A Platform for Public Education on Basic Climate Change Science
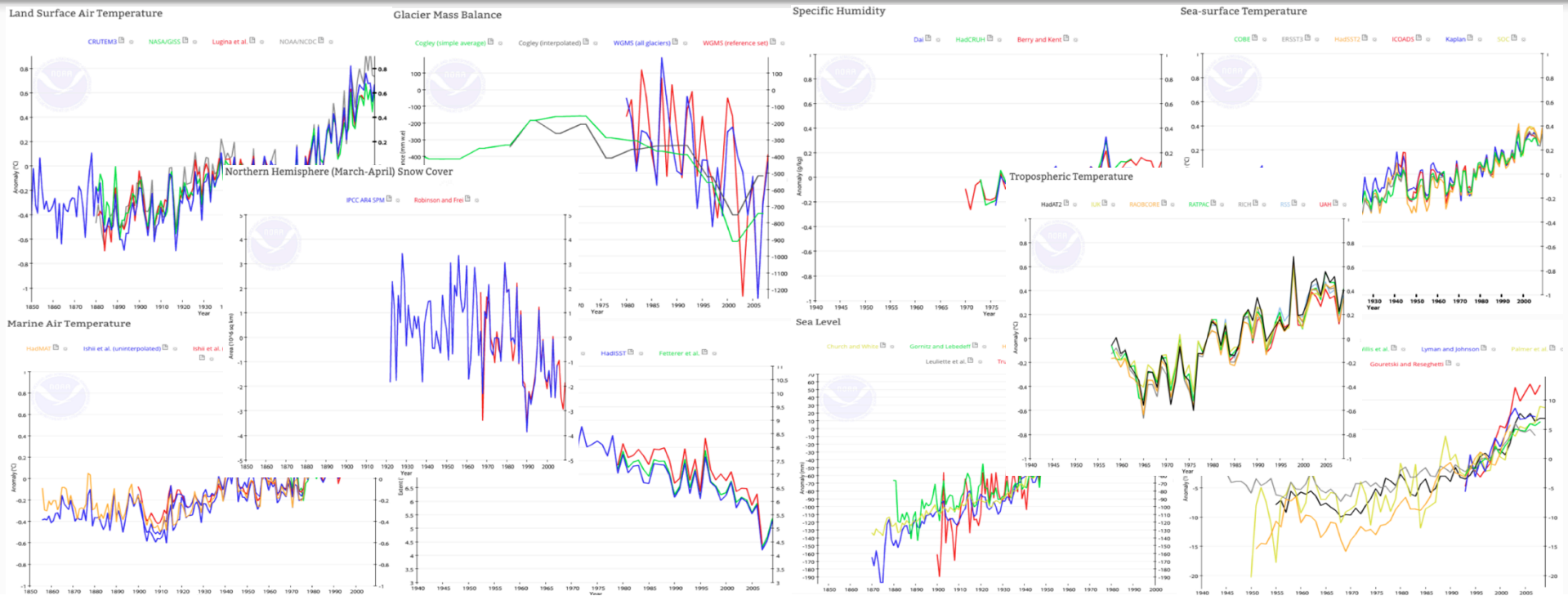
Joshua Cohen, Jason Williams, Lucas Zeppetello
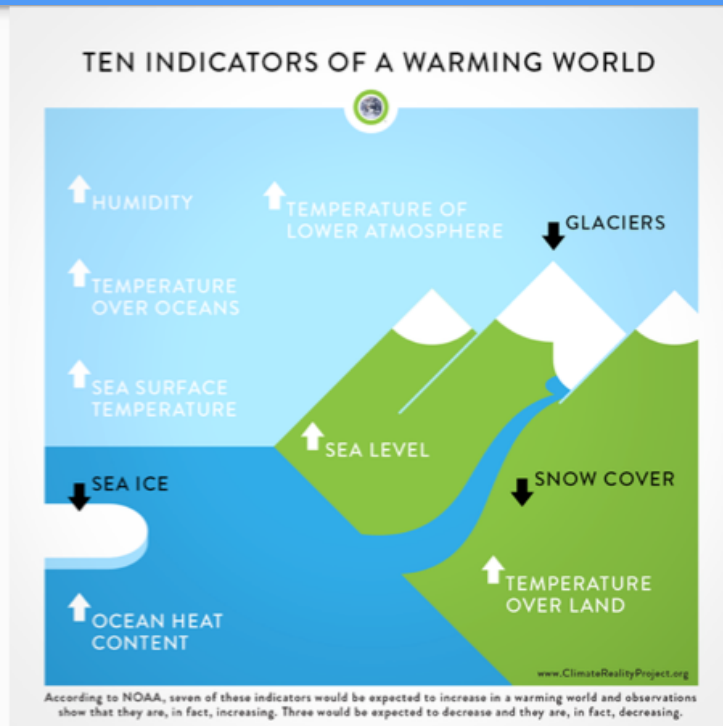
Climate Change Is Coming! The Earth is Telling Us So!

