Big Education in the Era of Big Data

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Big Education in the Era of Big Data @ FedCSIS 2014, September 7-10, 2014, Warsaw, Poland

Under-Secretary of State
Ministry of Science & Higher Education

Wlodzislaw Duch

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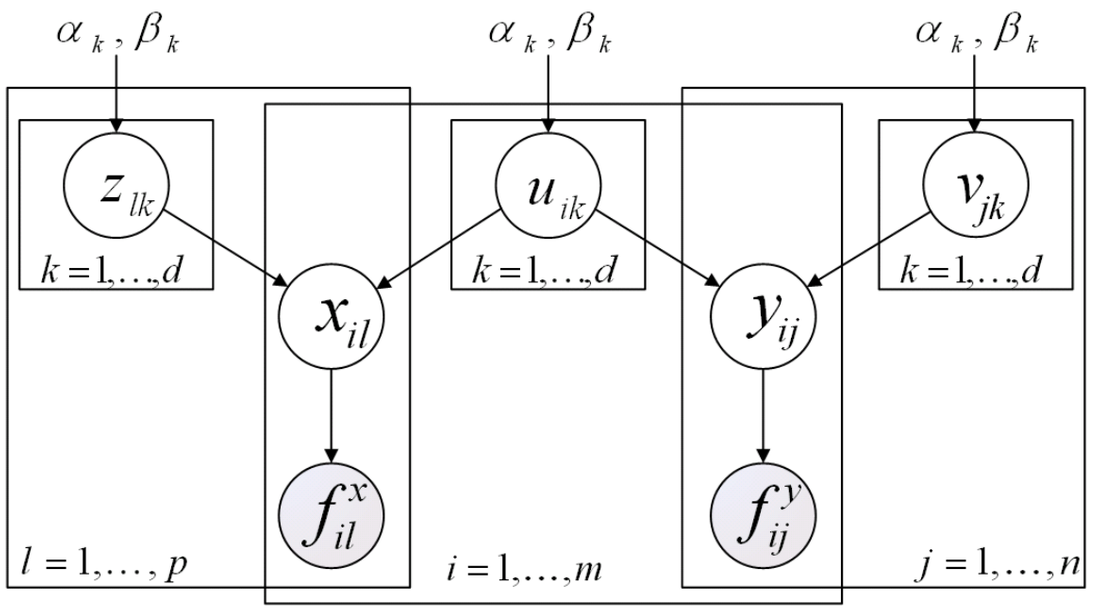
Collective Probabilistic Factor Model



$$\mathcal{L}(U,V,Z;F^x,F^y)$$
$$= \sum_{i=1}^{m}\sum_{l=1}^{p}(f^x_{il}\ln x_{il} - x_{il}) + \sum_{i=1}^{m}\sum_{j=1}^{n}(f^y_{ij}\ln y_{ij} - y_{ij})$$
$$+ \sum_{i=1}^{m}\sum_{k=1}^{d}((\alpha_k - 1)\ln(u_{ik}/\beta_k) - u_{ik}/\beta_k)$$
$$+ \sum_{j=1}^{n}\sum_{k=1}^{d}((\alpha_k - 1)\ln(v_{jk}/\beta_k) - v_{jk}/\beta_k)$$
$$+ \sum_{l=1}^{p}\sum_{k=1}^{d}((\alpha_k - 1)\ln(z_{lk}/\beta_k) - z_{lk}/\beta_k) + \text{const.}$$

$$u_{ik} \leftarrow u_{ik}\frac{\sum_{j=1}^{n}(f^y_{ij}v_{jk}/y_{ij}) + \sum_{l=1}^{p}(f^x_{il}z_{lk}/x_{il}) + (\alpha_k - 1)/u_{ik}}{\sum_{j=1}^{n}v_{jk} + \sum_{l=1}^{p}z_{lk} + 1/\beta_k}$$

$$v_{jk} \leftarrow v_{jk}\frac{\sum_{i=1}^{m}(f^y_{ij}u_{ik}/y_{ij}) + (\alpha_k - 1)/v_{jk}}{\sum_{i=1}^{m}u_{ik} + 1/\beta_k},$$

$$z_{lk} \leftarrow z_{lk}\frac{\sum_{i=1}^{m}(f^x_{il}u_{ik}/x_{il}) + (\alpha_k - 1)/z_{lk}}{\sum_{i=1}^{m}u_{ik} + 1/\beta_k}.$$

$$u_{ik} \leftarrow u_{ik}\frac{\theta\sum_{j=1}^{n}(f^y_{ij}v_{jk}/y_{ij}) + (1-\theta)\sum_{l=1}^{p}(f^x_{il}z_{lk}/x_{il}) + (\alpha_k - 1)/u_{ik}}{\theta\sum_{j=1}^{n}v_{jk} + (1-\theta)\sum_{l=1}^{p}z_{lk} + 1/\beta_k}$$

The grass is greener on the other side...

