



**Wisdom is not the product of schooling
but the lifelong attempt to acquire it.
- Albert Einstein**

Envisioning and Grounding New Educational Designs in Data Driven Approaches

Gerhard Fischer
Center for LifeLong Learning & Design (L³D), University of Colorado, Boulder

EC-TEL Conference, September 2017, Tallinn, Estonia

Basic Message

exploring different dimensions (challenges, opportunities, promises, pitfalls) of the interplay between

new educational designs ↔ data-driven approaches

to address the themes of EC-TEL 2017:

- papers having (visionary) new educational designs
- Data Driven Approaches in Digital Education'

Overview

- Guiding Principles for New Educational Designs
- The Age of Dataism
- Exploiting the Opportunities and Avoiding Pitfalls with Dataism
- Conclusion

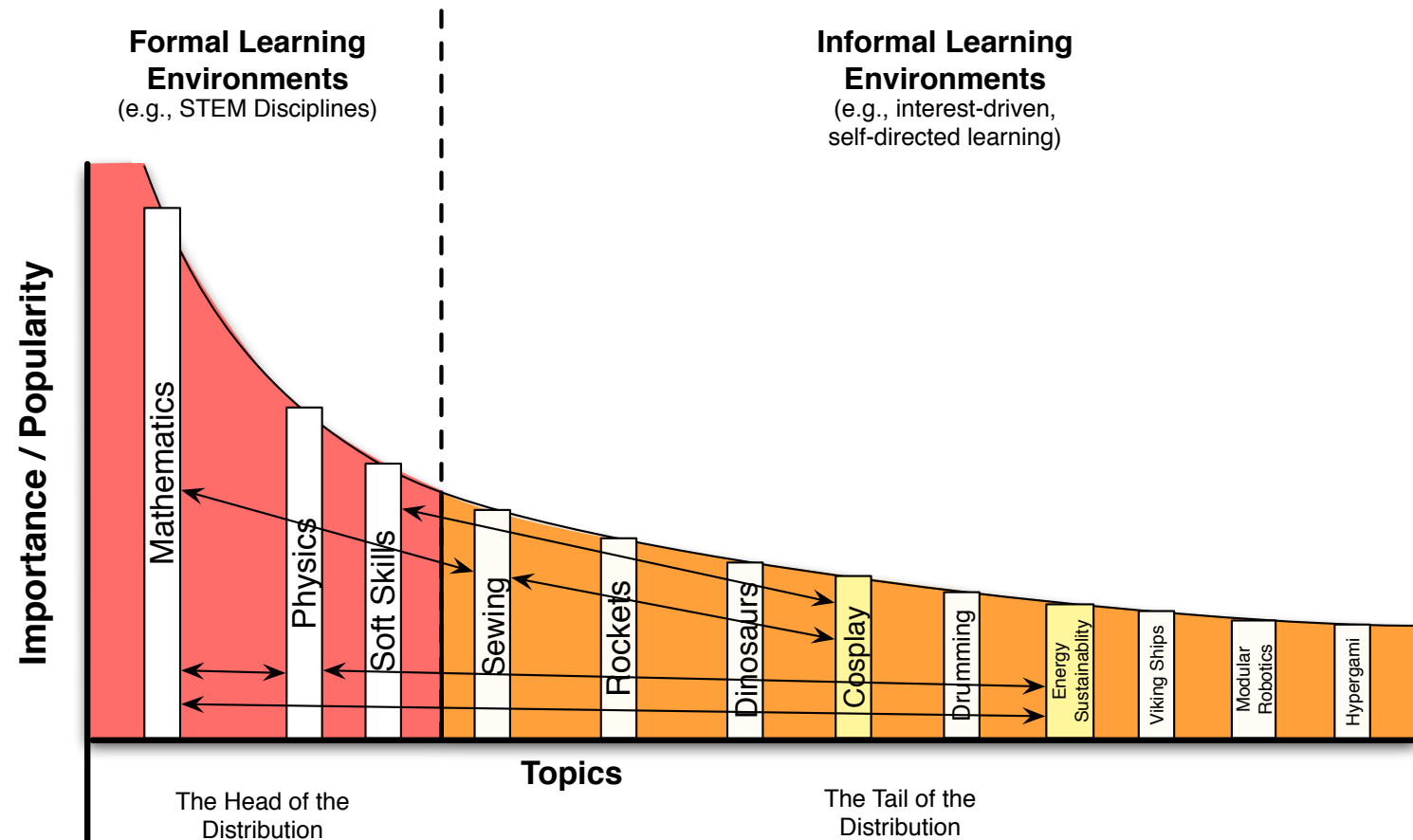
Guiding Principles for New Educational Designs