(a.k. TEN CLEAR INDICATORS OUR CLIMATE IS CHANGING

www.noaa.gov/

Too Much + Too Fast = Indifference? Worse?

TEN INDICATORS OF A WARMING WORLD

- HUMIDITY
- TEMPERATURE OF LOWER ATMOSPHERE
- GLACIERS
- TEMPERATURE OVER OCEANS
- SEA SURFACE TEMPERATURE
- SEA LEVEL
- SEA ICE
- SNOW COVER
- OCEAN HEAT CONTENT
- TEMPERATURE OVER LAND

According to NOAA, seven of these indicators would be expected to increase in a warming world and observations show that they are, in fact, increasing. Three would be expected to decrease and they are, in fact, decreasing.

www.ClimateRealityProject.org

- Simple
- Visual
- "Pre-"Interpreted

www.climaterealityproject.org/

What do we propose to do about it?

What:

    (1) "Google (Your) Earth" - a web-based application platform that aggregates and correlates the trove of scientific data on climate science available online, and gives the public users and scientists an easy-to-use platform to discuss, interpret, and understand what's happening to our planet.

    (2) An improvement on the already existing "Next Generation Science Standards" - a proposed change in the high school curriculum which we would opt to include additional topics on non-anthropogenic climate change, energy conservation, and solutions to solve our current climate issues.

What do we propose? (part two)

Who:

GYE will be available to anyone with internet access - free for standard accounts, paid for premium accounts (only provides access to more recent and/or higher quality data). The curriculum would be available for any state to adopt.

How:

GYE can be developed based on currently-available data, and combining currently-available similar platform structures (est. <$10m budget, <5y time-scale). The original team of 40 members and an additional 10 scientists and teachers who are experts on climate science solutions and alternative energy solutions. The NGSS is currently not funded at all, so there isn't any incentive for states to adopt these standards. Therefore we propose federal grants that will assist with the implementation of the entire program. Because of the inherently political nature of this curriculum with regards to climate change, we will also give states the option to choose to implement certain parts of the program, with appropriate funding for the parts the adopt.

Motivation

The current climate change debate is happening on unacceptable premises. There is too much data available and the scientific consensus is too strong to justify the lack of publicly available and understandable knowledge about climate change. We feel that a platform created and moderated by scientists purely for educational purposes is essential to drive for a more informed dialogue surrounding the issues that are already affecting humanity.

The problem that needs to be addressed contextualized

Exxon Knew about Climate Change almost 40 years ago

A new investigation shows the oil company understood the science before it became a public issue and spent millions to promote misinformation

Recent Exxon investigation purportedly citing internal documents

- Claims primarily focus on Exxon "stressing uncertainty" of climate change[1]
- Regardless of total veracity, any truth to these claims imply long-term avoidable damage

