“The "Manhattan Project" approach to development of STEM education”

http://www.cognisity.how/2016/11/4projects.html

Dr. Valentin Voroshilov

www.Cognisity.How

Professional experience and areas of expertise:

Teaching:

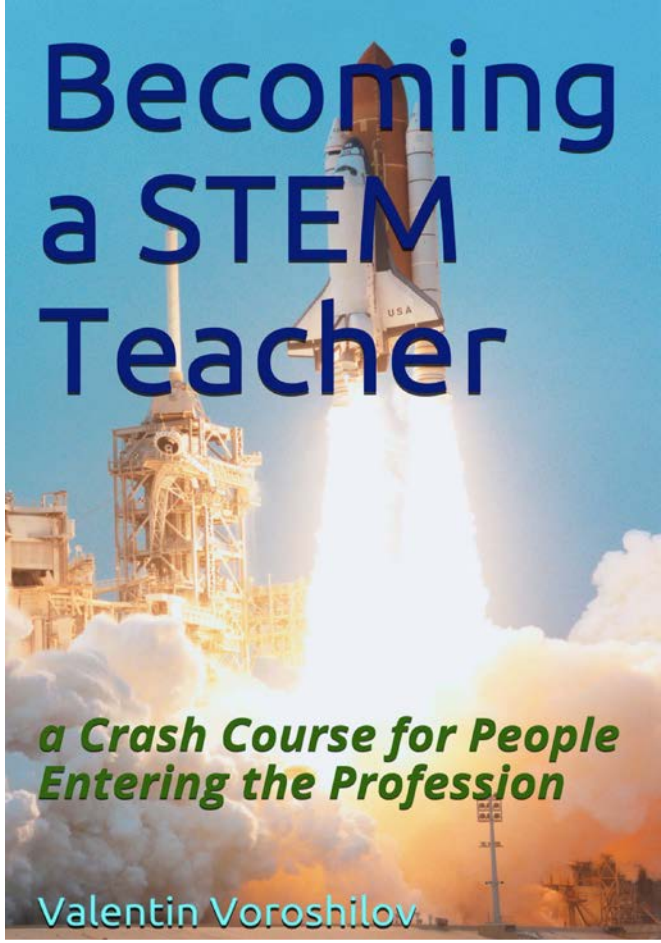
Algebra based physics
Calculus based physics
Physics for science teachers
Physics for students with learning disabilities

Algebra
Geometry
Trigonometry
Methods for teaching physics

Consulting:

Individual teachers
School administrators
District administrators
School and district teams of educators

on strategies and tactics for advancing teaching practices and improving learning outcomes.



1. Hello. I'm Dr. Valentin Voroshilov. My best recommendations come from my students. My resume, my experience, and philosophy are available online.

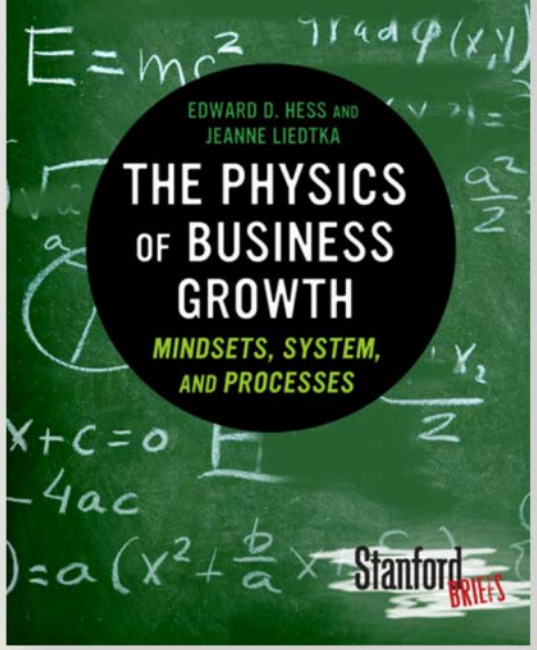
STEM education has become a priority for the government and the business community. I invite everyone to get involved into 4 educational projects. http://www.cognisity.how/2018/04/EdRole.html

1. Physics as an entry in STEM.

2. Universal scale for measuring content knowledge in physics as a primer for all STEM subjects.

3. Research facilities specifically designed to study learning and teaching processes.

4. Transforming teacher professional development from passive into active forms (“growing by doing”).



The Physics of Business Growth
Mindsets, System, and Processes

EDWARD D. HESS AND JEANNE LIEDTKA

Physics for Business Applications

Due to the persistent efforts of our former Chair, Professor Hans Bozler, the University of Southern California has been funded by the Alfred P. Sloan Foundation to create four new professional master's degrees in the sciences.

One of these four new programs is Physics for Business Applications which is designed for the physical sciences, mathematics, or engineering graduate who wants to pursue a career in management, consulting, and finance, rather than follow the traditional path of research and teaching. "We expect the physics-plus degree to be comparable to MBA and law degrees, but grounded in the tools and techniques of advanced technology," says Hans Bozler.

After first consulting and holding conferences with potential employers who have shown an interest in the hiring of our future Physics for Business Applications graduates, our department has designed a program which is interdisciplinary, hands-on (an internship is required), and designed to meet the demands of graduate students and employers. Professor Bozler explains, "We expect that the resulting professional master's degrees will be `high-valued' and will attract recent graduates as well as professionals already in commerce, government, and industry who perceive the need for more specialized training."

Organizational Physics

The Science of Growing a Business

MIT News Browse

Physics and business share a bond

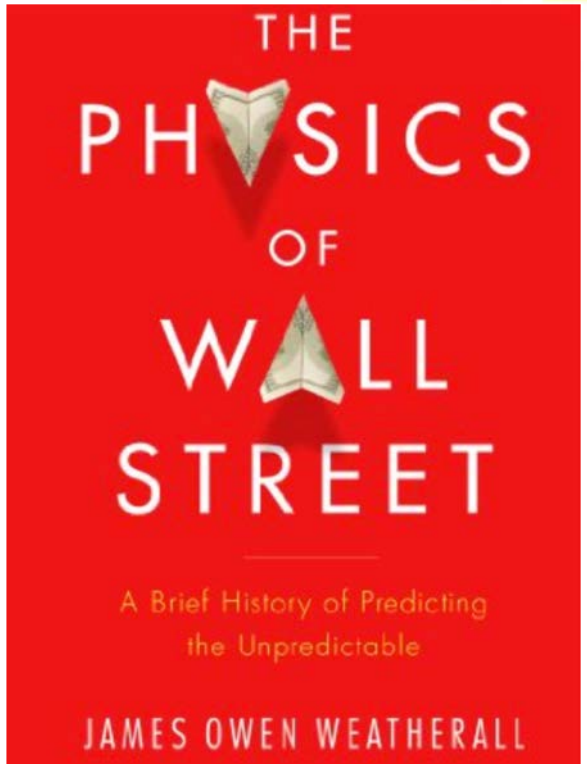
Sarah H. Wright, News Office
February 4, 2004

Press Inquiries

Having a physics degree from MIT can lead not only to a life in academia amid the joys of quantum physics–it can give you a leg up in the business world, as two alumni recently explained.

Jeff Evenson and Jeff Trester, who both received the S.B. in physics in 1988, use the tools of math and physics at work and relish the worldly success they found in business consulting and venture capitalism. They spoke in a Jan. 28 IAP session titled "Physics in Business: A Tale of Two Graduates and How They Made It Big in the Real World."

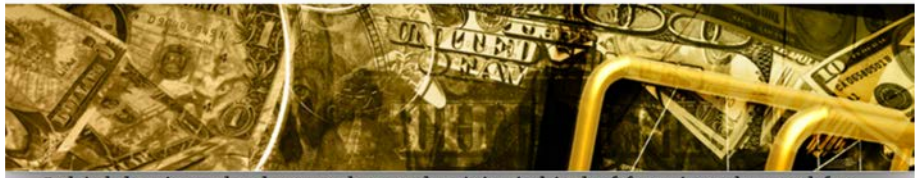
Evenson is a partner in the Boston office of the management consulting firm McKinsey & Co., heading the company's high-tech practice. Trester, co-founder and CEO of PriceScan.com, is a venture capitalist.



3. First to mention, of course, is applications of computational physics to business. There are books, articles, conferences.

What's a Physicist Doing on Wall Street?

Over a year ago by EMANUEL DERMAN



I think having a background as a physicist is kind of fortuitously good for people who work on Wall Street because there are a lot of fields that use mathematics, but physics is sort of the field *par excellence*. It has made the best use of mathematics. And I think physicists understand what's a really good theory and what's accurate and they also, in their every day life, work on models which are like approximations that give you some idea of the way something behaves. And they have a good sense for what's a good theory and what's a good model and where the boundary lies between them.

When Elon Musk was an undergraduate at the University of Pennsylvania, he pursued a dual degree in business and physics.

"It was an unusual combination," he told Physics World in 2007, "and I enjoyed the physics more. I'm not sure I would study business again if I could replay things."

The interest in physics was long in the making for Musk. He's said that he grew up in a "technical" household in South Africa, thanks

Elon Musk. Bill Pugliano / Getty

In recent years, many physics graduates have been recruited by the financial services sector; 18.3% of physics graduates who entered employment after leaving university in 2008 found work in the business and financial professions, more than any other sector. However, only 37.9% were picking up pay cheques six months after graduating, far below the average for other graduates. This is a reflection of the fact that more than a third of physics graduates went on to further study - again, above average.

What jobs can you do?

"There are a number of physics-based careers - medical physicist, research scientist, scientific laboratory technician, radiation protection adviser, the armed forces and defence industry," says Margaret Holbrough, careers adviser at Graduate Prospects. Physics graduates also find employment in academic institutions, and government research organisations as well as industries such as aerospace, engineering, manufacturing, oil and gas, space exploration and telecommunications.

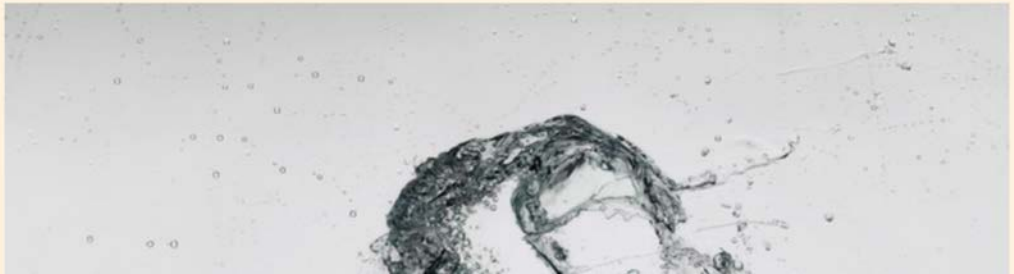
October 18, 2013 1:12 pm

Physicists and the financial markets

By Stephen Foley

Share Author alerts Print Clip Comments

Physicists have been lured into the financial market for decades, prized for their insights and data-crunching skills. But in a time of turbulence, flash crashes and high-frequency trading, can they really spot things that others miss?

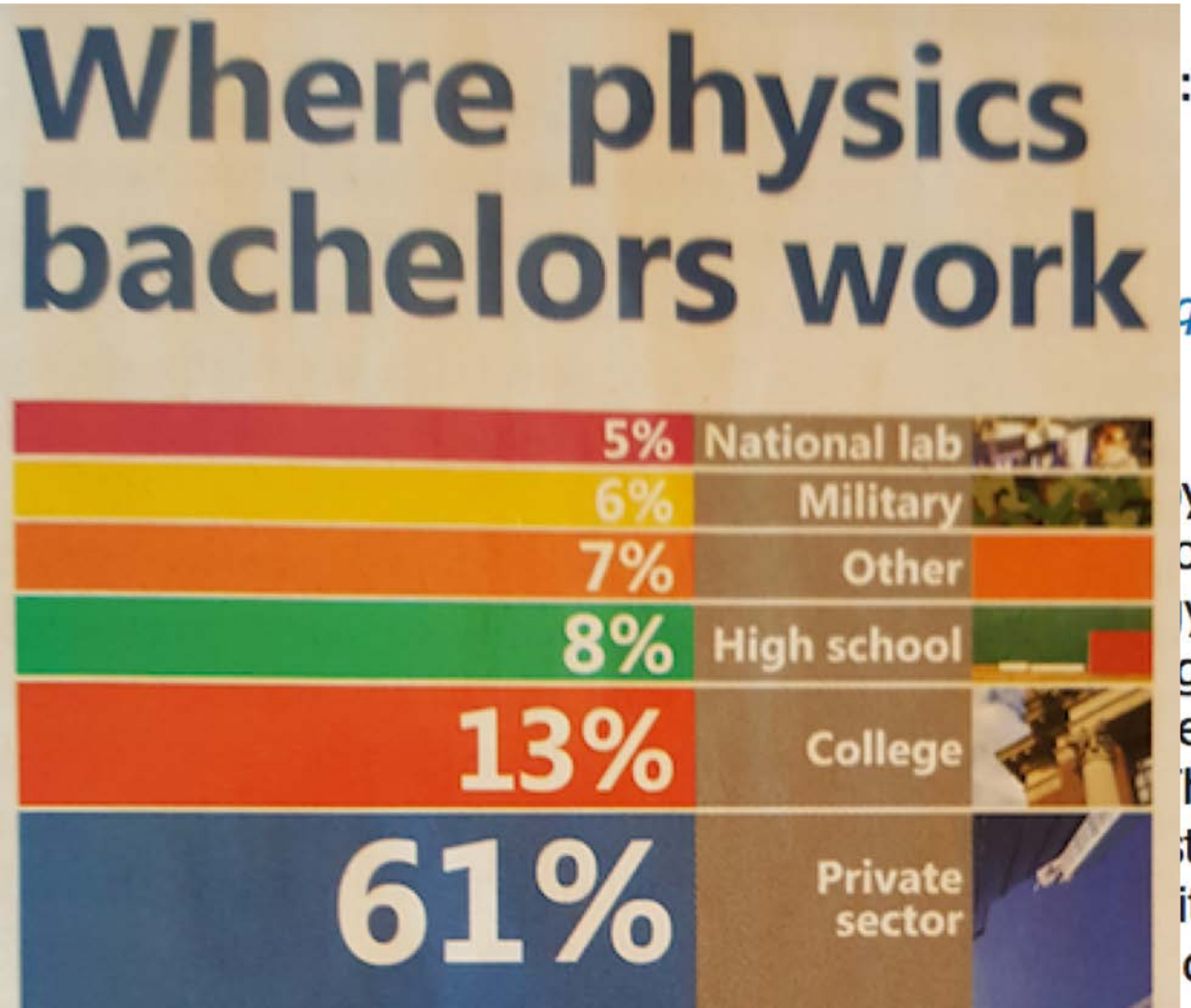


4. Many people majoring or minoring in physics have become successful business men.

Breaking the Myth of the “Non-Traditional” Physicist” The Real Story about Employment for Physics Graduates