- **have** to learn → **want** to learn
- teacher, learner = **f{person}** → teacher, learner = **f{context}**
- learning when the **answer is known** → learning when the **answer is not known**
- schools and universities are **natural (“god-given”) entities** → are **social constructs**
- **teaching and learning are not inherently linked** →
 - there is a lot of **learning without teaching**
 - there is a lot of **teaching without learning**

Success Models of “Want to Learn”

- skiing in Boulder, Colorado
- LEGO construction kits
- Scratch Programming Environment
- **“October Sky”** (http://en.wikipedia.org/wiki/October_Sky), based on a true story, illustrates the many aspects of how passion and self-directed learning can change people’s lives.
- **Destination Imagination** (<http://www.destinationimagination.org/>) is a volunteer-led, educational non-profit organization that teaches 21st century skills (including teamwork, perseverance, self-directed learning, courage, and leadership) and STEM principles to kindergarten through university level students through creative and collaborative problem solving challenges.

The Relationship between the Head and the Tail in the Long Tail Framework



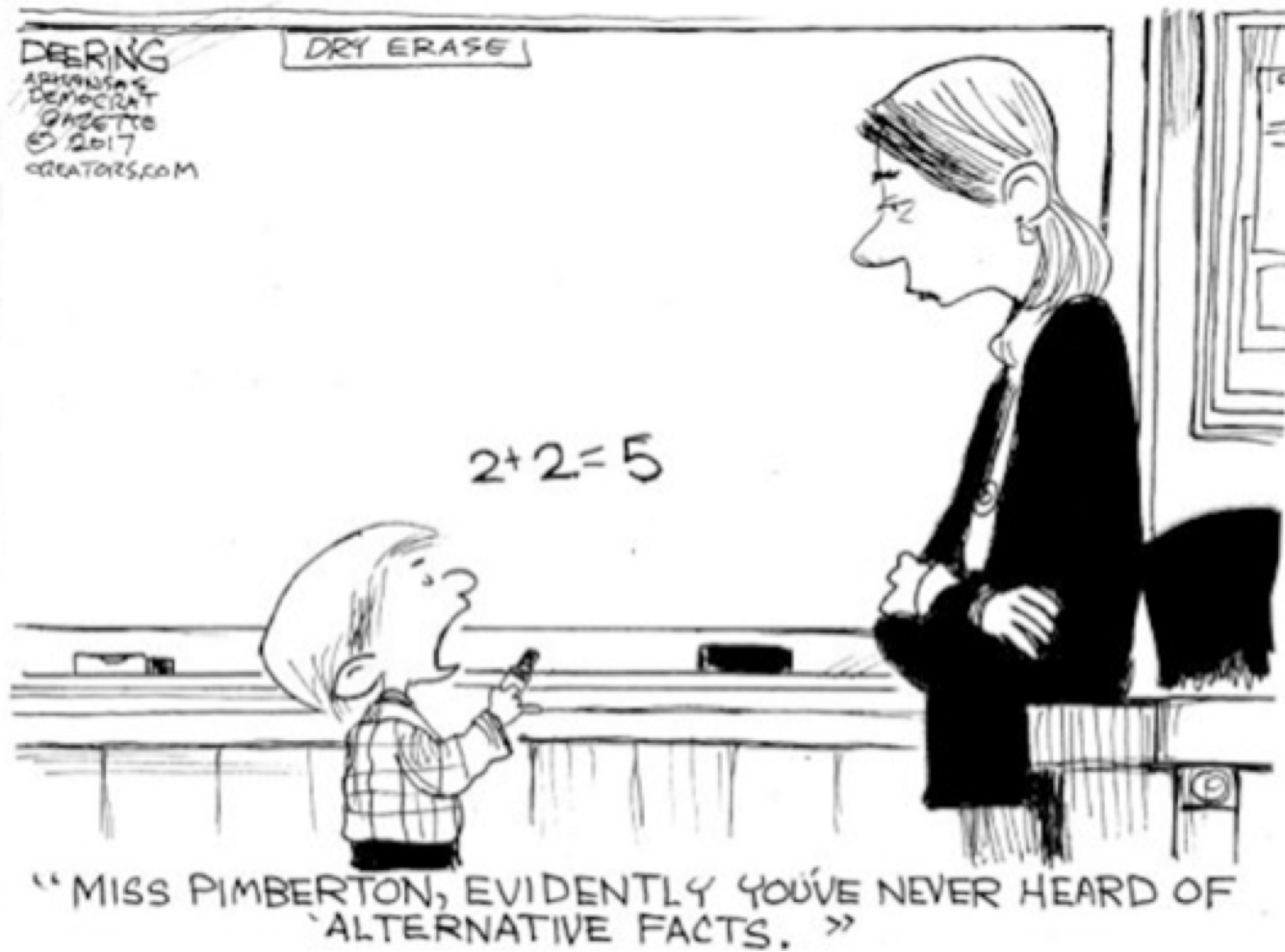
Why Some Students Want to Go to School



$$\begin{array}{ccc} \text{Teacher, Learner} & = & f\{\text{Person}\} \\ & \rightarrow & \\ \text{Teacher, Learner} & = & f\{\text{Context}\} \end{array}$$

- **“symmetry of ignorance”**
 - the expertise and ignorance is distributed over all participants in a wicked problem
