

# Science Overdrive: A K-8 & HS Collaboration



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## A lay of the land

Have you ever...(as a job)

- 1. Taught university Physics?
- 2. Taught high school Physics?
- 3. Taught middle school Physical Science?
- 4. Taught elementary school science/math?
- 5. (BONUS Q) Been unsatisfied with the level of interest and motivation in your classroom questioning your life choices and humanity as a whole?

# What is going on?

"Multilevel analyses showed that **first-grade** girls held a strong negative implicit attitude about math, despite no gender differences in math grades or self-reported (explicit) positivity about math." (Cvencek et. al., 2021)

Girls may learn math anxiety from female teachers

By Randolph E. Schmid, Associated Press

"...stereotypes are ingrained by second grade – before children even learn their multiplication tables..." (Meltzoff, 2017)

"80% of students make a conscious decision by 8th grade whether they think they are good at math and science; but it's important to note this decision is based on their perceptions of math and science and not their own ability..." (Gerlach article, 2023)

"But the exposure effect has a smaller positive impact on underrepresented minority students than on white and Asian students. Underrepresented minorities are also more likely to be influenced by early math achievement than are white or Asian students. Early math achievement influences students' belief that they can succeed in math, which, in turn, influences whether students choose to pursue STEM fields in college." (Wang, et.al., 2013)

## I miss being young and dumb

INTERNAL REVENUE SERVICE P. O. BOX 2508 CINCINNATI, OH 45201 Dear Applicant:

### Date: MAR 0 4 2010

#### SCIENCE OVERDRIVE

We are pleased to inform you that upon review of your application for tax exempt status we have determined that you are exempt from Federal income tax under section 501(c)(3) of the Internal Revenue Code. Contributions to you are deductible under section 170 of the Code. You are also qualified to receive tax deductible bequests, devises, transfers or gifts under section 2055, 2106 or 2522 of the Code. Because this letter could help resolve any questions regarding your exempt status, you should keep it in your permanent records.

Organizations exempt under section 501(c)(3) of the Code are further classified as either public charities or private foundations. We determined that you are a public charity under the Code section(s) listed in the heading of this letter.







### OVERDRIVE Mission & objectives

Science Overdrive aims to develop an interest in, and instill a passion for science through active collaboration between secondary science teachers and K-8 science teachers.

## **The Model**

- 3 high school (HS) teachers facilitate workshops for 25 elementary/middle (E/M) school teachers
  - SOL-based (narrowed based on need)
    - 3 or 4, 7.5-hour days\*

Objectives.



- (1) To provide teachers with a new depth of knowledge, increased self efficacy, and professional learning community.
- (2) To model lesson presentation and demonstrations that they may use in their own classroom. TEACHERS ALL RECEIVE CLASSROOM SETS (5-6 SET UPS) OF ALL ACTIVITIES.
- (3) E/M teachers collaborate; adapt lesson and activity for their students. (All presentations, worksheets, resources, etc. shared electronically)



Organizati		0			Facilitator	Sci content	Interest level for	Inc in confidenc	No./amou nt of new	Workshop as a total
on	Q of talks	activities	Q facilities	Relevance	S	learned	students	e level	ideas	package
4.95	4.93	4.98	4.95	4.67	4.98	4.62	4.86	4.5	4.79	4.9
0.05	0.07	0.02	0.05	0.37	0.02	0.34	0.13	0.3	0.22	0.14

2018 Workshop Data N=38 teachers ... 39,327 students





 "...it seemed a little heavy on the math above my students' heads." -5<sup>th</sup> grade Science, Math, Social Studies Teacher, 50 students

- "I truly appreciated your excitement towards the subject matter! It is very contagious. Besides learning science content, I learned pedagogy and that is just as valuable!" K-5 Science Teacher, 780 students
- "...I was a bit anxious @ the start thinking I wouldn't know enough science to get much out of this workshop & you guys put me at ease right away..." -5<sup>th</sup> grade Lang.Arts, Math, Science, History Teacher, 75 students
- "One of the best experiences as a teacher I have ever been a part of." –Science Teacher Specialist for Norfolk Public Schools, 34,000 students

## **Funding...our albatross**



### Student outcomes are linked to Teacher skills



- Content Mastery
  Understanding the Nature of Science
  Teacher Self-Efficacy
- Collaboration
- Mentoring

# •Personal Value and Equity for Students



# \* Workshop details

Workshop details: The four interactive and relaxed workshop days would cover the following topics: **Matter and Motion** (Day 1), **Forces and Energy** (day 2), **Waves: Sound and Light** (day 3); **Electricity and Magnetism** (day 4). These topics will both build and merge with each other. The scale will include examples from atoms to solar systems. Each workshop day follows a rough schedule outlined below. Some lessons activities will be longer or shorter depending on the content and the involvement of the activity.

