



THE STATE OF AZ PHYSICS

A PRESENTATION FOR THE AZ-AAPT in September 2016
by Michael Vargas, Pinnacle High School, Phoenix

<http://education.azgovernor.gov/edu/blog/2016/09/why-arent-your-kids-taking-physics>



NUMBERS.....

- 6.7 million people live in Arizona, and $\frac{2}{3}$ of them live in Greater Phoenix.
- How many of these people are high school kids?
- * How many of these kids take high school physics?

THE NUMBERS

CURRENT 2015 ARIZONA DATA

-- numbers of
Arizona high school
students, teachers,
and high schools
(including charters)

AZ by the Numbers

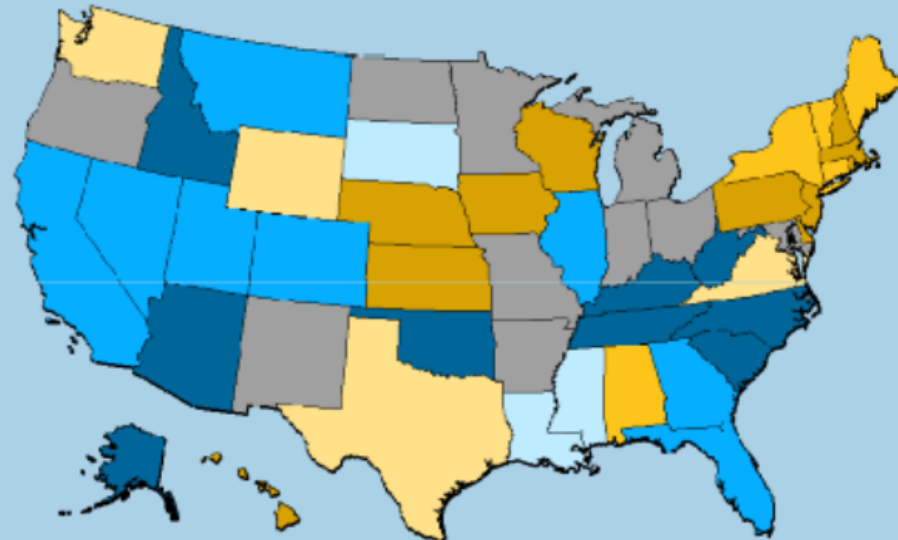
Districts	289
High Schools	519
Full-Time Teachers	13,365
Students Enrolled	343,161

200 district high schools serve about
85% of Arizona's high school kids.

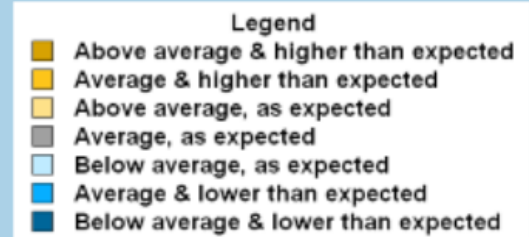
WE ARE AT HALF THE NATIONAL AVERAGE

Only 20% of high school kids in Greater Phoenix take physics.
(Nationwide, 40% do.)

Actual Availability of Physics in U.S. High Schools versus Expected Availability*, 2008-09