 - for important and challenging problems: there are no experts anymore (people who know all the relevant knowledge)
- **in instructionist classrooms:** teachers are knowledgeable, because they talk about topics they know and for which they got prepared
- **in interest-driven settings where the students have the freedom to bring up topics**
→ it will become quickly obvious that the knowledge of teachers is limited

A Student knowing something that the Teacher does not know



Learning when the answer is known
→
Learning when the answer is not known

*“In important transformations of our personal lives and organizational practices, we must learn new forms of activity which are not there yet. They are literally learned as they are being created. **There is no competent teacher.** Standard learning theories have little to offer if one wants to understand these processes.” — Yrjö Engeström*

Schools and Universities are **Natural Entities** → **Social Constructs**

*“A decade of interdisciplinary research on everyday cognition demonstrates that school-based learning, and learning in practical settings, have significant discontinuities. **We can no longer assume that what we discover about learning in schools is sufficient for a theory of human learning.**” — Scribner and Sachs*

Teaching and Learning are not Inherently Linked

- **there is a lot of learning without teaching**

- informal learning
- rich resources at our fingertips
- Illich, I. (1971) Deschooling Society → Learning Webs

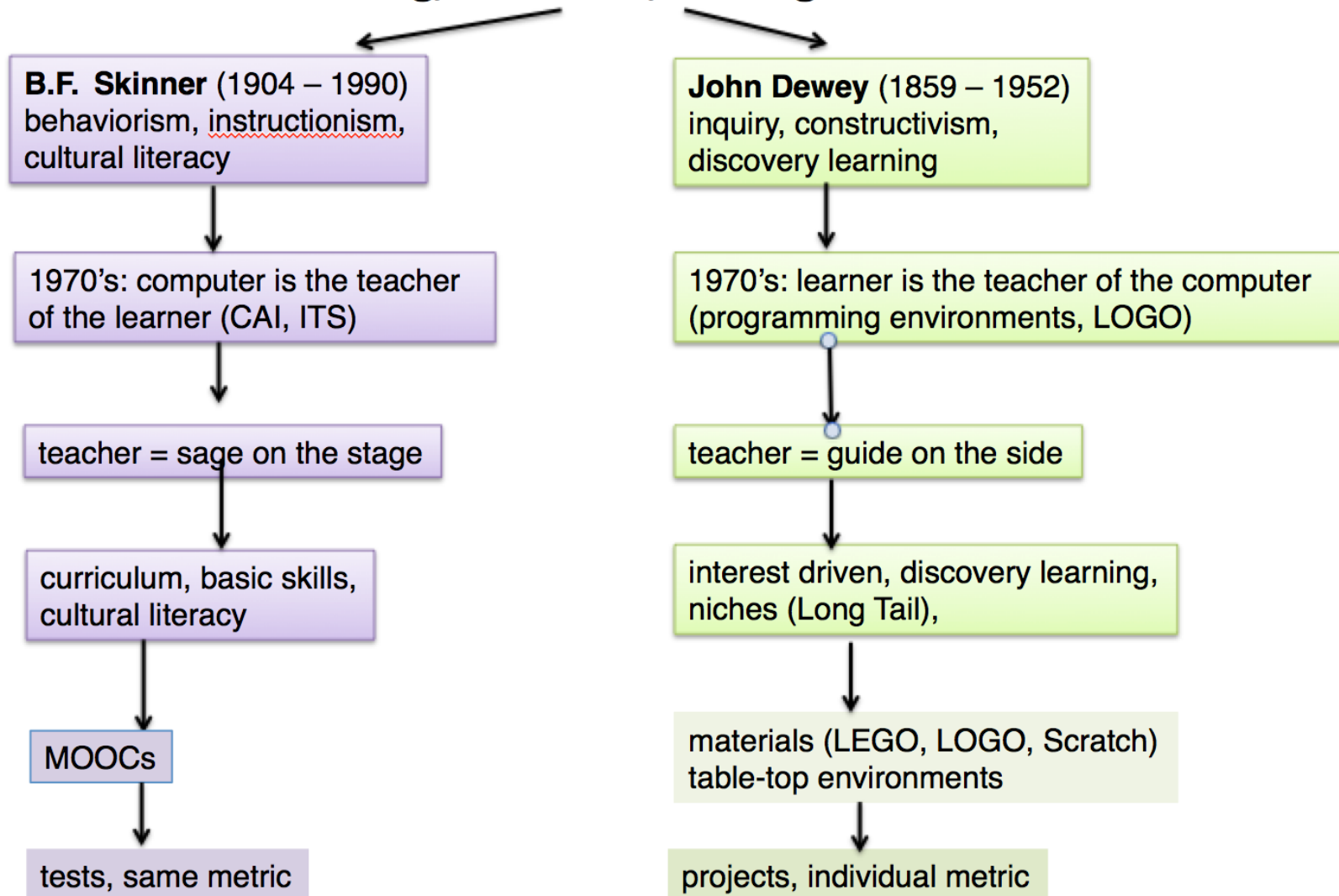
- **there is a lot of teaching without learning**