5. And physics is changing many other human practices:

Speaker: Crystal Bailey, Careers Program Manager, American Physical Society



:30PM (add to my calendar)

quia S *rved at 3:00 in the*

Private Sector

yable ything from
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y emp cs training, a
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trial settings the same time, only about 25% of
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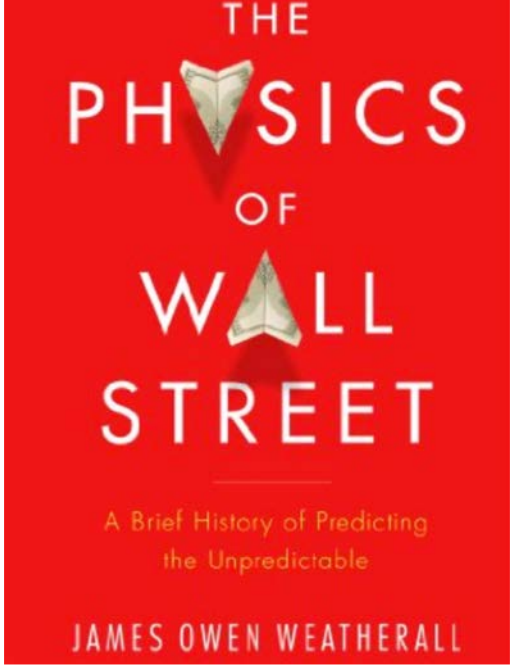
degrees.

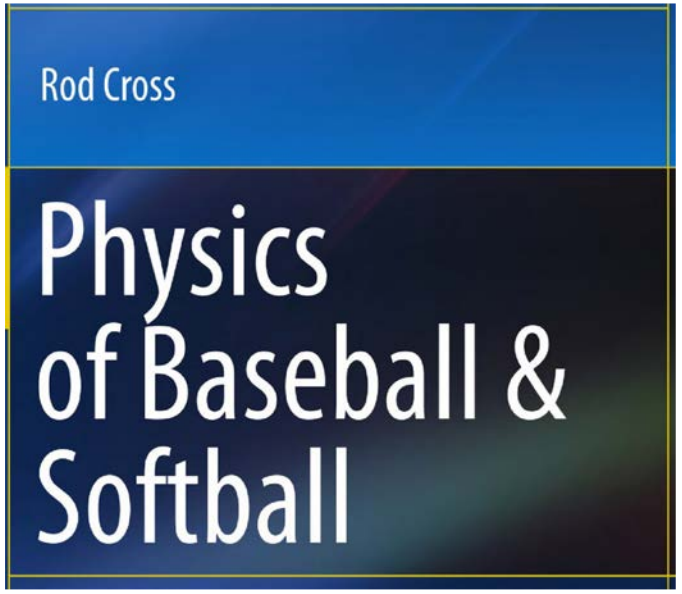


Medical physics (also called **biomedical physics**, **medical biophysics** or **applied physics in medicine**) is, generally speaking, the application of physics concepts, theories and methods to medicine or healthcare. Medical physics departments may be found in hospitals or universities.

Biology

Medicine

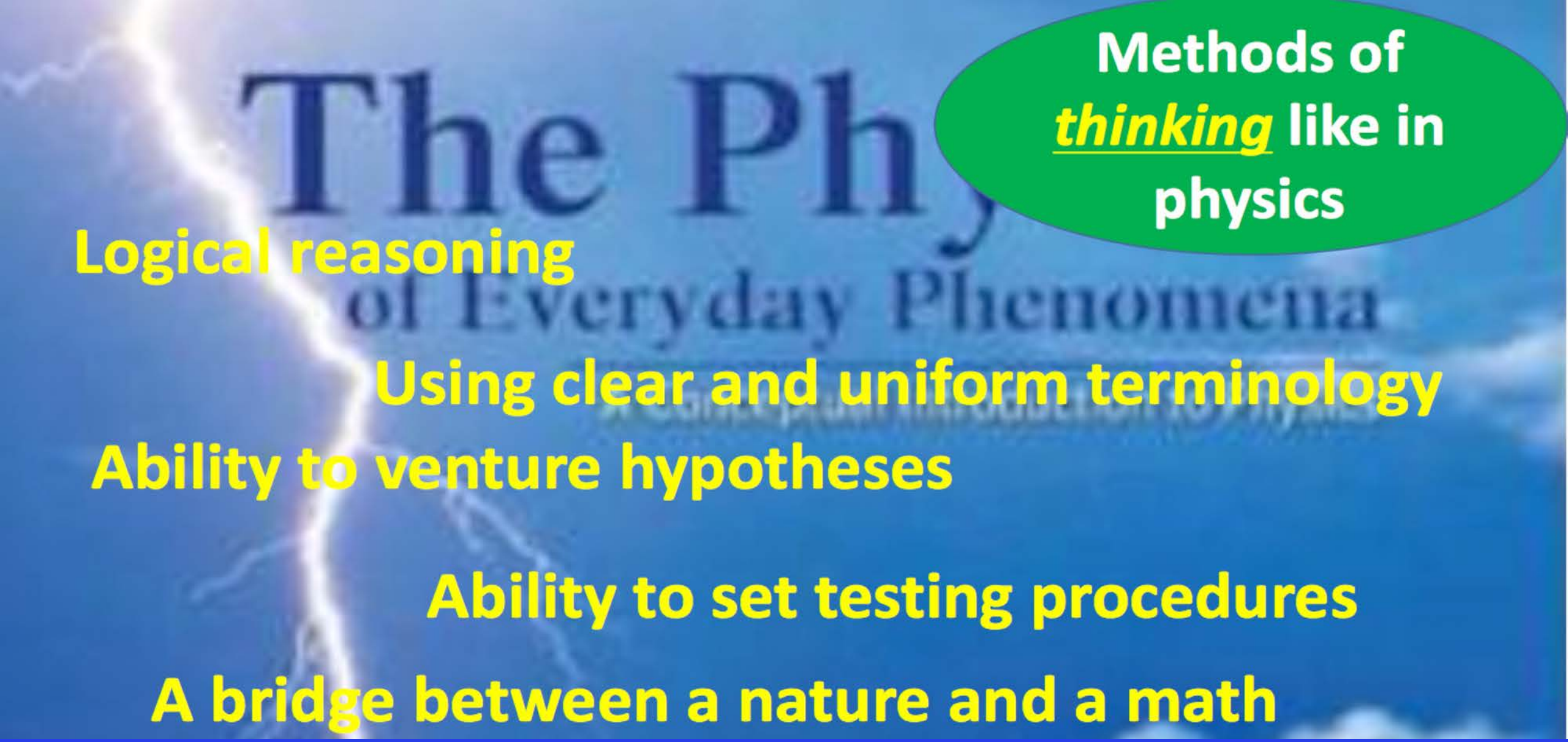
Methods of physics



6. Biology, medicine, even sport.

SPORT

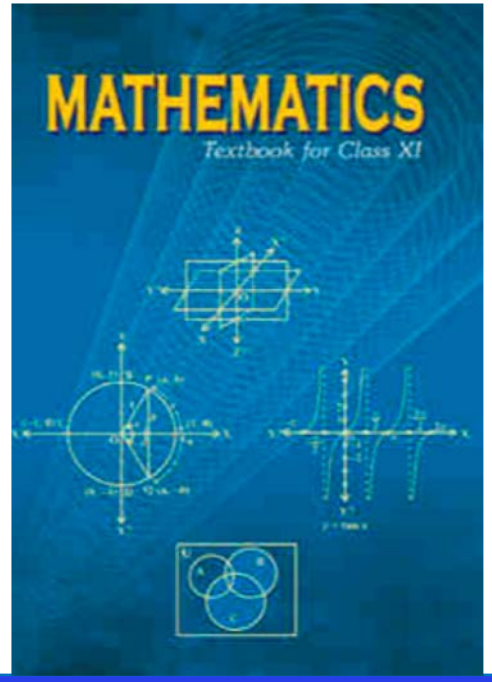
1 Mission statement of Medical Physicists
2 Medical biophysics and biomedical physics
3 Areas of speciality
3.1 Medical imaging physics
3.2 Radiation therapeutic physics
3.3 Nuclear medicine physics
3.4 Health physics
3.5 Clinical audiology physics
3.6 Laser medicine
3.7 Medical optics
3.8 Neurophysics
3.9 Cardiophysics
3.10 Physiological measurement techniques
3.11 Physics of the human and animal bodies
3.12 Healthcare informatics and computational physics

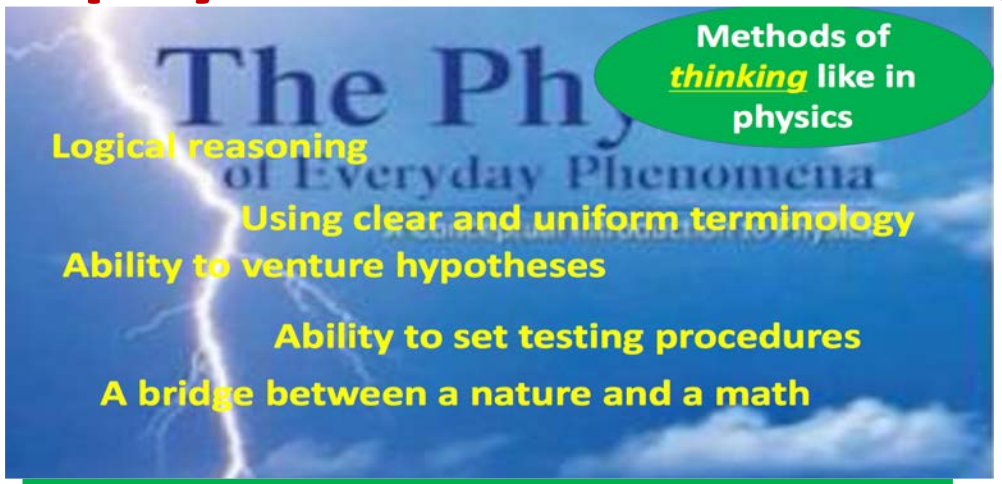


7. But the true importance of physics is not in the computational methods developed in it and ready to be deployed in other fields. The true importance of physics is in enhancing reasoning abilities of every single person taking physics course.

8. Physics is more powerful tool for advancing reasoning abilities than mathematics or computer coding!

Everyone who learns physics can learn coding. The opposite ???





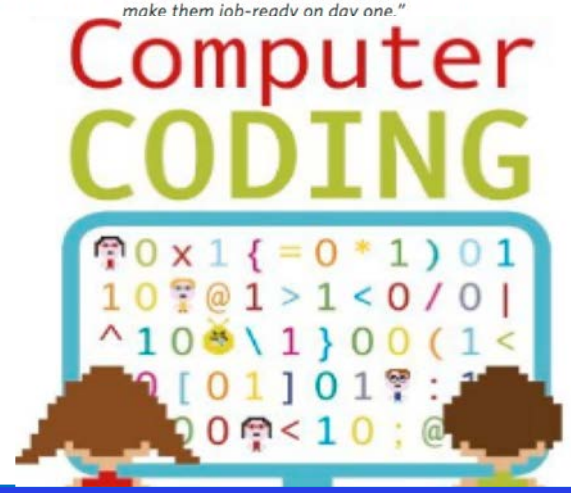
Physics = Reasoning

+ Mathematics

1

FACT SHEET: President Obama Announces Computer Science For All Initiative

"In the coming years, we should build on that progress, by ... offering every student the hands-on computer science and math classes that make them job-ready on day one."