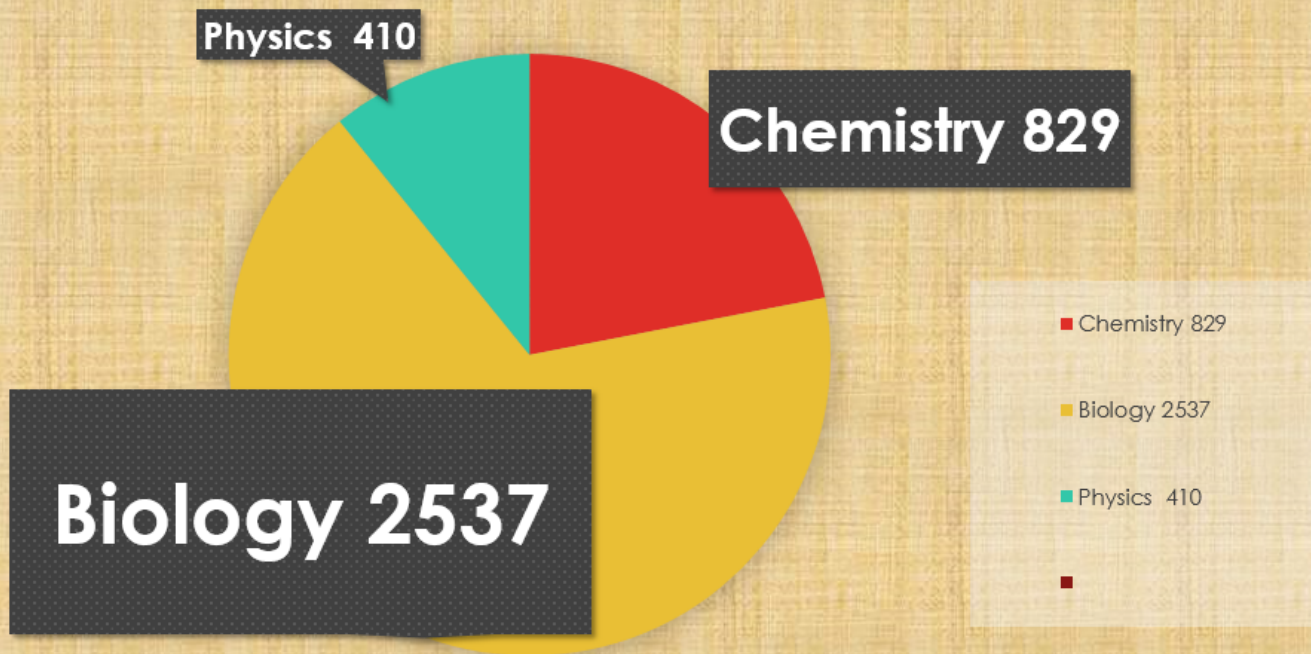


* Expected availability based upon enrollment factors (proportion of seniors in small and large schools) and proportion of seniors attending public schools.



<http://www.aip.org/statistics>

Current ADE Science Certificates

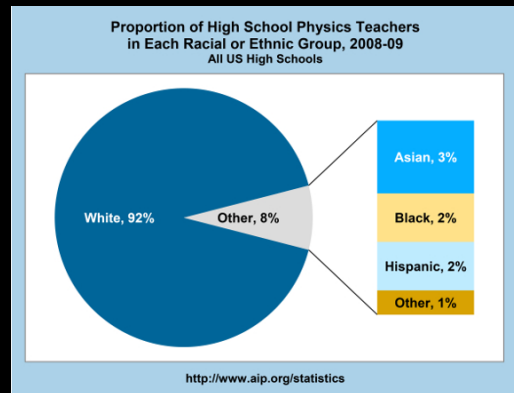




CURRENT STATE OF AZ PHYSICS TEACHERS

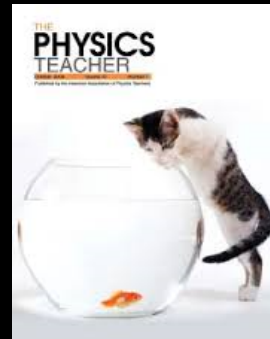
- 400 people in Arizona have a Physics certificate, according to the Arizona Department of Education, as of July 2015.
- Only 159 of them taught physics for a school district in AZ in 2015-2016.
- Fewer than 30% of them teach full loads daily of "physics only" classes.
- As a physics teacher in AZ, you are quite literally 1 in 100 for teachers and 1 for every 2000 high school kids.

WHO CARES ABOUT PHYSICS ANYWAY?



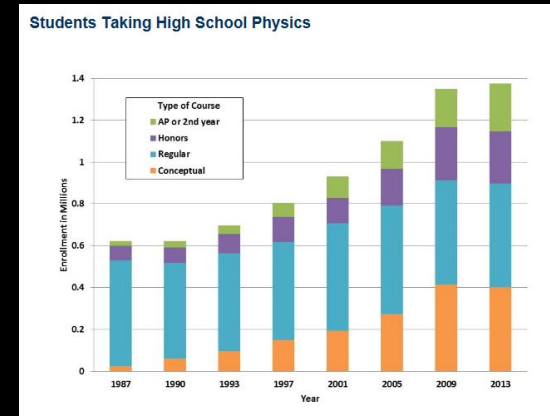
Physics is a 4th Math

RT-2-302-02 State Regulation states clearly that physics in HS can be used as a 4th year math class for graduation requirements.



Physics Makes You Smarter

Kids who take physics generally do better on tests and can think critically – more so than kids who don't.



Universities Want Kids Who Took HS Physics

Kids who take physics in HS look good for college admissions. Hence demand is growing..

Most STEM degrees want you to take at least one physics class.



Who cares? Position statement: National Alliance of Black School Educators

- Physics is a gateway course for post-secondary study in science, medicine, and engineering, as well as an essential component in the formation of students' scientific literacy. Physics classes hone thinking skills. An understanding of physics leads to a better understanding of other science disciplines. Physics classes help polish the skills needed to score well on the SAT and ACT.
- Nationwide, only 25% of Black and Hispanic high school students take any course in physics. Thus many do not even get to the gateway. ...



IT GETS WORSE:

- American colleges and universities produce only .5 (that's right, only a half) qualified physics teacher a year.
- Arizona's 3 universities produce a total of about 6 physics teachers yearly.
- 25 open positions for physics teachers in Greater Phoenix were advertised in spring 2016.
- Do the math; we are not replacing teachers fast enough, therefore many schools are dropping physics altogether and replacing it with people and programs that are less rigorous, like environmental science and forensics. Administrators can fudge certifications for these disciplines to fill classrooms with teachers. In physics you cannot.