"We are in the middle of what you might call a global warming bubble. It is a failure of the global warming theory itself and of the credibility of its advocates..."
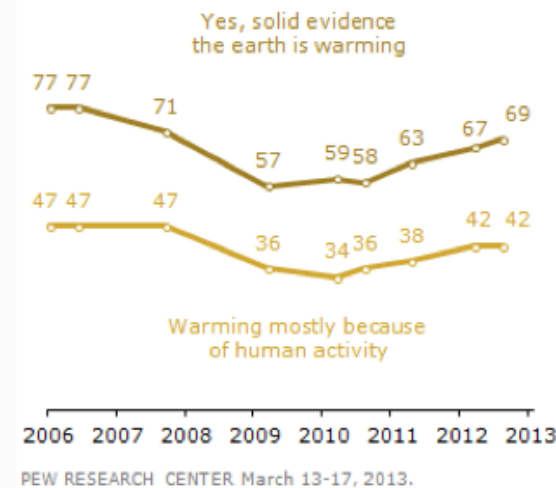
Robert Tracinski quote republished by the Wall Street Journal

- WSJ boasts roughly 2.4 million daily circulations[2]

- WSJ Digital Network claims an average of 31.3 million unique visitors, 50% of which visit daily[3]
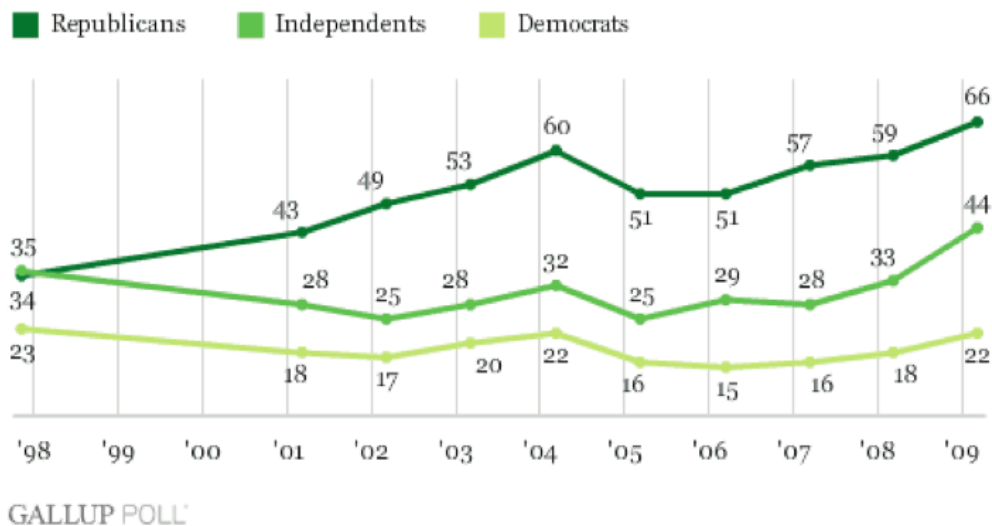
Data Driven Education (Pitfalls and successes)
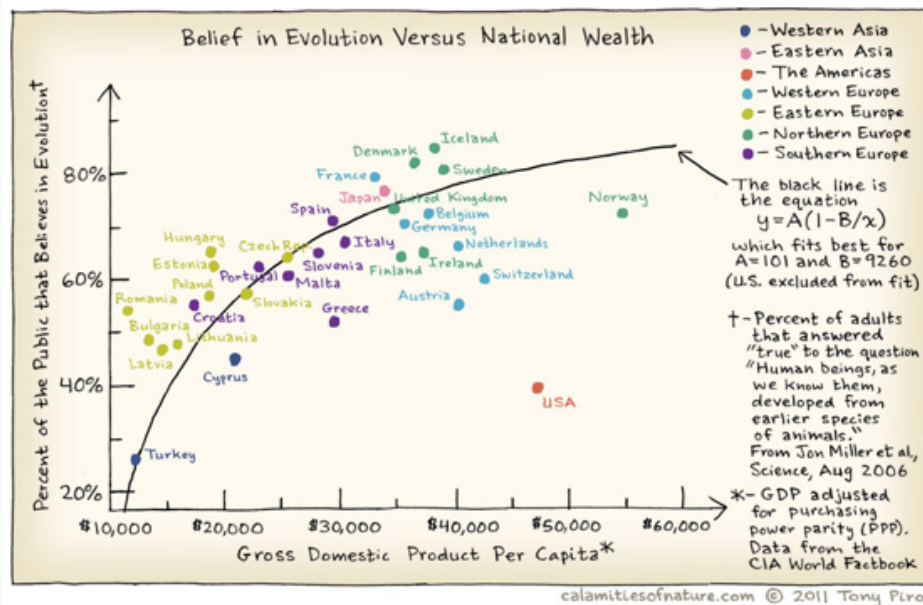
Importance of Uncertainty in Climate Change Science

Percentage Saying News of Global Warming Is Exaggerated, by Party ID

■ Republicans ■ Independents ■ Democrats

GALLUP POLL

- Crucial distinction between people believing in climate change and people understanding climate change.