2

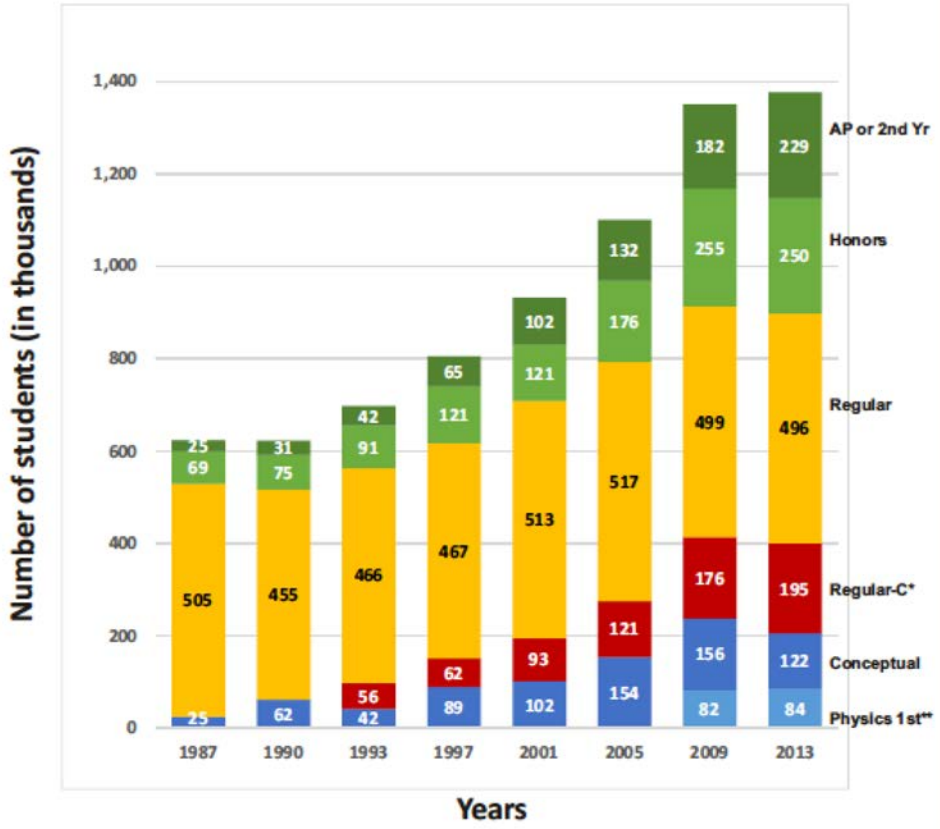
Coding = algorithmization (reasoning) + programming language (memorizing)

2

9. Currently less than a half of high school students take physics classes.

American Institute of Physics

High School Physics Enrollments 1987-2013

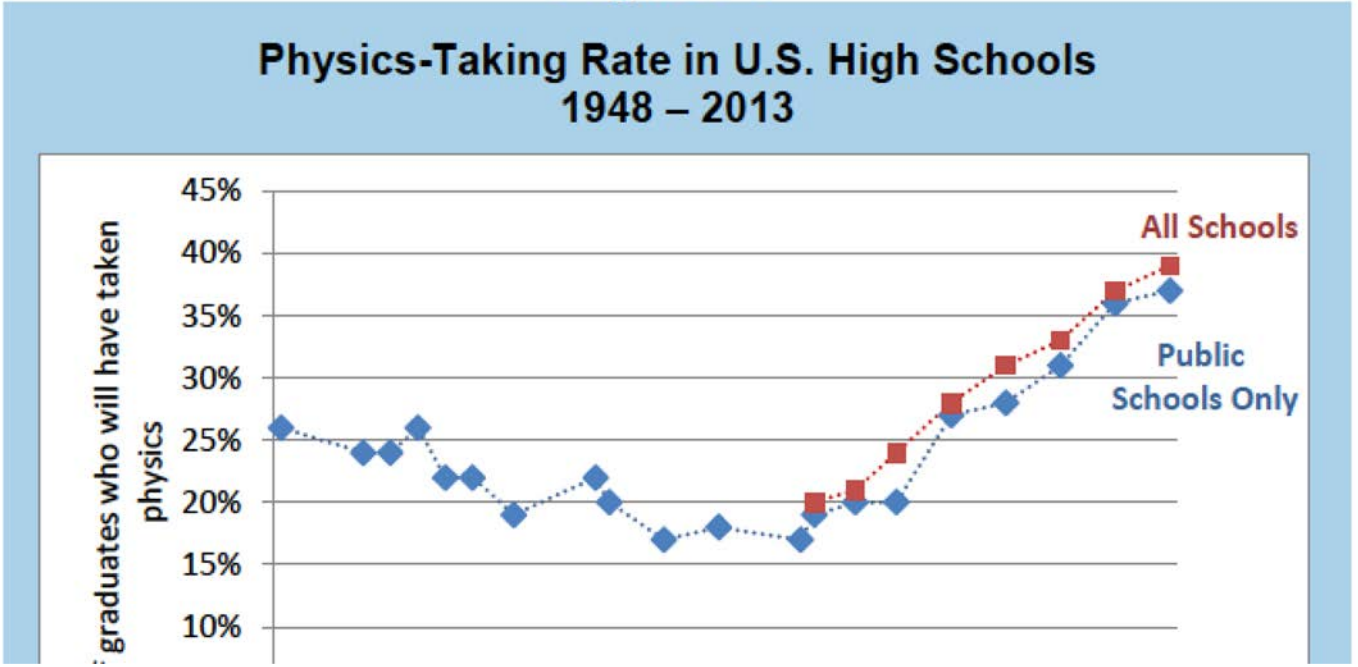


Source: The 2012-2013 Nationwide Survey of High School Physics Teachers.
* Regular-C is regular physics taught using a conceptual physics text.
** Physics 1st was first included in the survey in 2009.

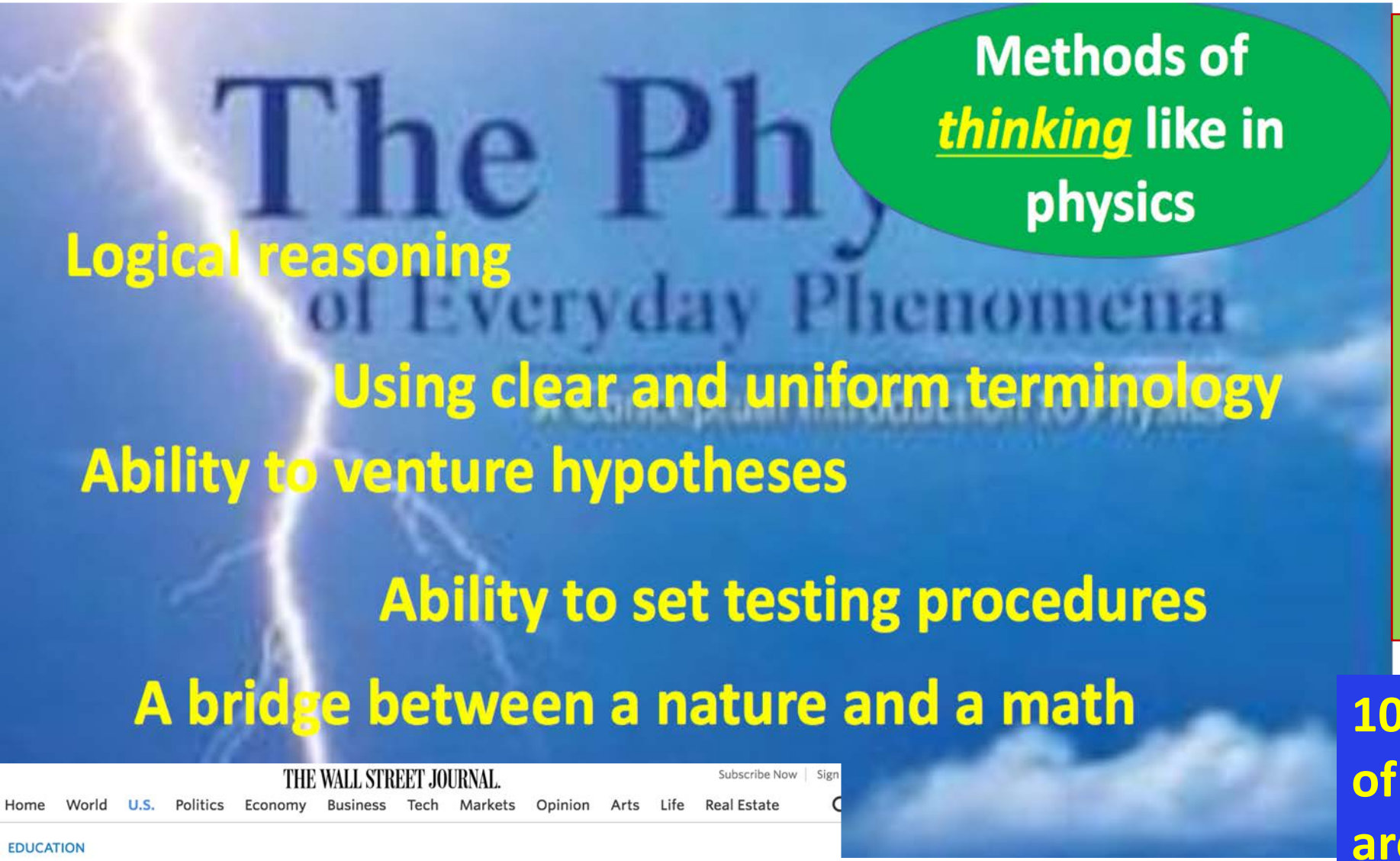
Four Graduates in Ten Take High School Physics

The proportion of high school graduates who will have taken at least one physics course prior to graduation continues to grow. When we began this study in 1987, the "physics-taking rate" (the proportion of high school graduates who will have taken at least one high school physics course) was 20%. Based on data from our most recent survey (which includes both public and private high schools in the U.S.) during the 2012-2013 school year, we estimate that 39% of the class of 2013 took high school physics before graduating. Figure 1 provides a historical perspective.

Figure 1



Four Graduates in Ten Take High School Physics



Only four Graduates in Ten **are ready to enter contemporary job market.**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EDUCATION

Obama Calls for Two Years of Free Community College for All Students

Proposal Will Face an Uphill Climb in Congress

10. This means that 60 % of high school graduates are not ready for the demands of the contemporary job market.

11. That is why I am asking today all members to join forces and to petition the governors to develop a plan with the goal of having all high school students taking physics course by the year of 2020.

Physics course for every student!

Physics into every school!

New England Section of American Association of Physics Teachers petitions to the Governors of the states to develop a plan with the goal of having all high school students taking physics course by the year of 2020.

12. There are so many people in this room who are much more experienced than I to draft such a petition. But I think every state should do it independently. Here in Connecticut you can tell your governor – “We have to have all our high school students taking physics, but if we want to be first in the nation, we got to do it fast, I heard guys in Massachusetts want to do it, too”. And in Massachusetts we would tell our governor – “We have to have all our high school students taking physics, but if we want to be first in the nation, we got to do it fast, I heard guys in Connecticut want to do it, too”.

NES-AAPT PETITION to our GOVERNOR

NES-AAPT PETITION to our GOVERNOR

To the Governor of …

Many people don't know that nowadays physics methods of analyzing various phenomena have spread far beyond the world of physics.

First to mention, of course, is applications of computational physics to business.

There are books, articles, you name it.

Many people majoring or minoring in physics have become successful businessmen.

But physics is changing many other human practices:

Biology, medicine, even sport.

But the true importance of physics is not in the computational methods developed in it and ready to be deployed in other fields. The true importance of physics is in enhancing/intensifying logical or reasoning abilities of every single person taking physics course.

Currently less than a half of high school students taking physics class.

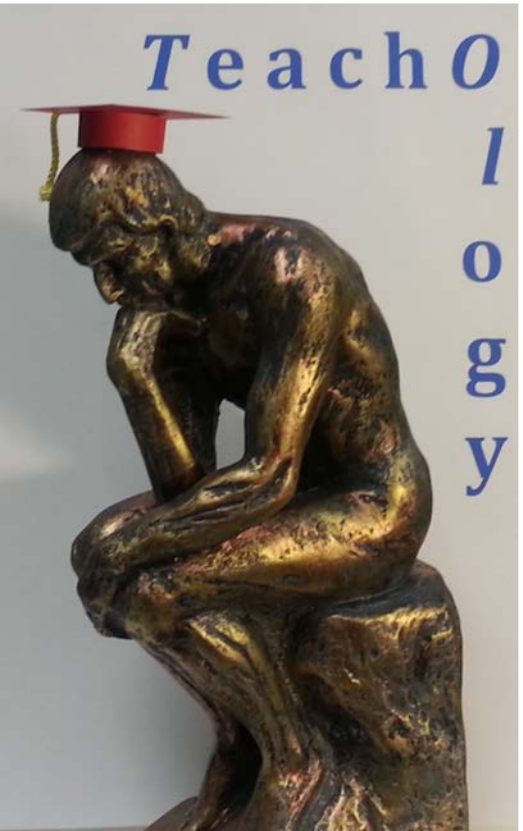
This means that 60 % of high school graduates are not ready for the demands of the contemporary job market.

That is why we are asking today all members to join forces and to petition the governors to develop a plan with the goal of having all high school students taking physics course by the year of 2020.

Be curious (and a curio)!

Be critical (including yourself)!

Reason! Doubt! Innovate!