- I considered this as a major challenge for my professional life as a teacher
- the question: what kind of data will help me to identify my failures and give me indications how to improve?

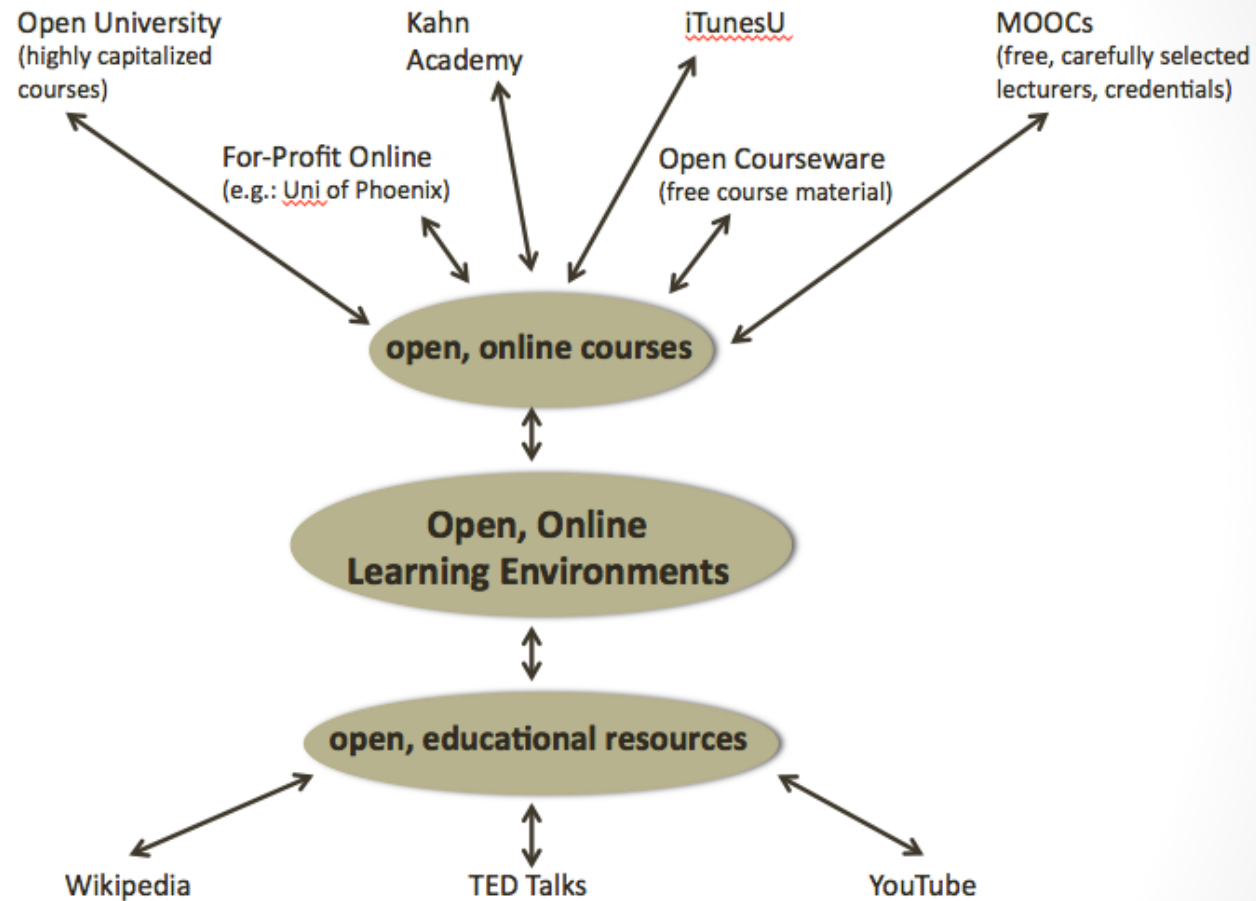
A Fundamental Distinction for Technology Enhanced Learning