The consequences:

- Only 10% of Hispanics and Blacks in Greater Phoenix take physics. The rest never get to the gateway, so they are locked out of college STEM majors and STEM careers.





WE NEED MORE TEACHERS FOR PHYSICS AND WE NEED THEM NOW

Business and Politicians

- These groups that govern have failed to realize that Physics is STEM!
- 60% of the new jobs in the 21st century will require skills possessed by 20% of the current workforce. No one has realized that these 20 percenters are the ones with physics skills.

Physics Teachers Are Not Social Studies Teachers

- The exam that physics teachers pass to teach is not the same as social science. Nor is the classwork for physics even remotely similar. No one is going to run that gauntlet to get certified unless MAJOR incentives are offered, including higher pay and student loan forgiveness. Hence that is why most new physics teachers take Title One school jobs, because these schools can offer student loan forgiveness.



MOVING FORWARD

- We must actively re-train science teachers already in service by any means possible.
- We must recruit new talent and retain aggressively the talent we still have left.
- Students and parents lack an understanding of why physics is important. They must be educated on why it is critical to tomorrow's job market.
- Administrators need to foster strong physics programs, while counselors and staff need to encourage students to enroll in physics, whether it is regular, honors, dual enrollment, AP-1,2, or C.



MOVING FORWARD: The Research

- ACT research shows that kids who take physics are twice as likely to be ready for college science. (Students who take physics in 9th grade are even more likely to succeed; however that is an entirely different presentation.)
- Thus ACT recommends a MINIMUM CORE curriculum that includes biology, chemistry, and **PHYSICS**.
- A college student who took high school physics is twice as likely to earn a STEM degree than a student whose highest high school course was chemistry.
- Therefore, to save physics in AZ, changes to the status quo must take place for our kids' sake. Teachers already in service must be recruited and fostered to teach physics. The fear of physics exists with not just kids and parents but teachers as well. That fear must be conquered if we are to prevent the further dumbing down of our science education.

WHAT WE ARE ASKING FOR:>

- The ultimate goal is to double the number of Arizona physics teachers in 5 years. Thus doubling the number of access of physics classes to Arizona HS kids.
- We have spoken to several Republican Senators and Reps, as well as the GOP Policy Advisor Matt Simon. We have recommendations that would be easy win- wins that would make a huge difference:
 - An amendment to the Arizona Commission for Postsecondary Education Math, Science, and Special Education Teacher Loan Forgiveness Program (MSSE) to include graduate credit for continuing teachers. Plus add emergency funding to make it happen.

The Mechanism For
Change Already
Exists. We just need
to amend it:

**The Arizona Commission for Postsecondary Education (ACPE)
Math, Science, and Special Education Teacher
Loan Forgiveness (MSSE) Program
FY 2014-2015 Annual Report**

Submitted December 1, 2015
Dr. April L. Osborn, Executive Director

Introduction and Description of the Program

The Math, Science, and Special Education Teacher Loan Forgiveness Program (MSSE) was created in 2007. This student-centered, need-based forgivable loan was designed to increase the number of math, science and special education teachers in the public K-12 system in Arizona by financially supporting and encouraging Arizona resident college students to pursue a teaching career in these identified high need fields and to remain in the State after graduation.

Forgivable loans are granted to eligible junior or senior students attending a qualifying public university or private college/university in the State to help defray the cost of tuition, fees and instructional materials. Additionally, students must complete the Free Application for Federal Student Aid (FAFSA). The maximum forgivable loan is \$7,000 per academic year for up to three years. To have the loan forgiven, students must sign a promissory note each year agreeing to teach in select subject areas (math, science, special education, or elementary education in a geographic area in the state experiencing a shortage of teachers) in a public K-12 school in Arizona for the number of years they received the loan funding plus one year. Students who do not meet the forgiveness criteria must repay the loan funds plus any interest.



SENATOR ALLEN NEEDS YOUR SUPPORT

- Senator Allen has agreed to introduce legislation to make this happen in the next session.
- We need more legislators to read the bill and support it.
- If this bill passes, it will help not only AZ physics teachers but all STEM teachers in Arizona in a cheap, cost effective form of human capital investment that will make a difference.

IMAGINE THIS:

- **We double the number of physics teachers in Arizona in 5 years.**
- We provide teachers access to professional development that already exists in Arizona and make these people more effective in their instruction.
- **The GOP can claim victory by increasing the number of students who are prepared for STEM careers in Arizona.**
- Arizona kids who want STEM majors in college are prepared and will have better chances at getting accepted. More kids at better schools – means more tax revenue as future professionals.



1990

THIS IS CHINA AND THE PROGRESS THEY ARE MAKING...



2010



HELP US FUEL OUR PROGRESS BY GETTING
KIDS ACCESS TO MORE SCIENCE AND MATH



THANK YOU

Information for this presentation comes from:

- Dr Jane Jackson – ASU Department of Physics, Modeling Instruction Program
- The AZ Department of Education
- Arizona Science Teachers Association