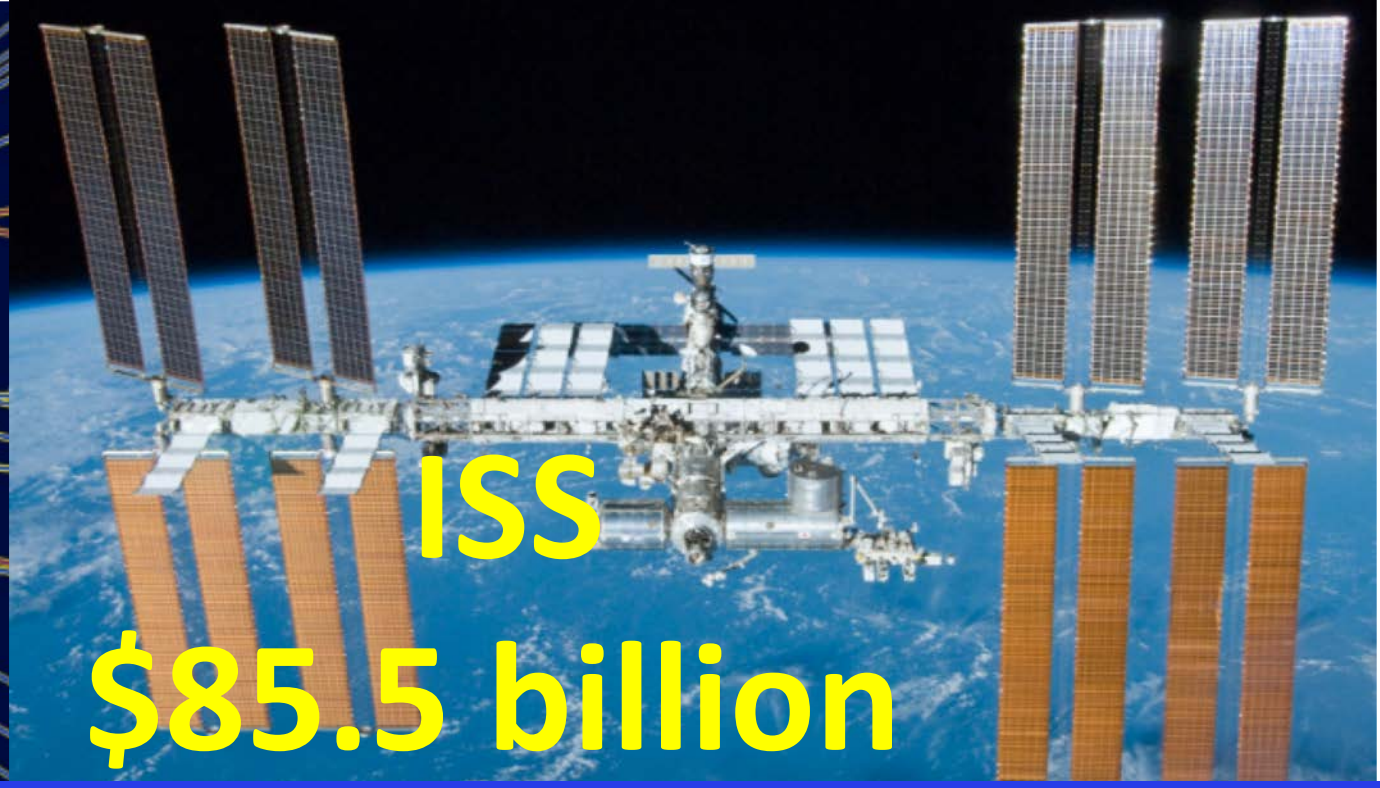


Use your imagination!

No imagination =>

=> No success!

The future of STEM education solely depends on the imagination of people who

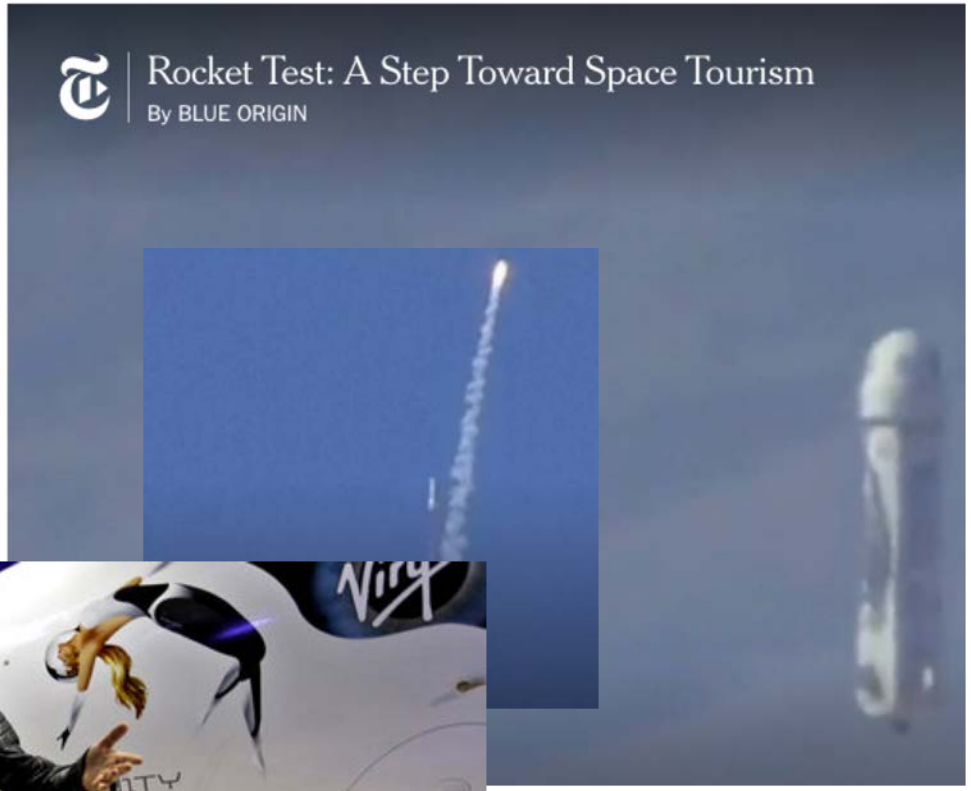


Billions of dollars have been spent to build research facilities to study the world

ELON MUSK ANNOUNCES HIS PLAN TO COLONIZE MARS AND SAVE HUMANITY

Blue Origin, Jeff Bezos' Rocket Company,

By KENNETH CHANG OCT. 5, 2016



or to conquer the physical world.

$3 billion

Billions of dollars are being spent for building research facilitates to study biology, and medicine.

Mission

CDC works 24/7 to protect America from health and safety threats, both foreign and domestic. Whether diseases start at home or abroad, are chronic or acute, curable or preventable, due to human error or deliberate attack, CDC fights disease and supports communities and citizens to do the same. CDC is the nation's health protection agency—saving lives, protecting people from health threats, and saving money through prevention.

Why We're Here

- A disease threat anywhere can mean a public health threat everywhere; a safer worl a safer America
- Each [illegible] million [illegible] and about 23,0[illegible] [illegible] are caused by antibiotic resi[illegible]nce
- More th[illegible] people die every day in the United States from [illegible] prescription drugs
- Chronic diseases afflict 117 million Americans
- More than 1.2 million Americans live with HIV infection, and 1 in 7 is unaware of his [illegible] her HIV status

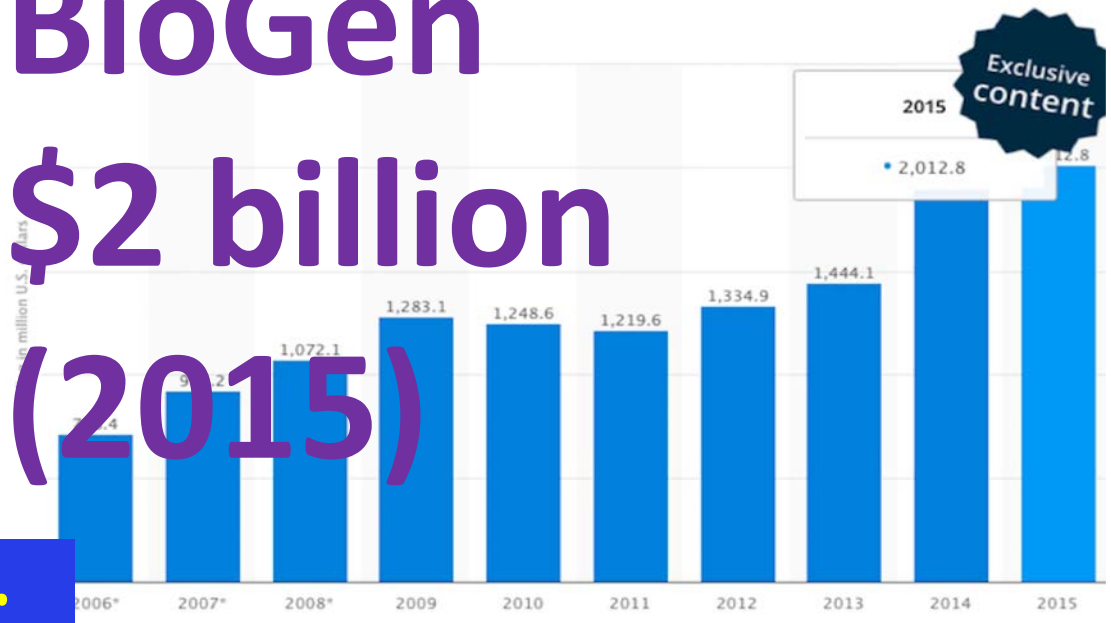
$6.98 billion

Biogen Idec's spending on research and development from 2006 to 2015 (in million U.S dollars)

This statistic shows the spending on research and development by biotechnology company Biogen Inc. between 2006 and 2015. In 2008, the company spent around 1.07 billion U.S. dollars on research and development.

BioGen

$2 billion (2015)



NewYork-Presbyterian

$4.8 billion

CHOOSE A SERVICE

Find a Doctor
Our Services
Pay My Bill

About Us
Clinical Trials
Our Health Library

Total Revenues	$4.8 billion

EdSource

Highlighting Strategies for Student Success

BILL & MELINDA GATES *foundation*

Only 25 percent of U.S. public high school graduates have the skills needed to succeed academically in college, which is an important gateway to economic opportunity in the United States.

TOPICS | COMMENTARIES | PROJECTS | STORYLINES | DATA | PUBLICATIONS | ABOU

CAREER PREPARATION

Survey: Most high school students feel unprepared for college,

However, despite the fact that too many U.S. schools cannot provide sufficient education to too many graduates,

college and careers, even though these remain top goals for stud
to a survey released Thursday.

Results from a multi-year College and Career Readiness survey
school students conducted by YouthTruth, a San Francisco-base
found that 45 percent of students feel positive about their colleg
readiness.

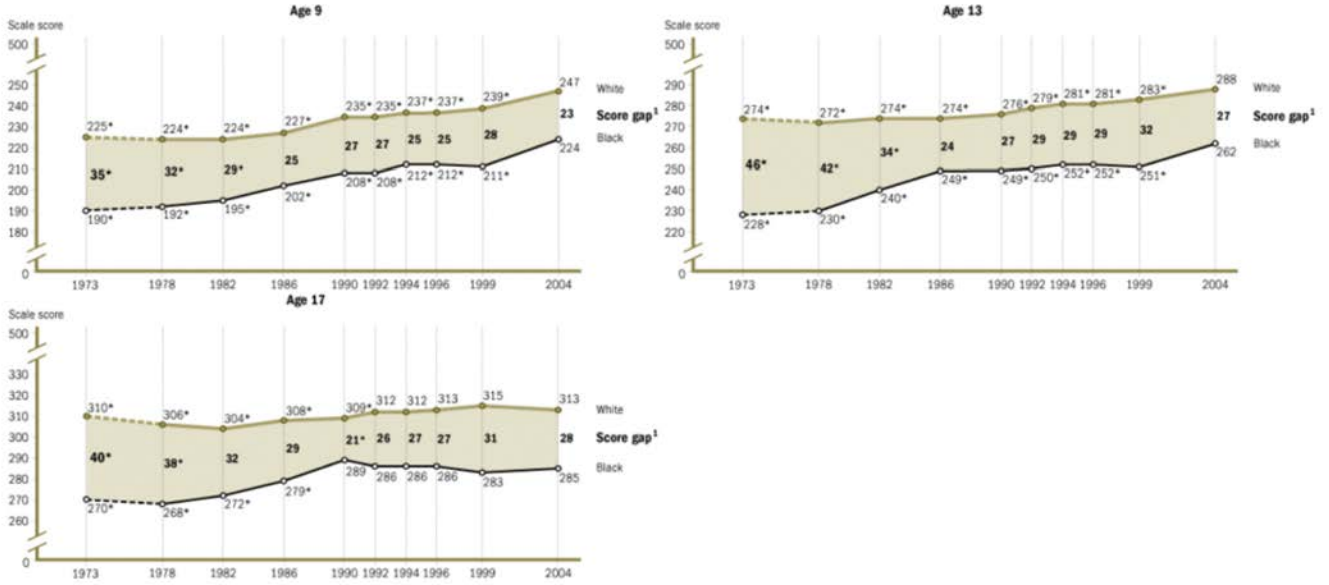
Evidence of the racial achievement gap: National Assessment of Educational Progress (United States) [edit]

Main article: National Assessment of Educational Progress

Evidence of the achievement gap can be found using various measures, but one assessment used nationwide is the National Assessment of Educational Progress (NAEP). The graphs below show the achievement gap on this assessment between black and white students and between Hispanic and white students in the U.S. over time. Although the gaps have generally narrowed in recent years according to this particular measure, there are clearly still large disparities between groups.

Math [edit]

Caucasian-African American gap [edit]



~~Center for Fundamental Research in Education~~

there are no investments in building research facilities designed specifically to studying learning and teaching processes.

We're investing in a new generation of courseware that adapts in sophisticated ways to students' learning needs. We're also supporting game-based learning that generates rich data about students' progress and challenges them with exactly what they need to learn next.

Blending face-to-face instruction with digital tools allows students to learn independently and at their own pace, freeing up time for teachers to give students more individualized attention and to focus on more complex tasks.

Boston-area Edtech Startups

LearnLaunch

Over 300 education technology and learning-oriented startups are currently based in the Boston area, drawing from its existing network of universities, learning companies, ecosystem, and technical talent. These companies have sprung up to solve challenges and take advantage of opportunities to support the growth and adoption of new products and methodologies within the education sector, which represents nearly 9% of the GDP.