- Skinner “Behaviorism” → Intelligent Tutoring Systems → instructionist approaches
- Dewey “Inquiry Based Learning” → design environments → constructionist approaches

Learning, Education, and Digital Media



Digital Education



Clickers

Classroom Response Systems: Creating Active Learning Environments



The Envisionment and Discovery Collaboratory (EDC)



The Age of Dataism

▪ Dataism — Definition

- “an obsession with data that assumes a number of things about data, including that it is the best overall measure of any given scenario, and that it always produces valuable results” — David Brooks, The New York Times

▪ Dataism — why now:

- technological changes: more digital storage, smartphones with GPS and timestamps (meta-information is provided for free)
- data is easy to collect because many transaction happen [inside of computational environments](#)
- examples: MOOCs, Scratch, buying books with Amazon, storing photos in our photo libraries (time stamp, location,)

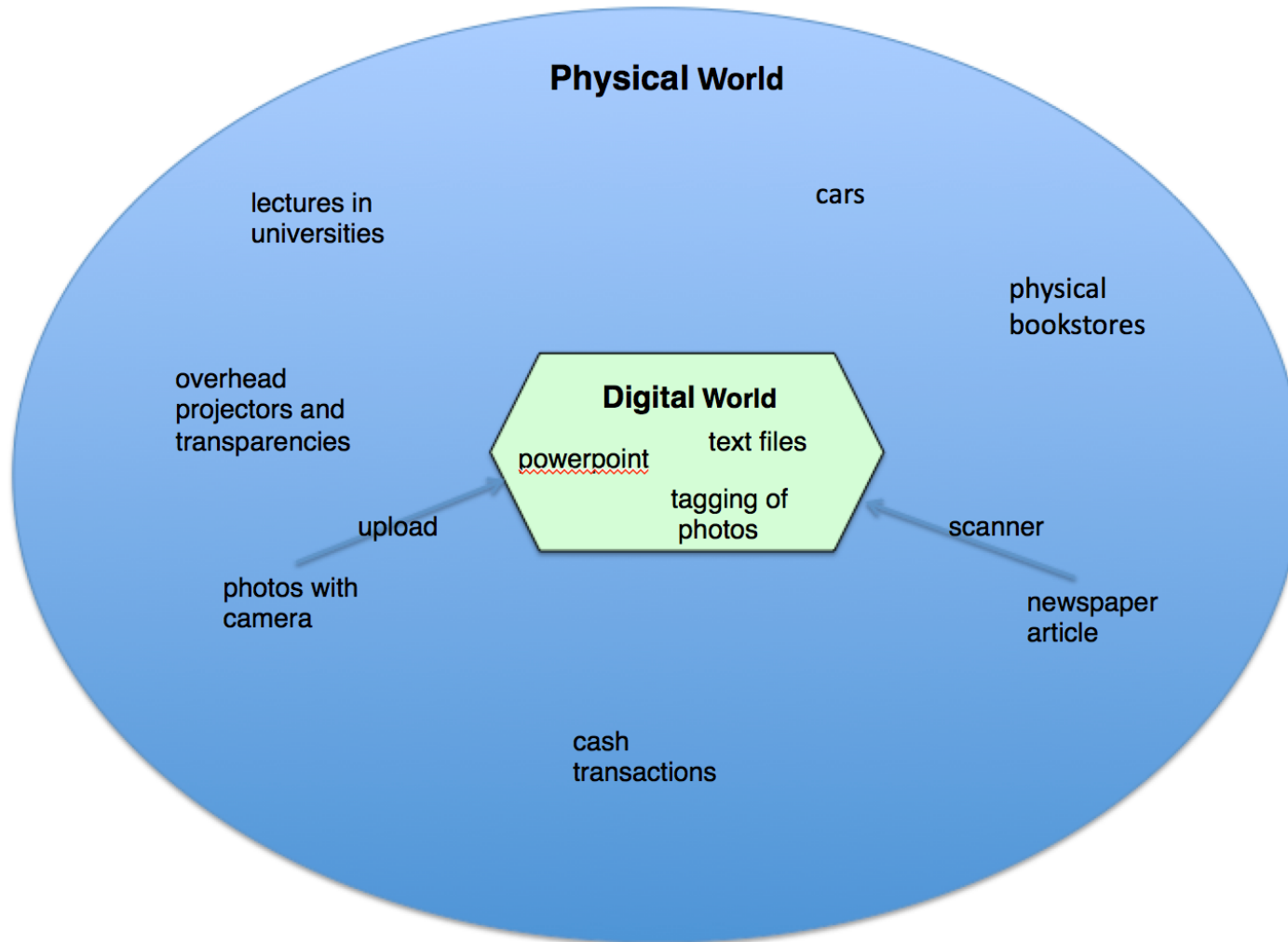
The current interest (and hype) associated with Big Data / Data Science