Be inspired!

Stories and more stories...

Be informed!

The devil is in the details...

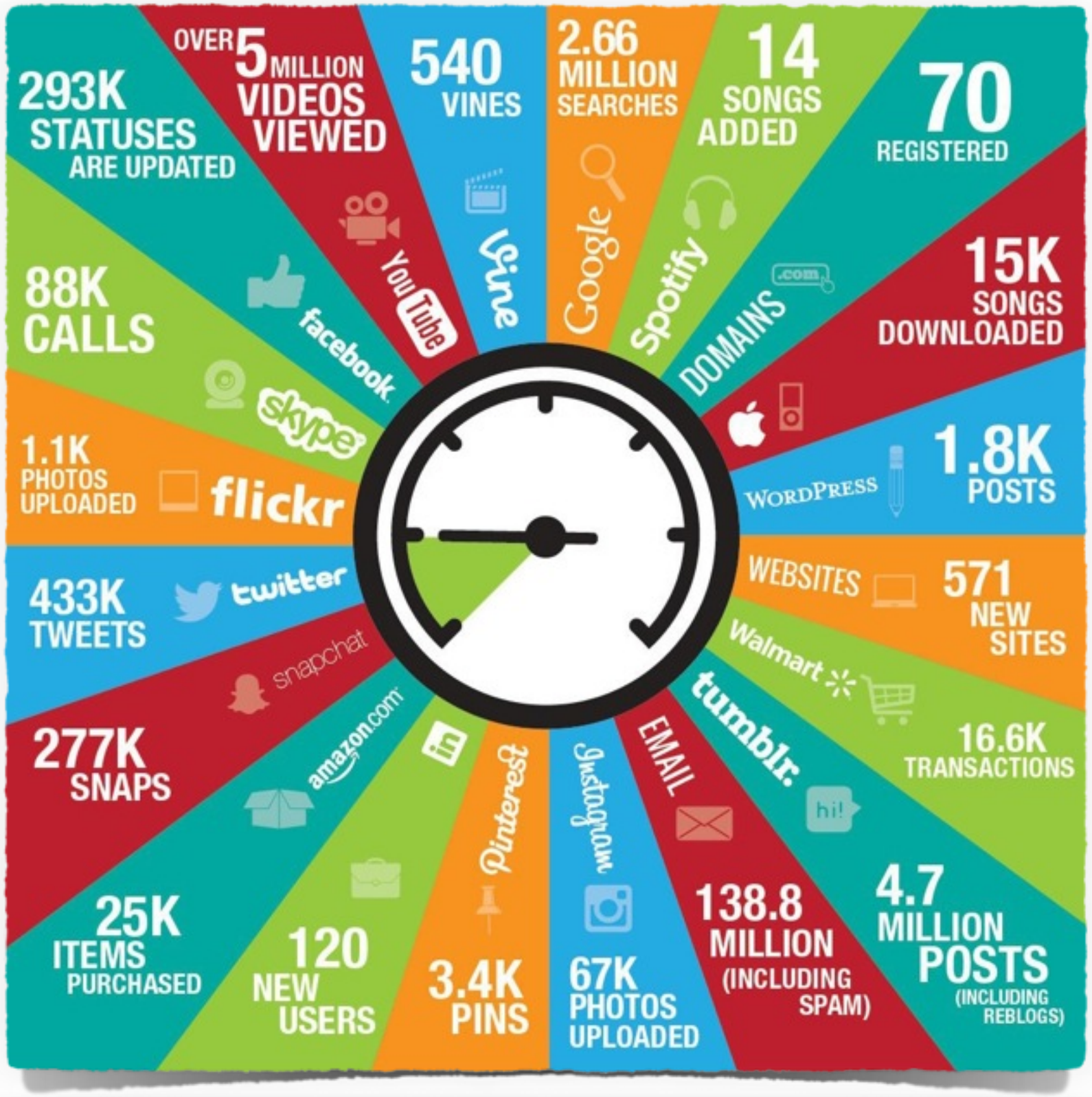
Be challenged!