- 8:30 8:45 Coffee & conversation/networking
- 8:45 9:30 Unit 1 Lesson (45 minutes)
- 9:30 10:15 Unit 1 activity (45 minutes)
- 10:15 10:30 Unit 1 Discussion (15 min)
- 10:30 10:45 Stretch break (15 min)
- 10:45 11:30 Unit 2 lesson (45 minutes)
- 11:30 12:30 Lunch (60 minutes), off-site options
- 12:30 1:15 Unit 2 activity (45 minutes)
- 1:15 1:30 Unit 2 Discussion (15 minutes)
- 1:30 2:15 Unit 3 Lesson (45 minutes)
- 2:15 2:30 Break (15 minutes)
- 2:30 3:00 Unit 3 activity (30 minutes)
- 3:00 3:15 Unit 3 discussion (15 minutes)
- 3:15 4:00 Collaboration and lesson development (45 minutes)



# \* Workshop details

Units for each topic are as follows:

- 1.Matter and Motion
  - 1. Temperature and phases of matter
  - 2. Displacement and Velocity
  - 3. Acceleration
- 2.Forces and Energy
  - 1. Newton's Laws of Motion
  - 2. Potential and Kinetic Energy
  - 3. Gravity
- 3.Waves
  - 1. Wave Phenomena
  - 2. Sound
  - 3. Light
- 4. Electricity and Magnetism
  - 1. Circuits
  - 2. Magnets
  - 3. Energy transformations (solar, chemical)

Kersey, A.J., Braham, E.J., Csumitta, K.D. *et al.* No intrinsic gender differences in children's earliest numerical abilities. *npj Science Learn* **3**, 12 (2018). https://doi.org/10.1038/s41539-018-0028-7

Kricheli-Katz, T., Regev, T. The effect of language on performance: do gendered languages fail women in maths?. *npj Sci. Learn.* **6**, 9 (2021). https://doi.org/10.1038/s41539-021-00087-7

Cvencek D, Brečić R, Gaćeša D, Meltzoff AN. Development of Math Attitudes and Math Self-Concepts: Gender Differences, Implicit-Explicit Dissociations, and Relations to Math Achievement. Child Dev. 2021 Sep;92(5):e940-e956. doi: 10.1111/cdev.13523. Epub 2021 Feb 19. PMID: 33605449.

Wang, X. (2013). Why Students Choose STEM Majors: Motivation, High School Learning, and Postsecondary Context of Support. American Educational Research Journal, 50(5), 1081–1121. https://doi.org/10.3102/0002831213488622 https://www.insidehighered.com/news/2013/10/01/study-finds-math-and-science-exposure-has-significant-impact-intent-study-stem

https://www.kpcc.org/2017-03-09/how-early-do-girls-decide-math-isn-t-for-them

https://everfi.com/infographic/k-12/is-stem-interest-fading-withstudents/#:~:text=80%25%20of%20students%20make%20a,and%20not%20their%20own%20ability.

Female teachers' math anxiety affects girls' math achievement <u>https://www.pnas.org/doi/10.1073/pnas.0910967107</u> (Beilock, et.al., 2010)



Office of \_\_\_\_\_\_



### WORKFORCE DEVELOPMENT FOR TEACHERS AND SCIENTISTS (WDTS)





Office of

Science



**COMMUNITY COLLEGE INTERNSHIPS (CCI)** 

LEARN, ENGAGE, GROW

Paid internships & technical training at a DOE laboratory/facility for community college students.

#### SCIENCE UNDERGRADUATE LABORATORY INTERNSHIPS (SULI)

Paid internships and research training at a DOE laboratory/facility for enrolled undergraduate students & recent graduates seeking STEM careers.

#### OFFICE OF SCIENCE GRADUATE STUDENT RESEARCH (SCGSR) PROGRAM

Provides supplemental funds for graduate students to conduct part of their thesis research at a host DOE laboratory/facility.

#### ALBERT EINSTEIN DISTINGUISHED EDUCATOR FELLOWSHIP (AEF) PROGRAM

STEM educators receive a generous living stipend to spend a year as a fellow in a federal agency or congressional office in Washington, DC, to promote STEM education policy, programs, and initiatives.