National Science Foundation
WHERE DISCOVERIES BEGIN

The Network Science project is a three year ITEST strategies project designed to engage 120 disadvantaged high school students (grades 10-11) and up to 30 high school STEM teachers from Boston and New York urban schools in a network science research based program, using cutting edge computer modeling research technology. Working with graduate student mentors, Network Science students and teachers will: (a) learn about the emerging discipline of network science, (b) construct and analyze science networks using computations and data visualizations

M D

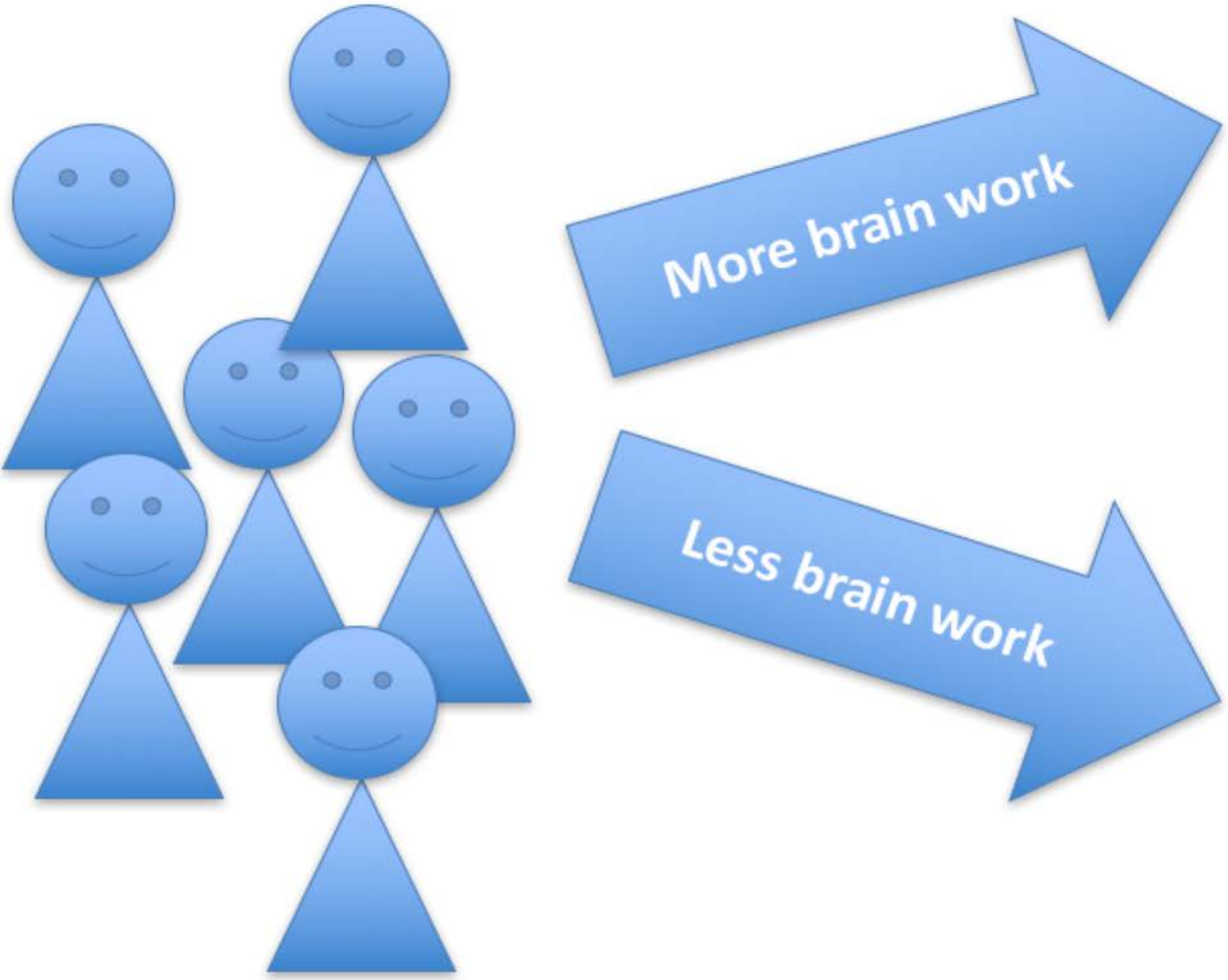
McCarthey Dressman Education Foundation
Celebrating programs that engage, enrich and inspire learners

The Government, the NSF, charitable and philanthropic organizations do finance various projects in the field, but the majority of the projects aim at solving social issues, like insufficient teacher preparation, adoption of new standards, bringing technologies in a classroom, and others.

According to Dr. Kauffman and others, the research in the field is currently in a pre-science state. Most of the research conclusions can be summarized in a single statement: ***if we take two large groups of similar students, and one group of students will have a more extensive or divers learning experience (for example, more contact hours, or more time spent on certain exercises, or training through more, or more difficult, or different exercises) students from that group, on average, will demonstrate better learning outcomes than the students in a controlled group.***
Period. (http://www.cognisity.how/2016/12/handbook.html)

"Today only a rare … educator can point to scientific data supporting the method ... using or recommended."

Dr. Kauffman "Toward a Science of Education"



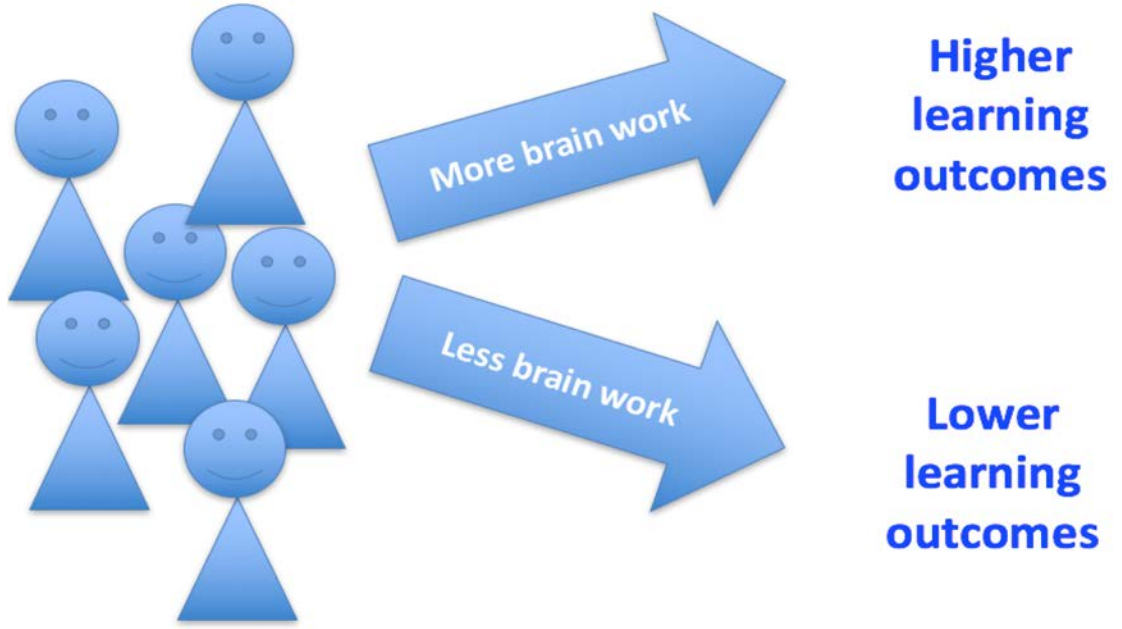
Higher learning outcomes

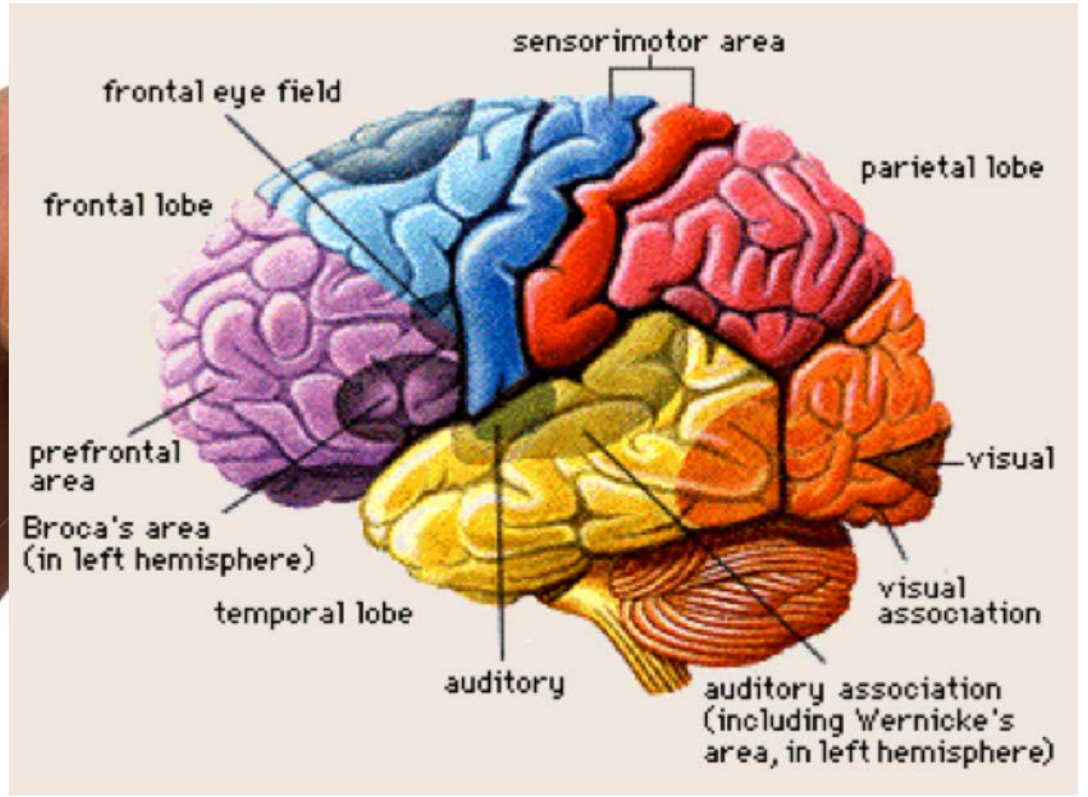
Lower learning outcomes

If we take two large groups of students, and one group will have a more extensive or divers learning experience, students from that group, on average, will demonstrate better learning outcomes.

This conclusion becomes almost obvious if we employ the notion that a brain is basically a muscle, or a collection of muscles,

the development of which strongly correlates with the *variety* and *intensity* of exercises it goes through during its development.





In order to move beyond the obvious and to make a transition from a pre-science state (like alchemy) to becoming a true science (like chemistry) we have to treat education as space exploration, i.e. the field of education needs research facilities *designated* specifically to studying learning and teaching processes.


Education
Treat
Like
Space
Exploration!
TeachOlogy.xyz
In order to move beyond the obvious and to make a transition from a pre-science state (like alchemy) to becoming a true science (lik chemistry) we have to treat education as spac exploration, i.e. the field of education needs research facilities designated specifically to studying learning and teaching processes.
A research
facility for studying
learning and teaching processes.

But first, two questions have to be answered:

What to study?

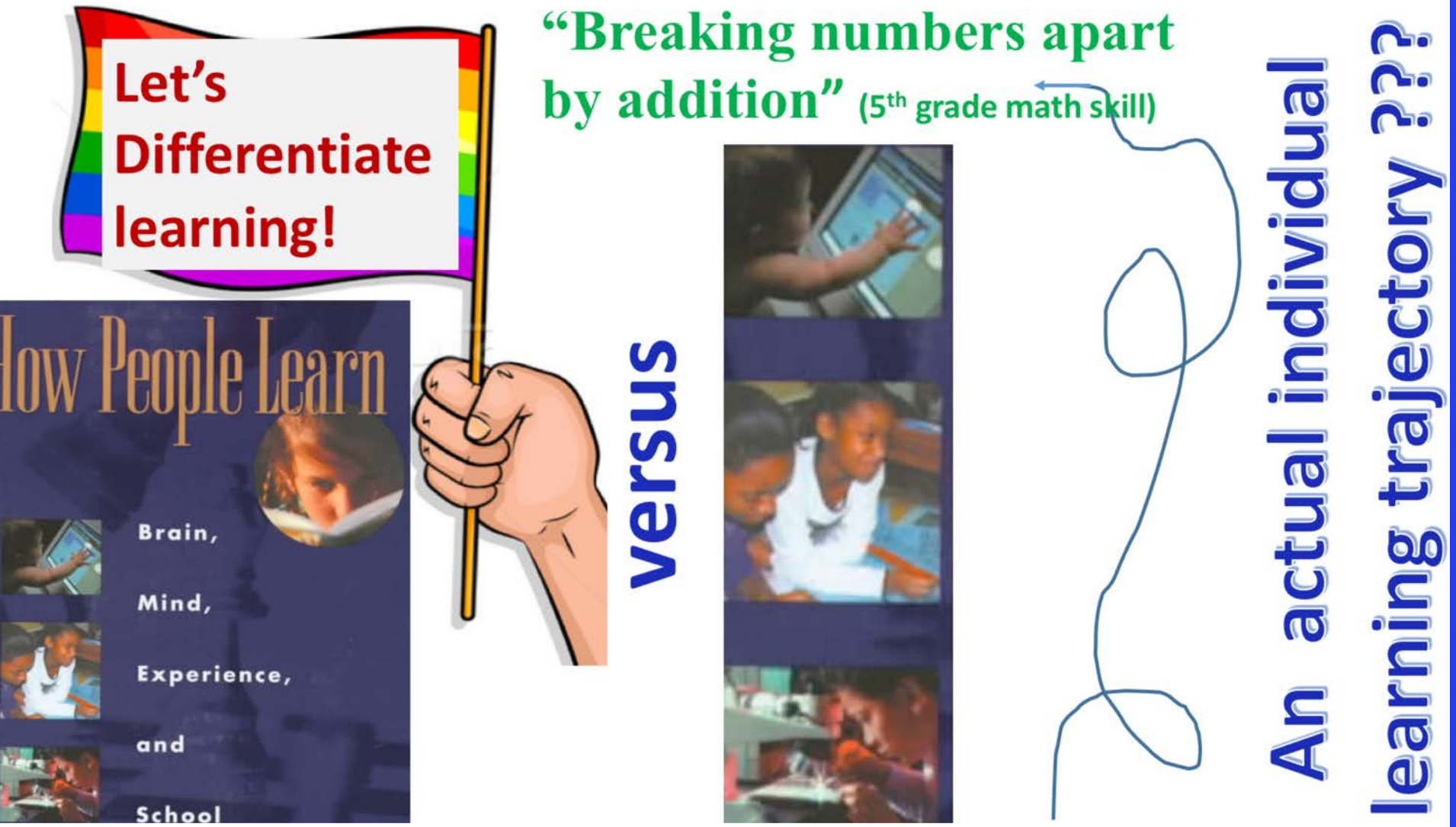
How to structure?