- abundance of faculty positions at American Universities
- data science = most popular courses in the MOOCs offerings (Coursera, edX)

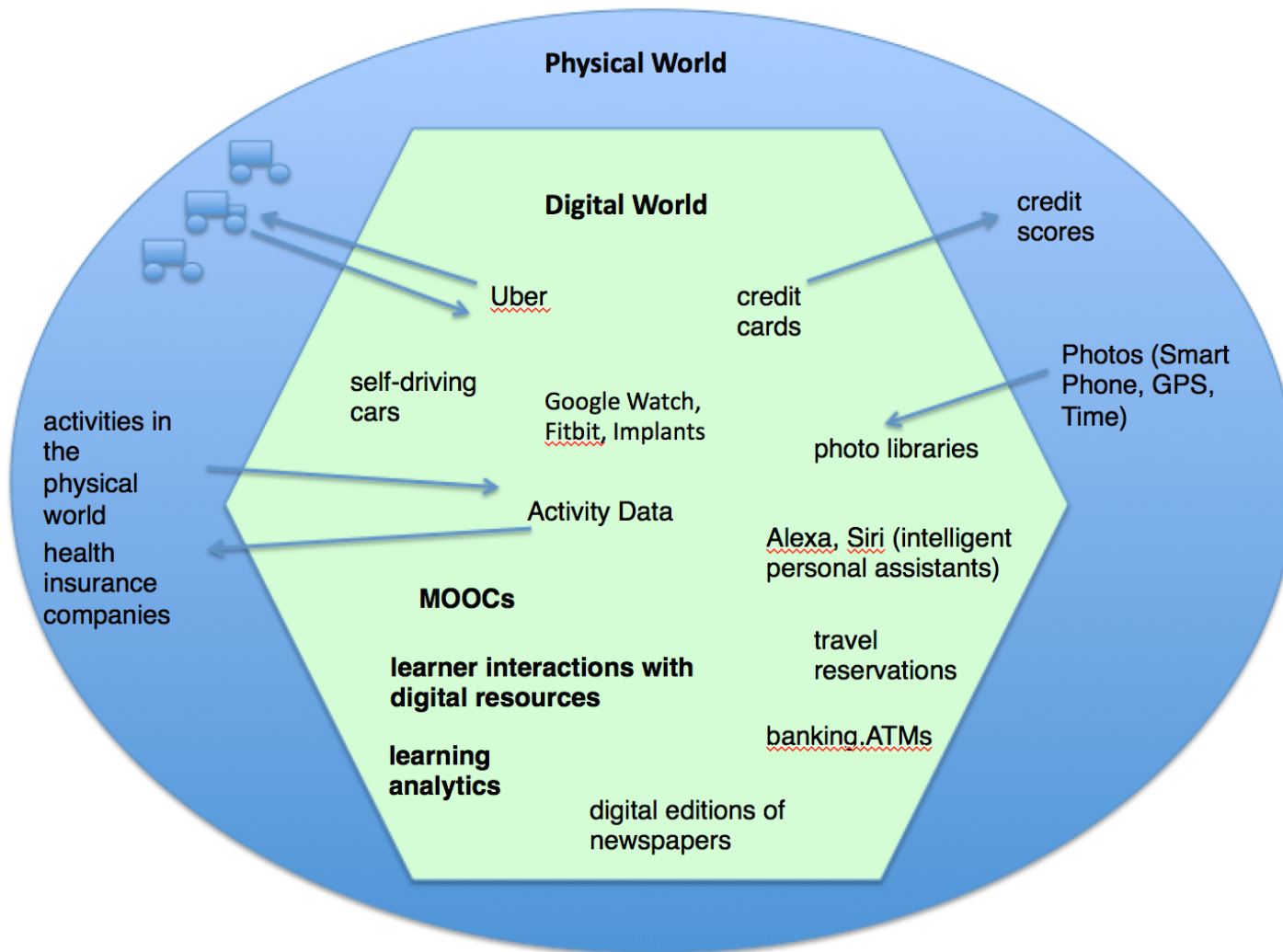
Arguments for Data Driven Approaches in Digital Education