- Sensationalism is our greatest challenge here.

- Any educational applet must lead users to draw their own conclusions based on presentation of evidence, not by lambasting and rhetorical flourishes.

Technical specs of our proposal

- Web-based platform similar in style and manipulations to Google Earth

- Climate data is aggregated from wide array of sources (NOAA, NASA, ESA, JAXA, GCOS (Global Climate Observing System), AERONET, CADIS (Cooperative Arctic Data Information System), just to name a few)

- Discussion platform accompanying it similar in style to Reddit: users/public ask questions, post infographics, tag interesting data. Scientists weigh in, interpret confusing images, add scientific analysis (official and unofficial). No viewpoint is suppressed!
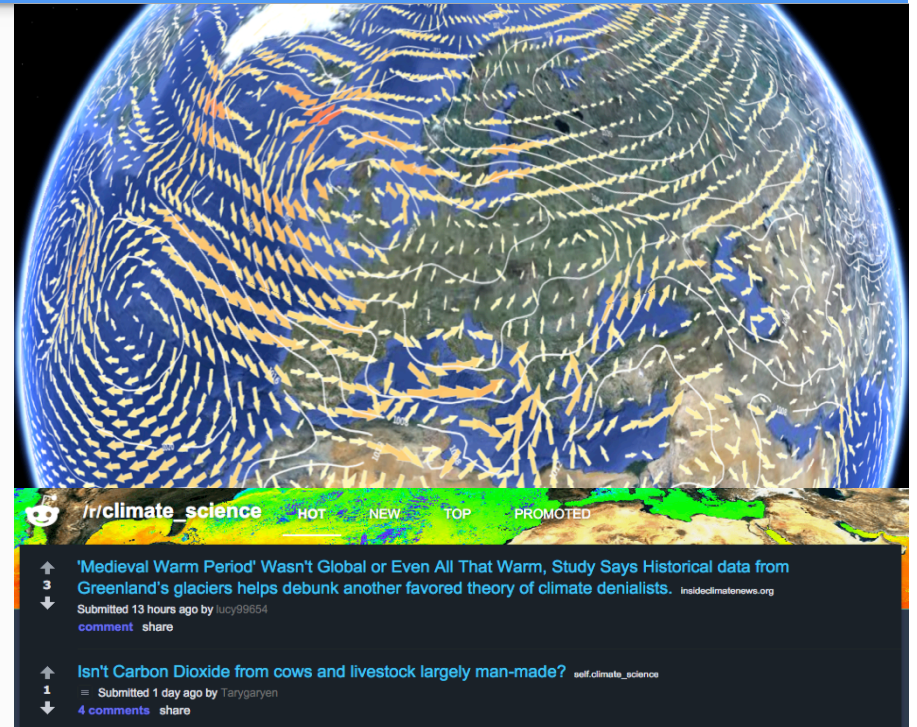
Technical specs (cont'd)