A research facility for studying learning and teaching processes.

Ladies and gentlemen! You have 2 hours to run!

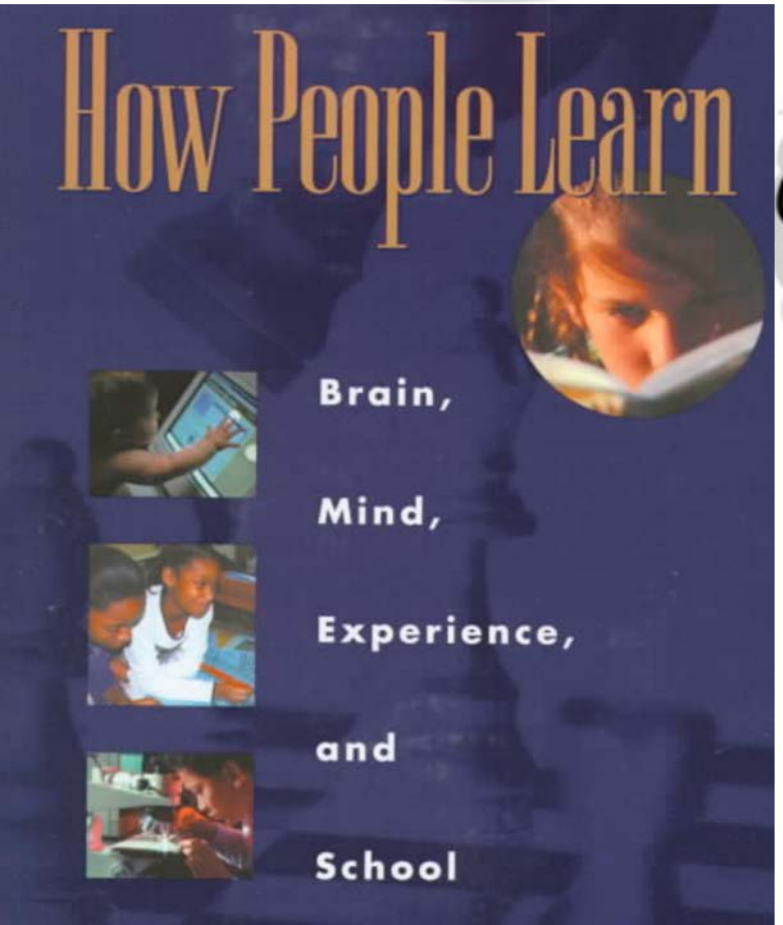
Children! You have one year to learn!
Whoever learns the most – wins!

I've been teaching math and physics for many years, and I know that *everyone can get an A*, but different people need a different path and a different time to achieve that. However, teaching today is like telling every marathon runner: "You have 2 hours to run, whoever runs the farthest – wins."



Many words are said about differentiation in learning. Those words however are just proclamations not based on any solid data. Nowadays we know *only in general* how people learn. But we have *no idea* how much time would Ben Smith need to spend to learn "Breaking numbers apart by addition".

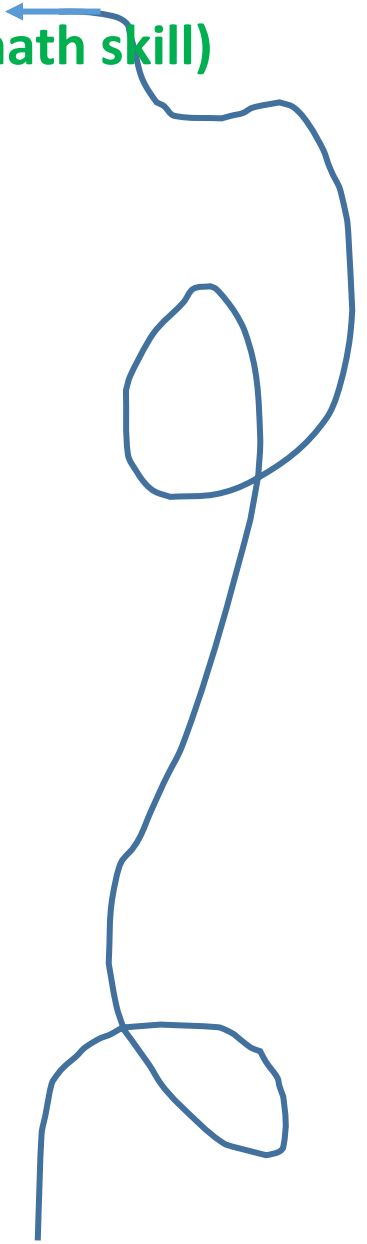
Let's Differentiate learning!



versus

"Breaking numbers apart by addition" (5th grade math skill)

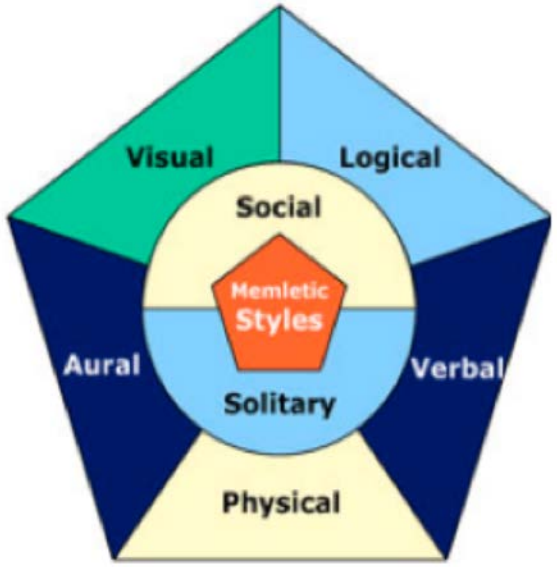
An actual individual learning trajectory ???



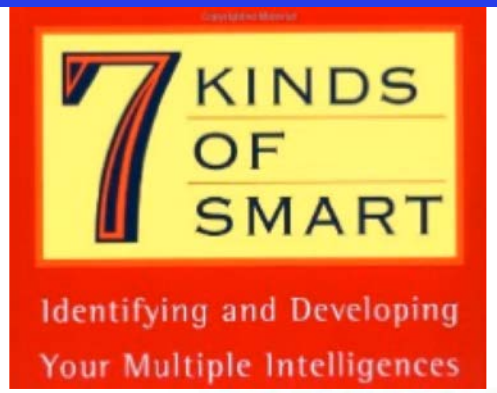
Overview of Learning Styles

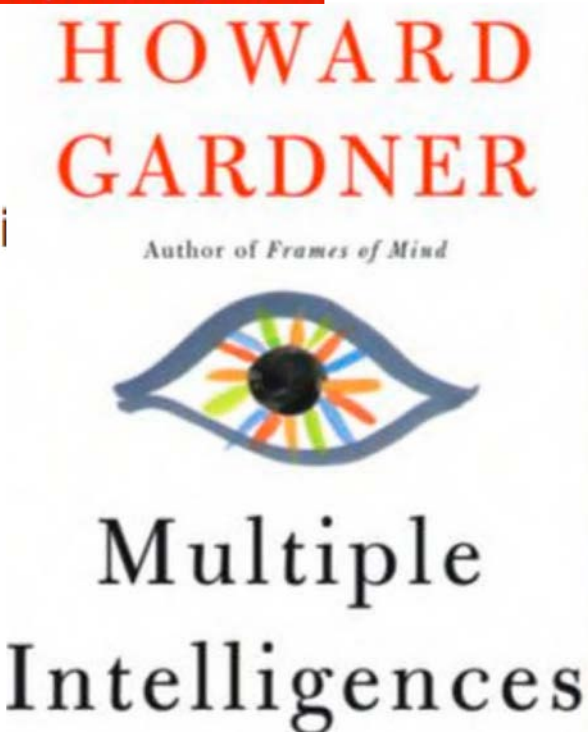
Yes, different people have different learning styles. We know that

Many people recognize that each person prefers different learning styles and techniques. Learning styles group commo ways that people learn. Everyone has a mix of learning styles. Some people may find that they have a dominant style of learning, with far less use of the other styles. Others may find that they use different styles in different circumstances. There is no right mix. Nor are your styles fixed. You can develop ability in less dominant styles, as well as further develop styles that you already use well.