- **focus:** the new possibilities and challenges brought by the digital transformation of the education systems
- **opportunity:** the increasing amount of data that can be collected from learning environments but also various wearable devices and new hardware sensors provides plenty of opportunities to rethink educational practices and provide new innovative approaches to learning and teaching
- **objective:** data can provide new insights about learning, inform individual and group-based learning processes and contribute to a new kind of data-driven education for the 21st century
- **learning analytics** is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs

The Physical World and the Digital World – The Past



The Physical World and the Digital World – The Future



Data Driven Approaches in Digital Education: Opportunities and Challenges

- **opportunity:** the data revolution is giving us wonderful ways to understand the present and the past (→ provide us with insights and understanding “how things are”)
- **challenge:** will the data revolution transform our ability to predict and make decisions about the future? (→ provide us with design inspirations and guidelines “how things could/should be”)
- **claim:** new educational designs are not only influenced by data but also by problems, ideas, and visions
 - “Knowledge does not start from perceptions or observations or the collection of data or facts, but it starts, rather, from problems.” — Karl Popper

Why Data is Important

- provide evidence instead of beliefs
- identify misconceptions
- refuting and/or supporting assumptions and claims

example:

MOOCS evangelists /
optimists
hype

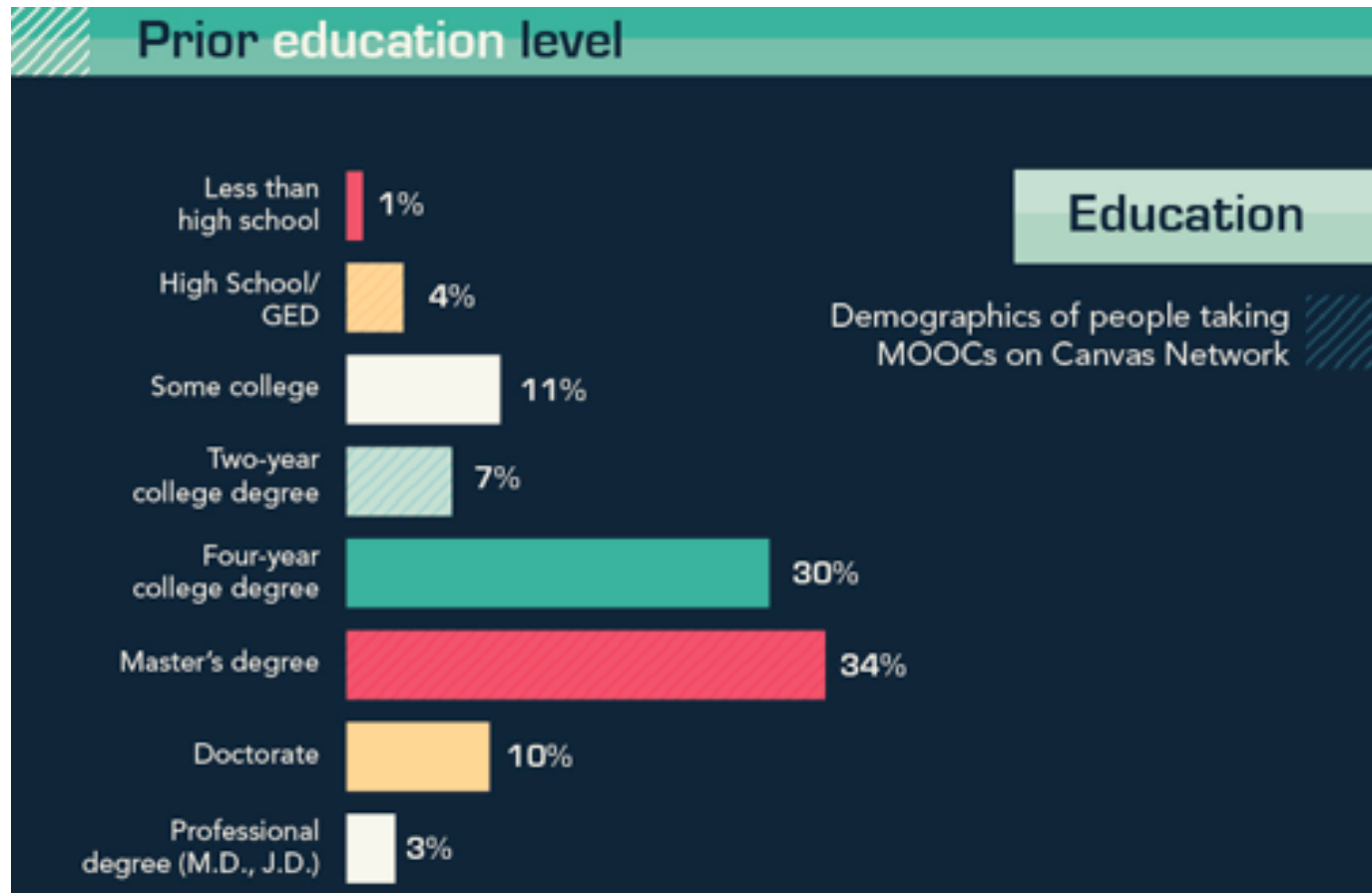
↔
↔
↔

MOOCs skeptics /
pessimist
underestimation

number of people who sign up but do not complete a MOOC course: “*just 4% of Coursera users who watch at least one course lecture go on to complete the course and receive a credential*” → **misinterpretation**

Data about MOOCs

source: <http://ideas.ted.com/2014/01/29/moocs-by-the-numbers-where-are-we-now/>



Pitfalls

(unintended, unnoticed, and undesirable side-effects)

- influencing our behavior (e.g.: focus publications from a H-Index orientation)
- reducing risks taking associated with innovations and changes
- creating a potentially misleading impression of being “scientific” (by comparing numbers)
- ethics and privacy policies
 - our data is payment for free or cheap services and content
 - personalization: interesting vision or future reality — Chris Eggers: “The Circle” (book) → movie (2017)

Data easily collected, easily compared and decontextualized to a number

- H-Index
- number of publication (quantity — not quality)
- research dollars/projects acquired
- Faculty Course Questionnaire (FCQ)
- Stephanie Teasley quoting ??? yesterday: “Don’t value what we measure — measure what we value”

Interesting Example

A Faculty Course Questionnaire (FCQ) with a Bi-Polar Distribution