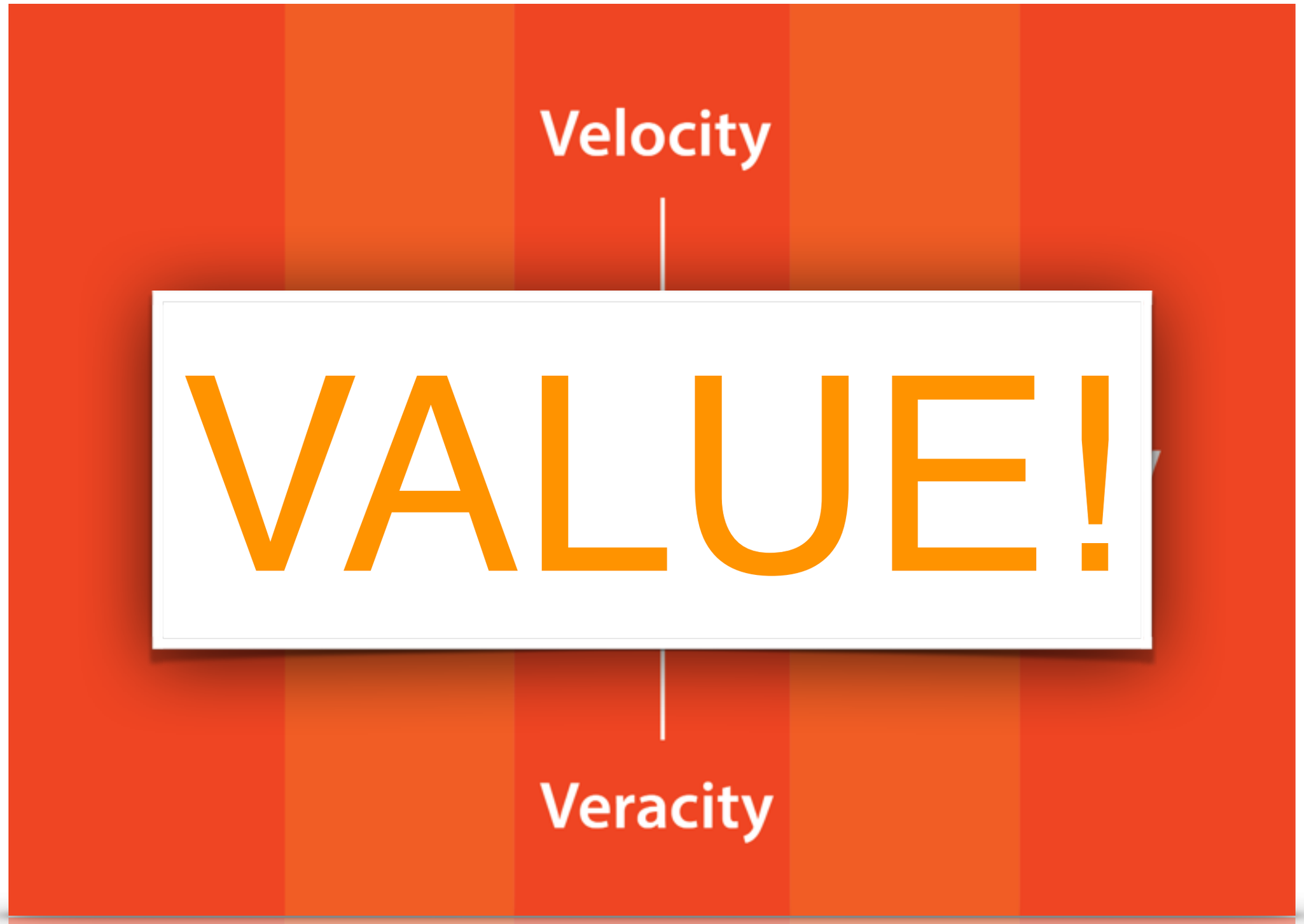
Words of Wisdom

The **BEST** universities focus on **EDUCATION**!

The **BETTER** universities focus on citation numbers and impact factors…

The **GOOD** universities focus on counting the number of publications…


293K STATUSES ARE UPDATED
OVER 5 MILLION VIDEOS VIEWED
540 VINES
2.66 MILLION SEARCHES
14 SONGS ADDED
70 REGISTERED
88K CALLS
facebook
YouTube
Vine
Google
Spotify
DOMAINS
.com
15K SONGS DOWNLOADED
1.1K PHOTOS UPLOADED
flickr
skype
WordPress
1.8K POSTS
433K TWEETS
twitter
WEBSITES
571 NEW SITES
snapchat
Walmart
277K SNAPS
amazon.com
16.6K TRANSACTIONS
tumblr.
hi!
EMAIL
25K ITEMS PURCHASED
120 NEW USERS
Pinterest
3.4K PINS
Instagram
67K PHOTOS UPLOADED
138.8 MILLION (INCLUDING SPAM)
4.7 MILLION POSTS (INCLUDING REBLOGS)


Velocity
VALUE!
Veracity

The Value of Big Data

Over 80% of organizations say:

Big Data is critical to meet strategic objectives.