LANDSLIDE MODEL OPACITY: 100%
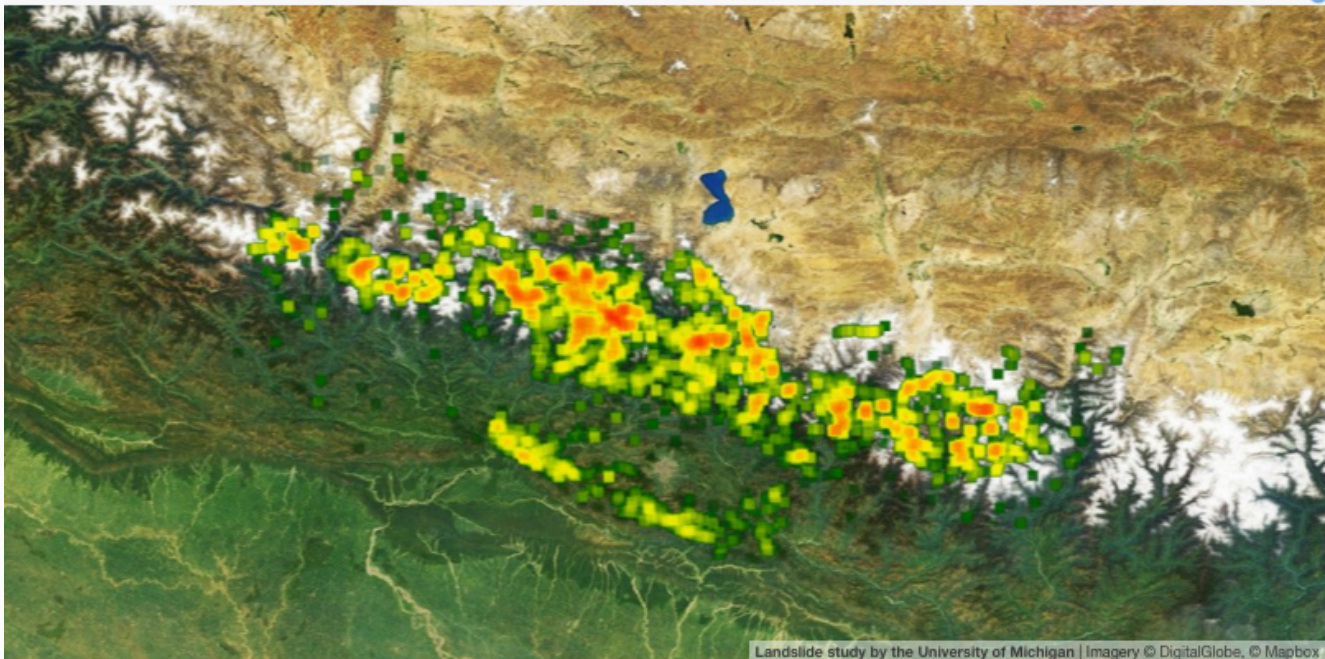
Landslide study by the University of Michigan | Imagery © DigitalGlobe, © Mapbox

Technical specs (cont'd)

- Data would be searchable by source, time, location, biome, popularity, and related events

- Many platforms already exist, but are highly specialized. Ex:

    - World Bank Group's Satellite Summit website (Landsat imagery only - still in prototype)

    - NASA JPL's Advanced Rapid Imaging and Analysis (ARIA) Center (Primarily for natural hazards)

    - NOAA's Climate Data Online (no discussion/feedback, limited to mostly specialized weather data)

- Large amounts of data are free, and are useful enough to the average user.

Satellite ▼	Operational ▼	Open Data ▼	Spatial resolution (m) ▼	Revisit rate (days) ▼	Cost ($ per km²) ▼
Airbus Pléiades	Live	No	0.5	1	13
Airbus SPOT 6/7	Live	No	1.5	1	5.15
Blackbridge RapidEye	Live	No	5	5.5	1.28
DigitalGlobe WV2	Live	No	0.46	1.1	17.5
DigitalGlobe WV3	Live	No	0.31	1	32
ESA Sentinel 2	Live	Yes	10	5	0
NASA MODIS	Live	Yes	500	1.5	0
NASA/USGS LandSat 1-3	Decommisioned	Yes	60	18	0
NASA/USGS LandSat 4-5	Decommisioned	Yes	30	18	0
NASA/USGS LandSat 7-8	Live	Yes	15	18	0
Planet Labs	Planned	No	3	0.25	n/a
Skybox	Planned	No	0.9	n/a	n/a

What is the short term goal?