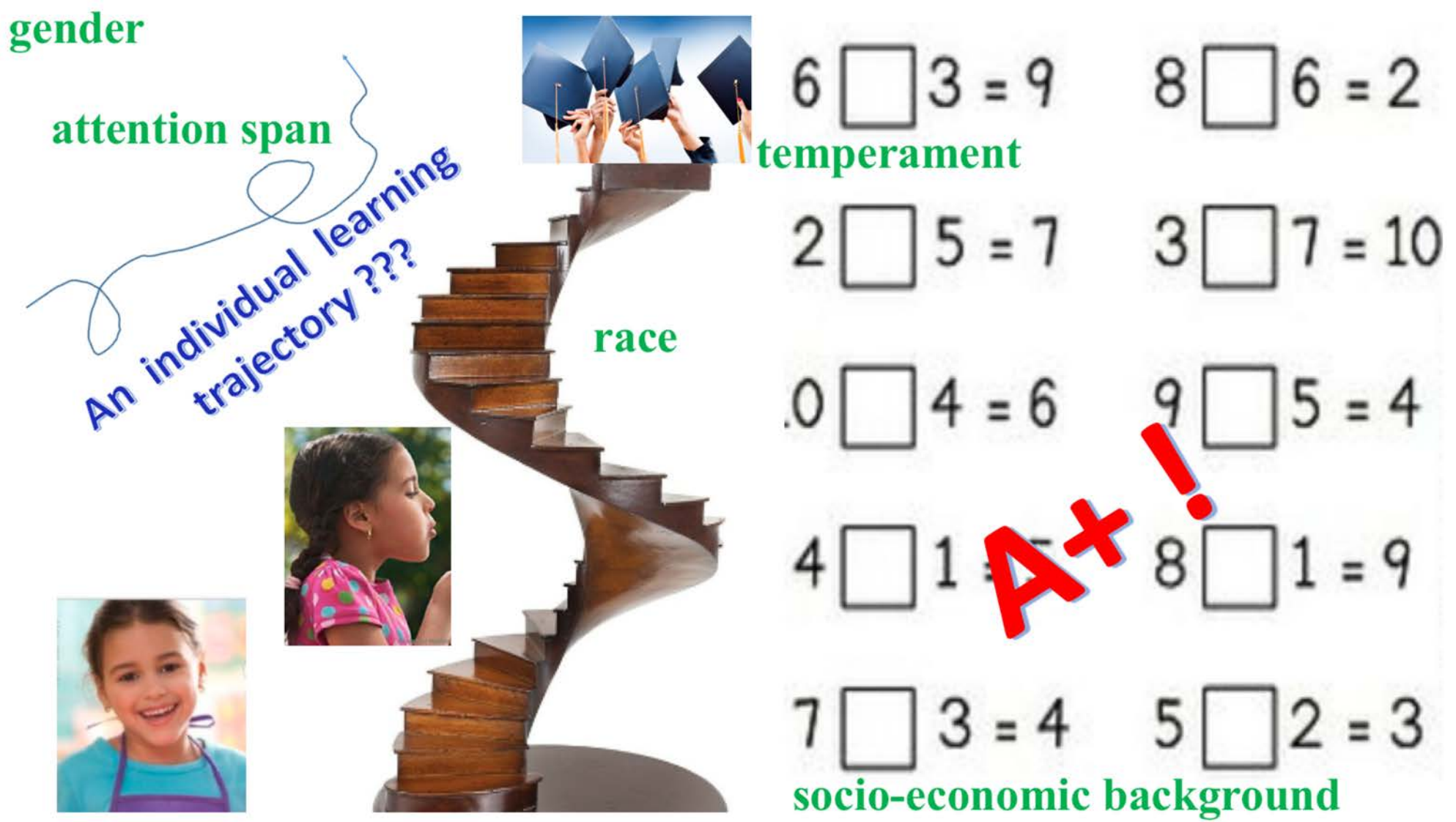


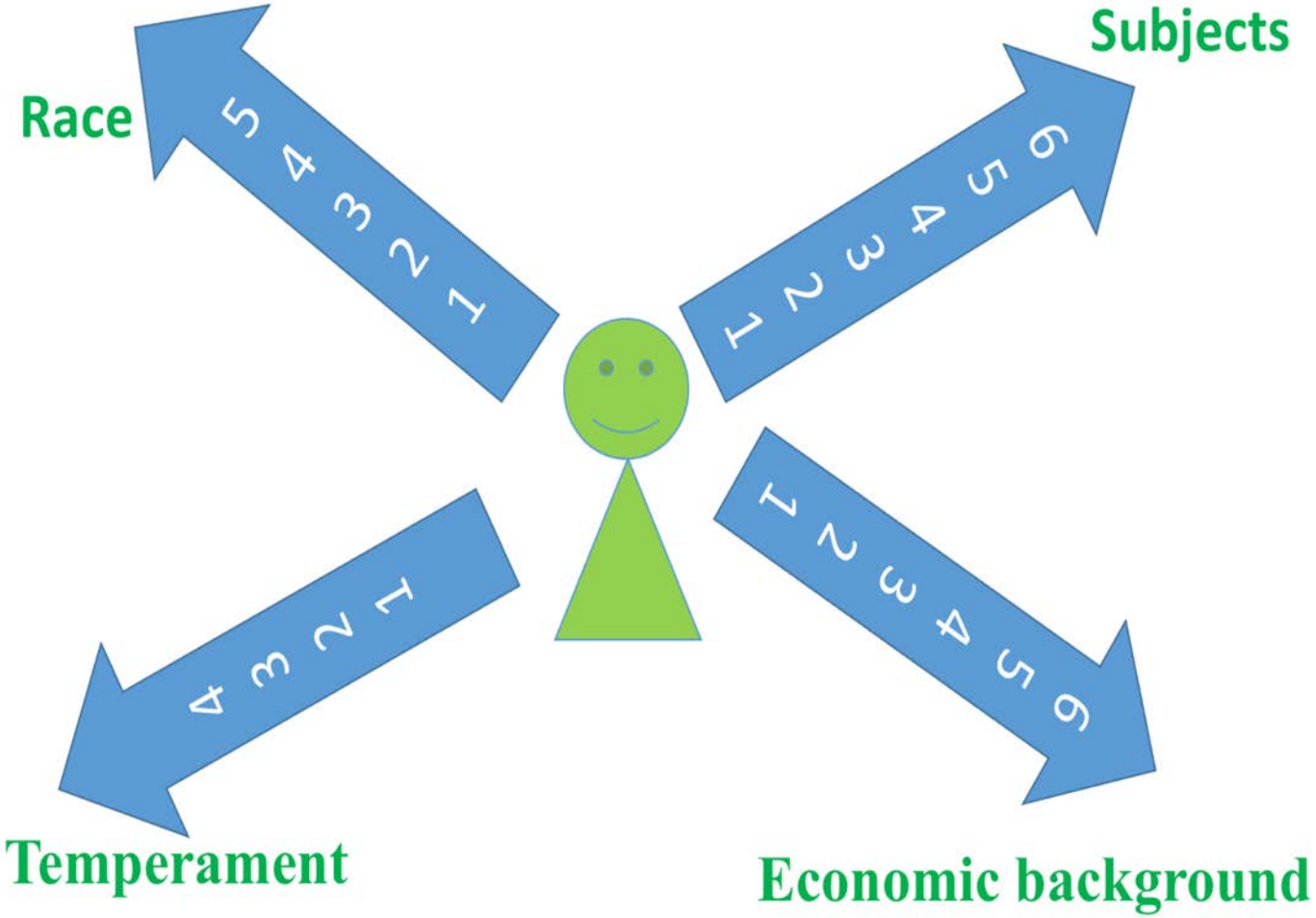
- **Linguistic intelligence** ("word smart")
- **Logical-mathematical intelligence** ("number/reasoni
- **Spatial intelligence** ("picture smart")
- **Bodily-Kinesthetic intelligence** ("body smart")
- **Musical intelligence** ("music smart")
- **Interpersonal intelligence** ("people smart")
- **Intrapersonal intelligence** ("self smart")
- **Naturalist intelligence** ("nature smart")



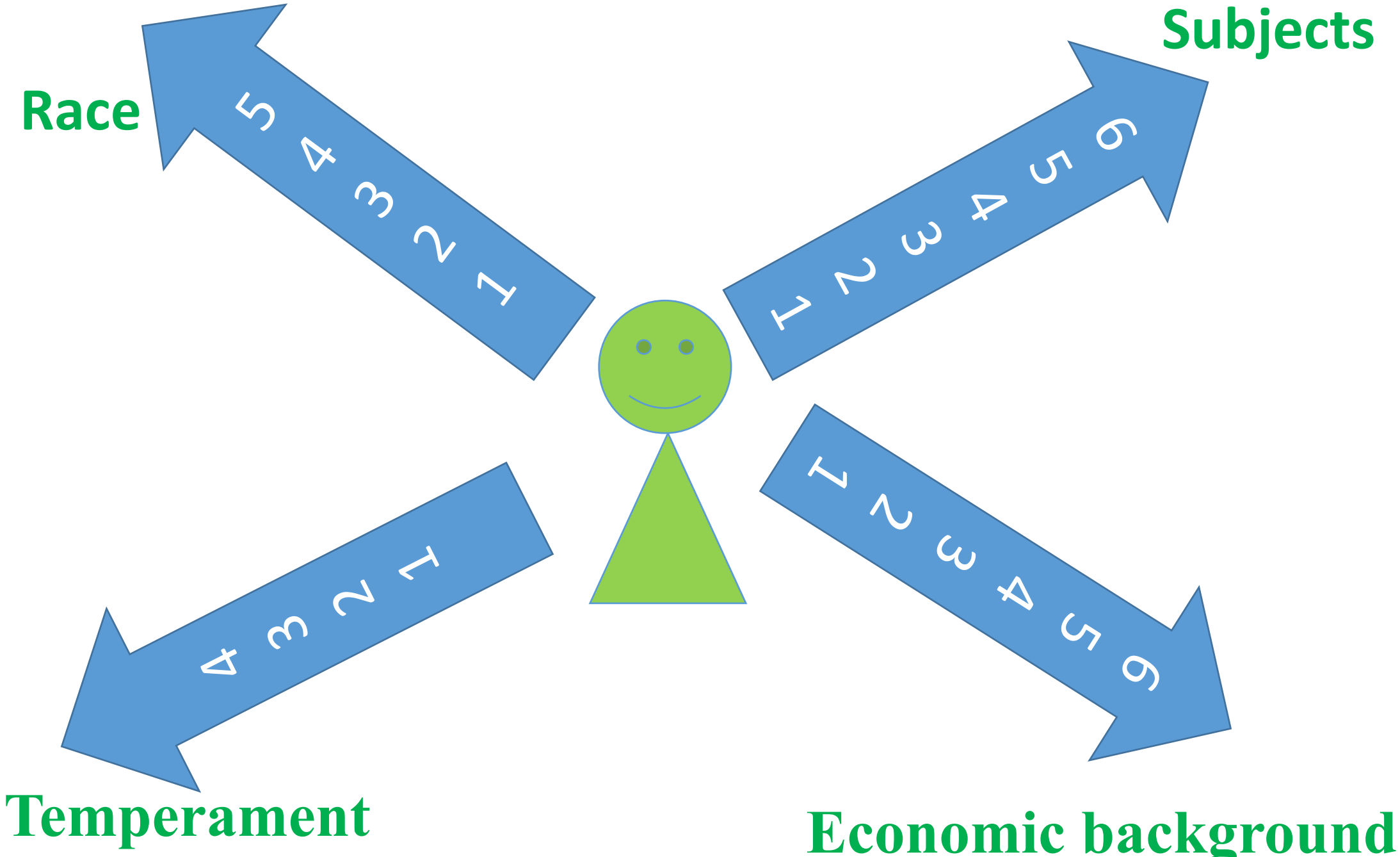


But how much time would it take to a child of a specific gender, race, socio-economic background, attention span, temperament, and other individual characteristics to master a given skill of a given subject? *That* we do not know.





For every child, there is a finite number of individual characteristics describing his or her learning, behavioral, and social styles. There is a finite number of subjects to learn, and within each subject there is a finite volume of knowledge to learn, and a finite number of skills to master. It should take a finite amount of time to study all relevant correlations.


Race
5 4 3 2 1
Subjects
1 2 3 4 5 6
4 3 2 1
1 2 3 4 5 6
Temperament
Economic background

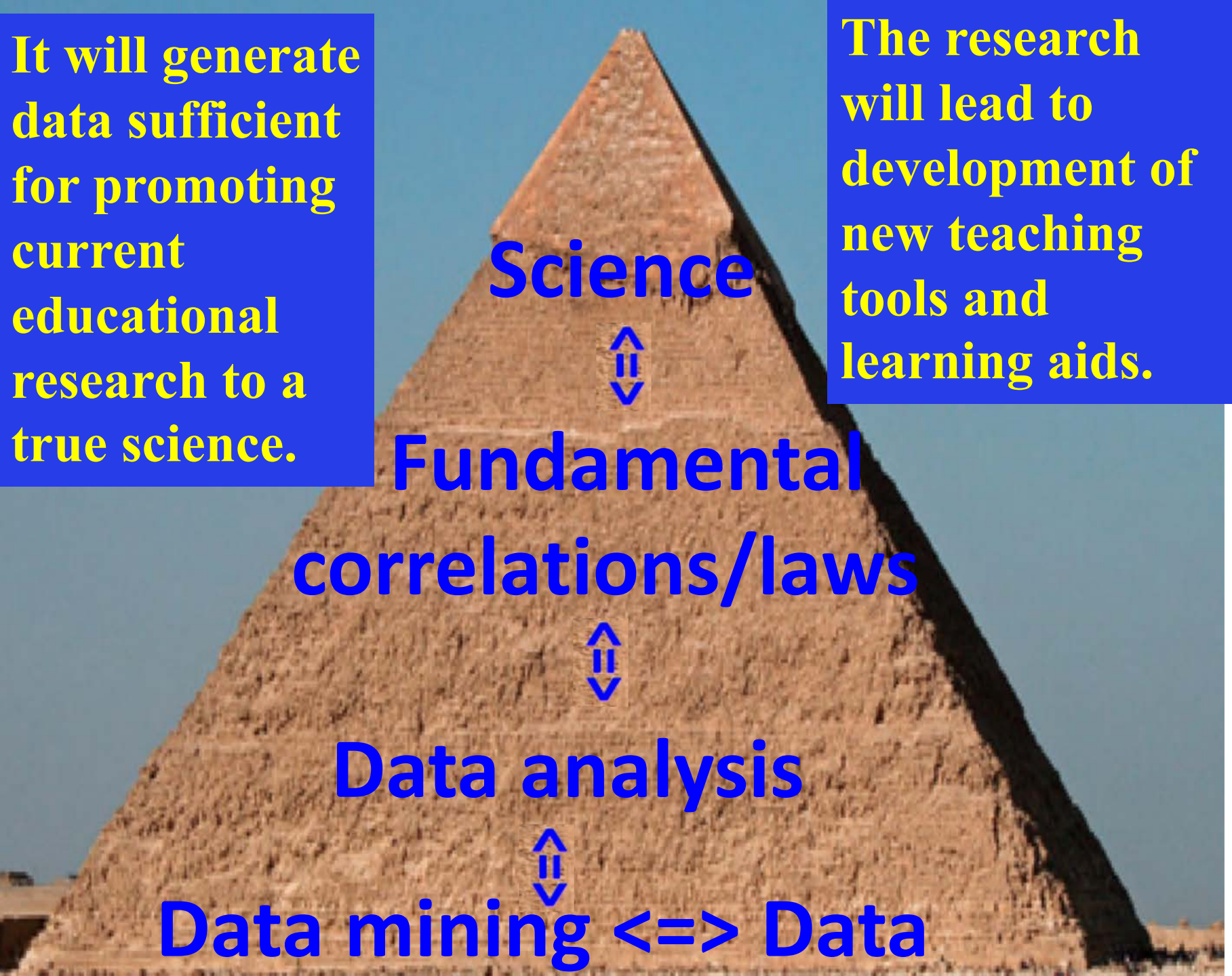
The research facility for conducting such a study must be developed around a specifically designed school, or a network of schools. Each school will be the nucleus of a facility where all students and professionals work together, with the whole world watching 24/7 (visit https://www.cognisity.how/2018/12/school.html).

Teachers

Team work organizers

Educational Psychologists

Teacher professional development specialists



It will generate data sufficient for promoting current educational research to a true science.

The research will lead to development of new teaching tools and learning aids.

R&D

Recommendation
Textbooks
Assessments
Apps
Gadgets
…
???
No way to predict!