negative comments

“I will not ever take a course of this nature again in my undergraduate career, and I hope to find a more structured graduate program with an adviser that is more forthcoming. I will reinforce my strengths by continuing to study in the method that I have developed over the past 15 years, I will redirect my weaknesses by avoiding unstructured class environments.”

“One should believe that the instructor knows at least the answer”

“I do not want to learn from my peers who know as little as I do — I want to learn from the instructor”

Positive Comments

“When I signed up for this class I had no idea what it was going to be about. Once I started understanding the material, however, I was extremely thrilled and interested to be a part of one of the most progressive courses on campus. I'm not sure what specifically to say except that I rank this class in the top three that I've taken at CU.”

“The self-directed nature of the work ensured that I wouldn't be bored or unchallenged, and the interplay between all of us was a lot of fun. After four and a half years in college, I can honestly say that this is one of the first courses where I was treated as an adult, a fact which means more to me than I can describe.”

Feedback (Data) from these Questionnaires

Sources of Insight for Making Changes

- **comment (data):**

“When I signed up for this class I had no idea what it was going to be about....”

- **change:**

- a detailed description of the nature of this class helping students decide whether they want to take this class or not

Design Trade-Offs Associated with Data-Supported Opportunities

Personalization and Filter Bubbles

Personalization — a highly desirable strategy for teaching and information delivery to avoid information overload, to link information to the needs and interest of users

Filter Bubbles — the downside of not being exposed to other opinions, losing the foundations for making compromises, being stuck in group think

Pariser, E. (2011) *Beware Online "Filter Bubbles"* (TED Video),
<http://www.youtube.com/watch?v=B8ofWfx525s>.

examples:

- web searches present different results based on data from previous searches
- watching CNN versus Fox News on American TV

Will we as Humans be defined by our Data? — A Modern Tombstone



The Challenge

the future is not out there to be discovered
—
it has to be **invented and designed**

- **question:** invented and designed → by whom?
 - by them? → Silicon Valley, MOOCs companies, Betsy deVos,
 - by the communities we belong to? **TEL, CSCL, CSCW, HCI, AI,**
 - **by each of you?**

A Challenge for the EC-TEL community

exploring different dimensions (challenges, opportunities, promises, pitfalls) of the interplay between

new educational designs ↔ data-driven approaches

by creating and evolving a collective understanding of how

a principled, collaborative, and balanced data ecosystem

can contribute to enhance and support learning in the 21st century