- Initiate and support critical dialogue between the scientific community and the general public on the immediate and long-term impacts of climate change in a highly visual and accessible way

- Allow for immediate response and interpretation of visual data, without waiting for a "major agency" to build a single colorful infographic

- Cater more broadly to a rising demand for data[1], and take advantage of "societal benefits":
    "Archaelogists can combat looting. Cities can build more resilience against the effects of climate change, from preparing for coastal flooding to reducing pollution and energy consumption. National governments and journalists can document and combat illegal logging that leads to deforestation. Non-governmental organizations engaged in disaster relief and development can use open climate data to improve responses, track projects and map roads and paths."[2]

- Avoid the potential for future controversies (e.g. "Climategate" - the Climatic Research Unit email controversy), which only inhibit the necessary progress to improve public support for

Possible Users and Business Sustainability

Separation of paid users and free users:

Paying users:

Free users:

- Insurance industry
  - Educational institutions

- High resolution and recent data (primarily satellite imagery in this case) can cost an additional
  - Coastal land development
  fee, potentially discouraging more amateur users. Ex: 1 km^2 of a high-res image may cost $35,
  which is prohibitive to a single user. But if 100 users request the same image, the cost can be
  - Renewable energy companies
  split to $0.35 each!
  - Public utilities

- Since these specialized platforms/datasets exist in some cases, much of the development cost
  can be avoided/shared/subsidized between companies, industries, and world governments,
  reducing a multi-million dollar effort to a relatively small contribution per participating entity

- Non-profit NGO

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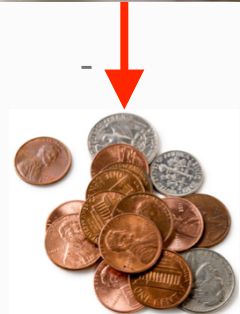
What is a long term curriculum driven goal?

Our long term goal is to standardize climate science as part of the high school curriculum. This will not only ensure that students coming out of high school have a basic understanding of how the things they do affect the climate, but will also serve the dual purpose of inspiring people to invent new ways to further protect the planet. This will also ensure that as time goes on, this is an issue that always remains in the mind of the public, solving the problem of people forgetting about climate issues once we have achieved our 'goals.' (specifically referencing the recent talks in Paris).

Technical specs (cont'd)

In order to see whether this will be a successful implementation or not, we will have to look at the NGSS as a whole to see whether that will be successful . However, the only thing that we can compare it to, the Common Core, has little empirical evidence since its implementation has been so recent.

Changes in NAEP 4th Grade Reading, By 2011 Implementation Index

Table 2-1

Implementation Rating	2009–2011	2011–2013	2009–2013
Strong (n=19)	0.22	0.64	0.87
Medium (n=27)	0.17	0.81	0.99
Non-adopters (n=4)	– 0.78	0.53	– 0.24
All (n=50)	0.12	0.73	0.84

Note: Strong = adopted CCSS in ELA and pursued three implementation strategies (PD, new instructional materials, joined testing consortium). Medium = adopted CCSS-ELA standards but did not employ at least one of the implementation strategies. Non-adopters = did not adopt CCSS-ELA.

Source: Modified from: Webber, A., Troppe, P., Milanowski, A., Gutmann, G., Reisner, E. and Goertz, M. State (2014), Table H.1. Standards and Assessment Indicators by State, 2010–2011, in *State Implementation of Reforms Promoted Under the Recovery Act*, National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education, Washington, DC.

How can we measure our successes and failures

Short Term:
- Measure daily usage statistics of the platform (which can be broken down by simple Analytics)

- Correlate usage of the platform against publicized "climate hazard" events (conferences, natural disasters, etc) - more usage means that people are fact-checking and looking for further input

- Any infographics/republished information from the platform online/in the media will be highly noticeable

Long Term:
- Collecting data on total users over a 5 year period and investigating correlation to change in beliefs.

- Ripple effect: statistical modeling of knowledge dissemination (can we model how ideas spread?).

- In any large-scale effort to improve a complex system, there must be continuous reviews of progress and of unintended consequences. But we do urgently call for mid-course evaluations to ensure that the promise of a standards-based education is fulfilled , which would involve designing evaluations that measure the full range of standards, including those that require problem solving, critical thinking, and building new understandings.