
- Review / promote all STEM Careers for college-bound students.

Feedback: try different aspects of these proposed changes in different school districts. Obtain feedback, modify implementation & share solutions. Look for other areas of college knowledge to divest. Give high school graduates an informed choice for STEM careers.

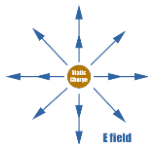


Real Examples: Maxwell's Equations in High School

Everett George (25-Apr-24)

card #2

Devise a set of science experiments that explain Maxwell's Equations. These experiments would target high school student & introduce Electro-magnetic (EM) Ideas with a historical write-up. Get feedback & modify set as needed ([eduDipole.pdf](#)).



#1) $\nabla \cdot \mathbf{E} = \rho/\epsilon_0$

Electrostatics – show the lines of force Faraday envisioned from a static electric charge. A generator could produce a negative charge on a group of threads for a visualized \mathbf{E} -field.

#2) $\nabla \cdot \mathbf{B} = 0$ & #4) $\oint (\mathbf{B} \cdot d\boldsymbol{\ell}) = \mu_0 I$ Magnetostatics – build a DC motor from a kit. Perform the dozens of windings around the rotor. Show why circular fields around a single wire promote windings forming a bar magnet ([eduEmotor.pdf](#)).



#3) $\oint (\mathbf{E} \cdot d\boldsymbol{\ell}) = - d\Phi_B/dt$

Induction – verify $V_s/n_s = V_p/n_p$ the Turns Ratio Formula. Plug a transformer into 110V AC & show voltage change by shunting the coils & measure with a light bulb or volt-ohm meter ([eduTRatio.pdf](#)).



Real Examples: Algebra Put to Practical Usage

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card #3

Algebra is the basis for many other branches of Math. Unfortunately, the fundamentals of Algebra are taught with no direct application. A problem:

Train A leaves Point A @ 9 AM traveling 50 mph toward Point B 300 miles away. Train B leaves Point B @ 10 AM traveling 60 mph toward Point A. When do the trains cross path?

The high school president/athlete/clown/cheerleader say to themselves:

When I want to know crap like that, I'll ask a Math teacher!

Physics / Trigonometry / Calculus combine for some **real** applications.

For, **Boyle's Law** in Scuba Diving. $V_1 \cdot P_1 = V_2 \cdot P_2$, In a standard tank & dive, Pressure (P_2) doubles, volume (V_2) of breath & time @ 33 ft (10 m) is halved.

For **Absolute Zero**, Nitrogen (N_2) @ 2 gm & 1 atm: Data #1 (1.6 L, 0°C) & Data #2 (1.717 L, 20°C) Then, Absolute Zero = $-1.6 \cdot (20-0) / (1.717-1.6) = -1.6 \cdot (170.9) = -273^\circ\text{C}$

Galileo's Artillery Equation for target @ distance (R): Angle $\theta = \frac{1}{2} \text{Asin}[gR/v_0^2]$



A Sincere Objective: Women & Minorities in Physics

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card #4

A **Primary** objective is to promote women & minorities in STEM. For discussion:

1. Women & minorities are different, address STEM jobs wrt to each.
2. Survey types of STEM jobs available to women & minorities.
3. Identify objective challenges for STEM educators & present solutions.
4. Do case studies, interview successful STEM women & minorities.
5. Survey successful life-long STEM mates for both hetero & LGBTQ.
6. Many minorities are bilingual. Survey STEM jobs that need bilingual.
7. Investigate “Die Rich” vs. “Leave the World Better” attitudes.
8. Show: “Science is a collection of good ideas from imperfect people.”
9. Show STEM Ethics, “Integrity, Honesty, Sincerity,” can be legally enforced.
10. Review morals of STEM Geniuses: “They are all human, imperfect, fallible.”
11. Show STEM pursuit of knowledge displaces drugs, gangs, crime, prison.
12. Put it in High Gear! Address Shakespeare vs. Galileo Celebrities.



Address Physics Hyperbole in Education - Section 1 of 2

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card #5

Present Supporting Data:

- Liberal Arts appears to portray Physics with a “too difficult” hyperbole!
- Galileo’s Grave (the most important guy in Florence) is an afterthought.
 - Graves of Galileo, Michelangelo, Rossini have about equal status.
 - Galileo’s tombstone emphasizes the telescope.
 - I’m not advocating Florence should change this historic tombstone.
- US grade school students graduate thinking Galileo is some esoteric thinker.
 - Shakespeare, Mark Twain, John Wayne are “heroes”.
- My website deliberately shows fault in:
 - Newton, Galileo, Faraday, Tycho, Kelvin; historians can find fault in anyone.
 - “Science is a collection of good ideals from imperfect people.”
- I skipped 12th Grade.
 - passing College American Lit was required for a high school diploma.
 - physical communication of the course & grade was required!!!



Address Physics Hyperbole in Education - Section 2 of 2

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card #6

Proposed solutions:

- Educate showing STEM practical worth & Literature (Lit) insight importance.
- Show faults in all scientific & liberal arts contributors as a matter of course.
 - not covering their contributions / faults diverts students from the fields.
 - indicate their personal faults, qualities of success, luck, childhood schooling.
 - show they were where the information was & took the effort to learn it.
- Gauge success of schooling in graduating students.
 - Galileo is orders of magnitude more important than Shakespeare.
- Have a traveling high school Physics lecturer with topic: Galileo, others w/feedback.
 - Have / show ramps mock-up of Galileo measuring acceleration.
 - demonstrate acceleration & per second per second concept.
- Have 4 high school experiments for the 4 Maxwell's Equations.
 - demystify analog electrical engineering; show college physics equations.
 - static electricity, DC electric motor, AC transformer, generator / motor.



Be Knowledgeable of Physics-Based Engineering Sectors

Everett George (25-Apr-24)

card #7

Point Physics students to mature Engineering fields when the student shows a Physics curiosity plus interest in mature technology implementation. If the student expresses:

- interests in traditional engineering hobbies and / or work history.
- moderate proficiency in Math & Science resulting in A-B grades.

Let them know of these fields of Applied Physics if they incorporate the listed interests:

- **Aeronautical Engineer (AE)**: has pilot's license, participates in model rocketry.
- **Civil Engineer (CE)**: installs plumbing, works in housing construction.
- **Electrical Engineer (EE)**: wires houses, codes computers, HAM radio operator.
- **Mechanical Engineer (ME)**: repairs cars or A/C units, installs plumbing, robotics.

Previously, Textile Engineering (partially a subset of ME) was popular in the US cotton belt. Before the Chernobyl Disaster (1986), Nuclear Engineering (partially a subset of ME) was offered. Check with your preferred college for a topic that motivates you to learn. I have education diversity: BS ME & MS Physics.