Cornelia I. Bargmann, Chair

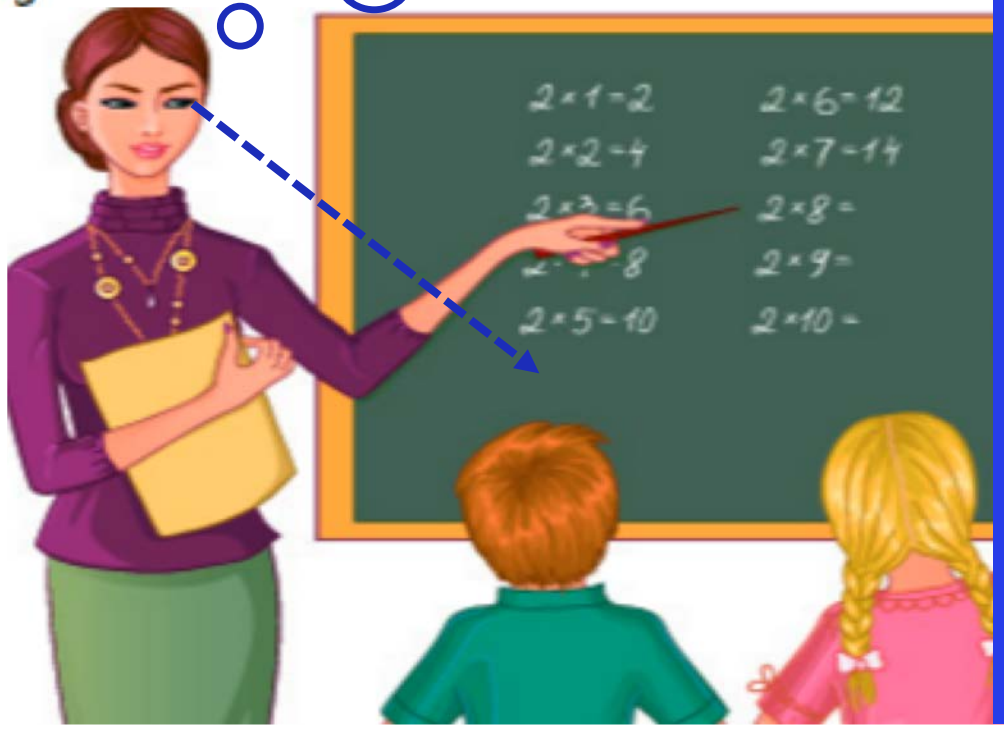
Anne Wojcicki

Mark Zuckerberg

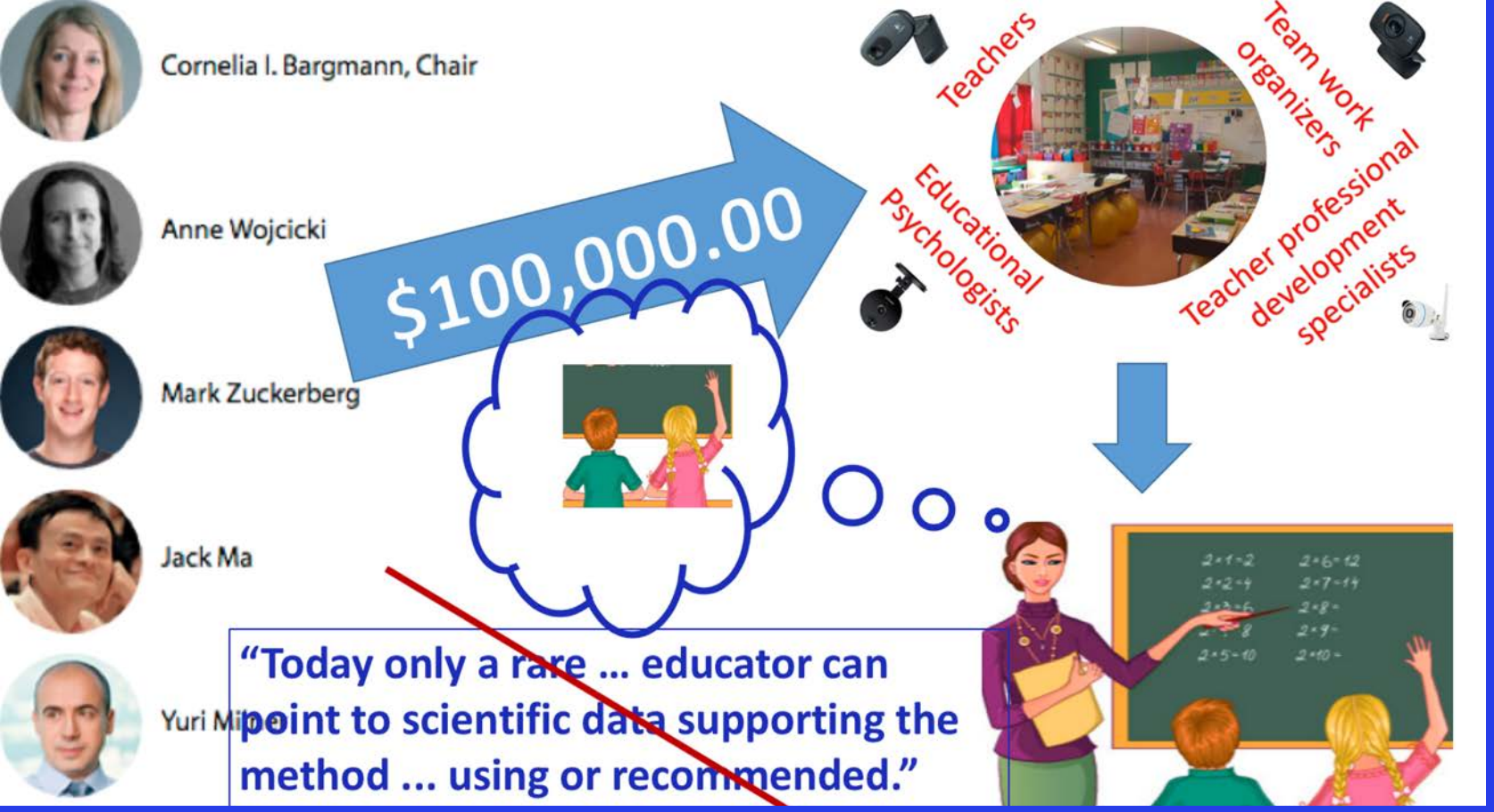
Jack Ma

Yuri Milner

$100,000,00



Two of the founders of the Breakthrough prize, Mark Zuckerberg and Yuri Milner, pledged to spend one hundred million dollars on the search for extraterrestrials. It did not occur to them, or to anybody else, that for many teachers their students do look like aliens.



Today I am calling on philanthropists to spend money on building research facilities designated specifically to studying learning and teaching processes, so in the coming decades every educator *could* point to scientific data supporting the method he or she uses, or recommends.

Cornelia I. Bargmann, Chair

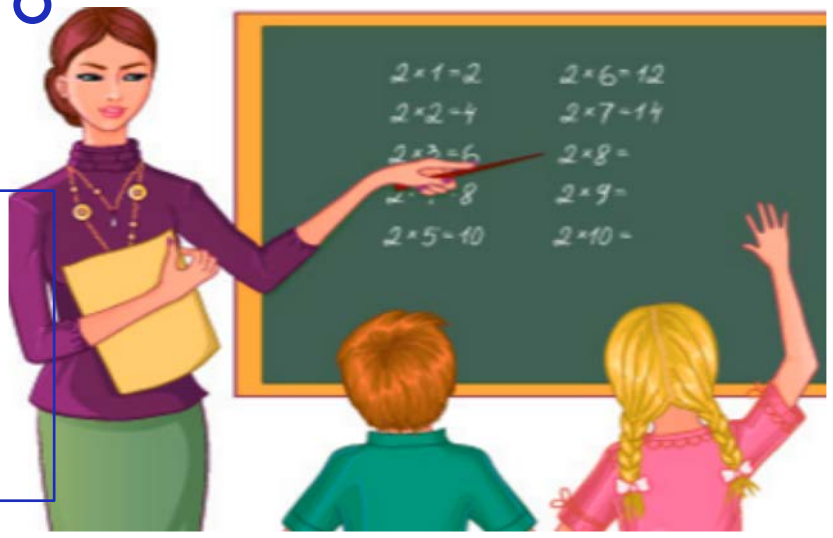
Anne Wojcicki

Mark Zuckerberg

Jack Ma

Yuri Milner

$100,000.00



"Today only a rare … educator can point to scientific data supporting the method … using or recommended."

Please, contact Dr. Valentin Voroshilov at teachology@teachology.xyz

Dr. Valentin Voroshilov

Teachology Consulting

Helping people with achieving their goals!

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617-657-9436

Areas of expertise:

A) administrative practices related to running a unit of an administrative structure, such as a department, or an institution, including but not limited to:

1. strategic and tactical planning
2. observing, guiding, coordinating, evaluating the performance of employees
3. analyzing individual reports, preparing and presenting cumulative
4. managing everyday workflow

B) consulting on developing teaching practices at different levels (individual teachers, teams of teachers, schools, school districts)

SELECTED CONFERENCES AND PUBLICATIONS

- The excitation energy spectrum for a system with electron pairs tunneling in a two-leg ladder has a doping depended gap": http://www.teachology.xyz/vv16.pdf (Aug., 2016)

Presentation at 2016 PhysTech conference: http://www.teachology.xyz/pr16.htm

- Learning aides for students taking physics", Phys. Educ. 50 (2015) 694-698, http://stacks.iop.org/0031-9120/50/694 (October, 2015; an unedited version is free at http://www.teachology.xyz/lc.htm)
- Education reform needs a new paradigm" // http://www.teachology.xyz/np.thm (Sept. 2015)
- Math self-test for students planning on taking a physics course" // http://www.teachology.xyz/mst/mst.thml (Sept. 2015)
- What does "thinking as a physicist" mean?" // http://www.teachology.xyz/sp.htm (Mar. 2015)
- A Map of Operationally Connected Categories as an instrument for classifying physics problems and a basis for developing a novel tool for measuring learning outcomes in physics." // http://www.teachology.xyz/mocc.htm (Mar. 2015)
- Why have hundreds of millions of dollars been spent on developing the common core math standards if content-wise they are not much different from the ones they replace?" // http://www.teachology.xyz/3r.htm (Mar. 2015)
- Critical reading of "Making sense of confusion" by Eric Mazur et al." // http://www.teachology.xyz/msm.html (Mar. 2015)

"Prof. Voroshilov, I'm at a loss for words to express my gratitude. In all of my years of school, from elementary, into high school, and through college, I have been blessed with top-notch teachers. But I'm pretty sure you take the cake. =>

click this link for *our publications*

Dr. Valentin Voroshilov

Professional experience and areas of expertise:

Teaching:

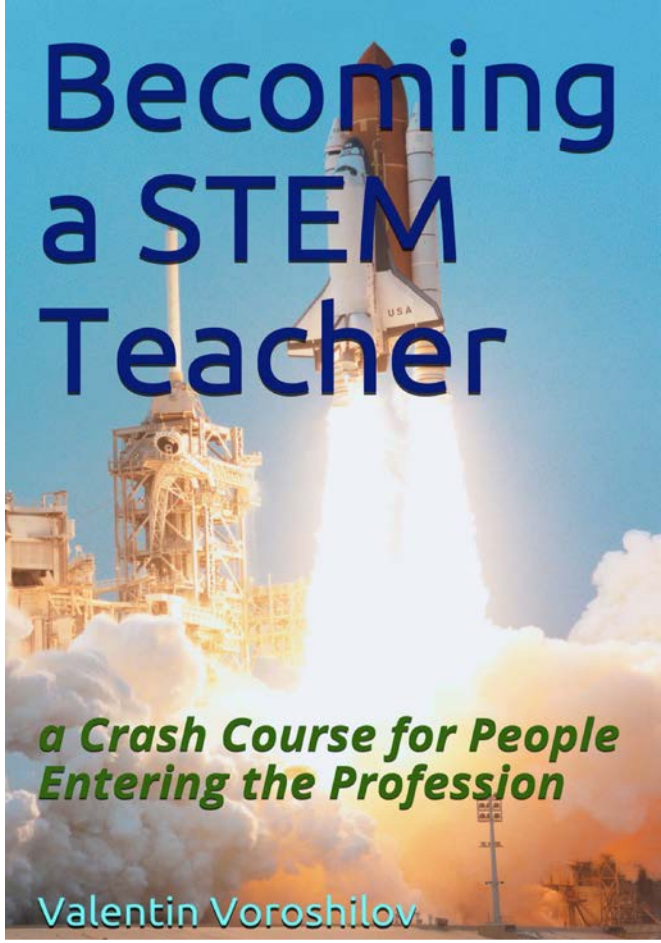
Algebra based physics
Calculus based physics
Physics for science teachers
Physics for students with learning disabilities

Algebra
Geometry
Trigonometry
Methods for teaching physics

Consulting:

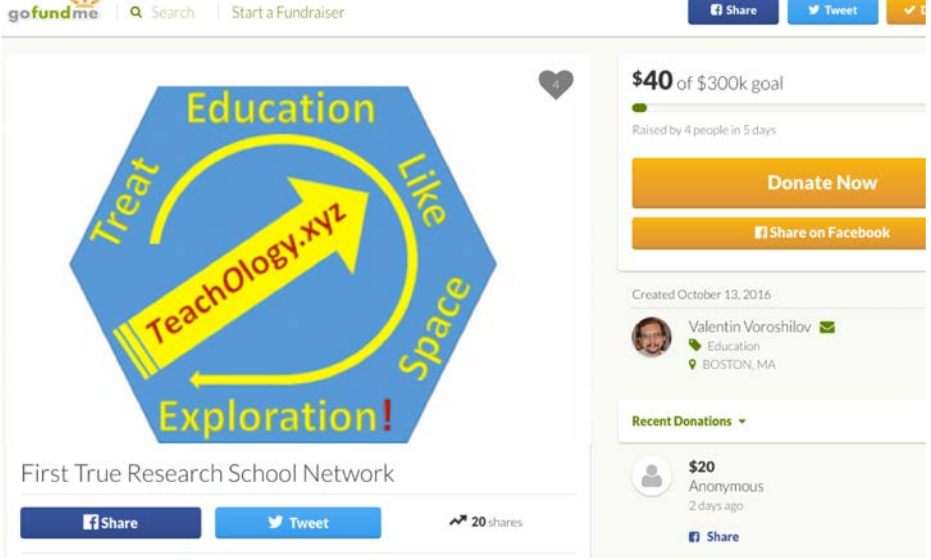
Individual teachers
School administrators
District administrators
School and district teams of educators

on strategies and tactics for advancing teaching practices and improving learning outcomes.

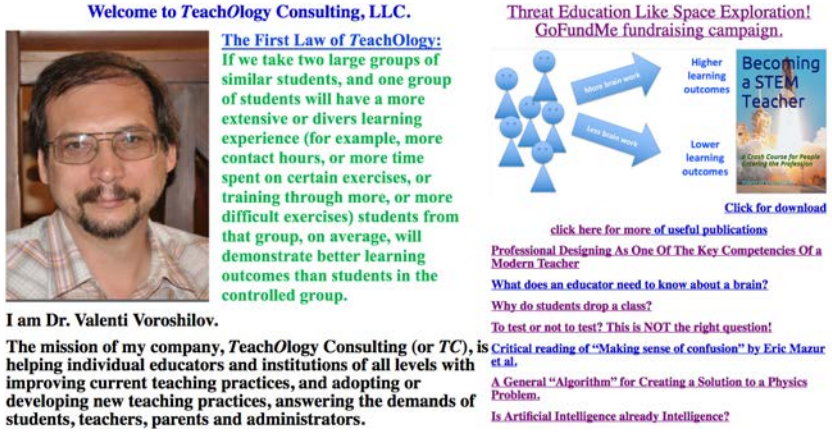


Teaching and researching on two continents.

Thank you!



https://www.gofundme.com/teachology



http://teachology.xyz/

https://teachologyforall.blogspot.com/