Sharing insights is a must-have capability for businesses.

Big Data will amplify other technology innovations.

Nearly **60%** have started to use Big Data in specific cases

. . . but only **3%** consider themselves mature.

Where people struggle:

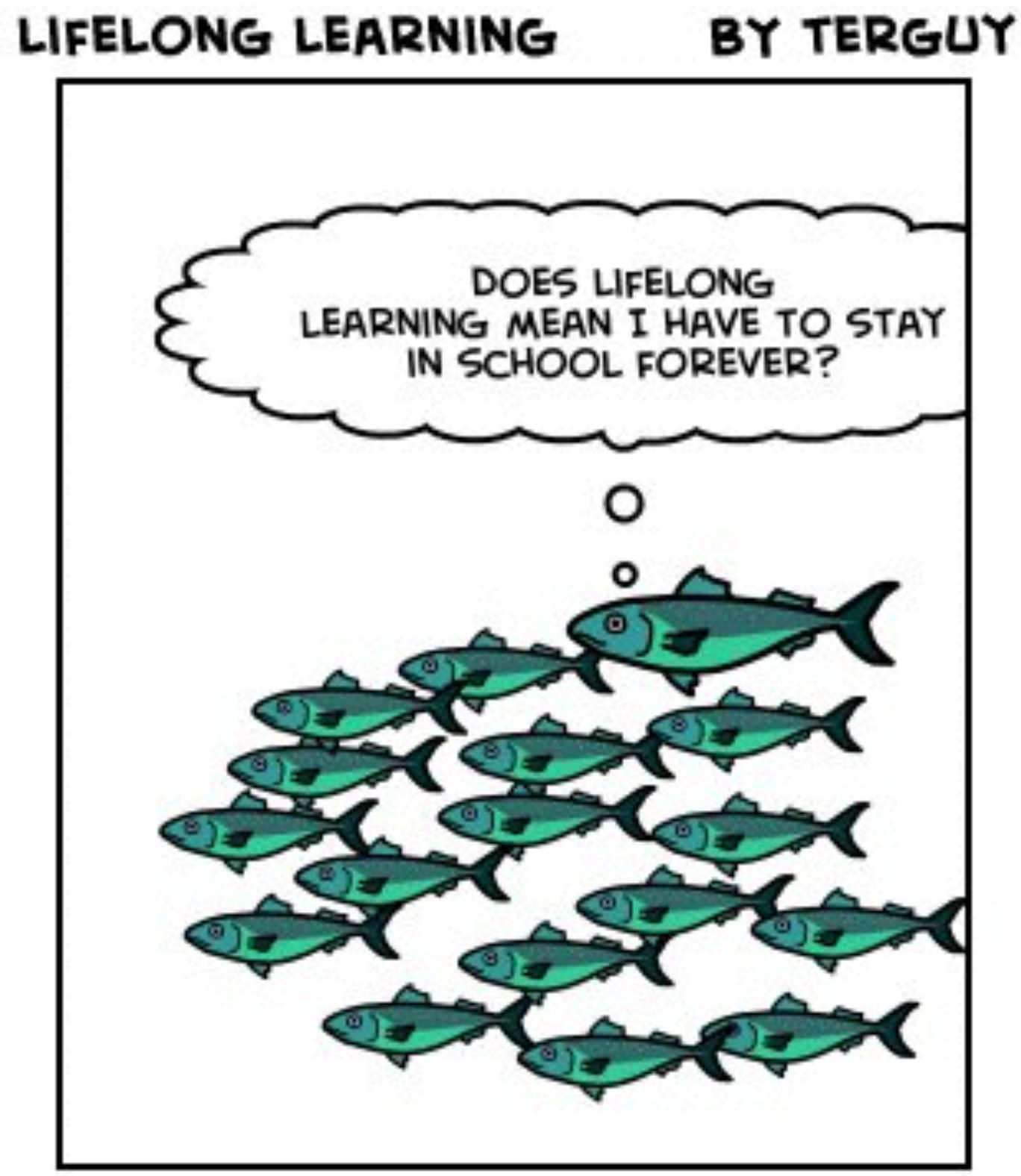
Beginners
28% Data quality

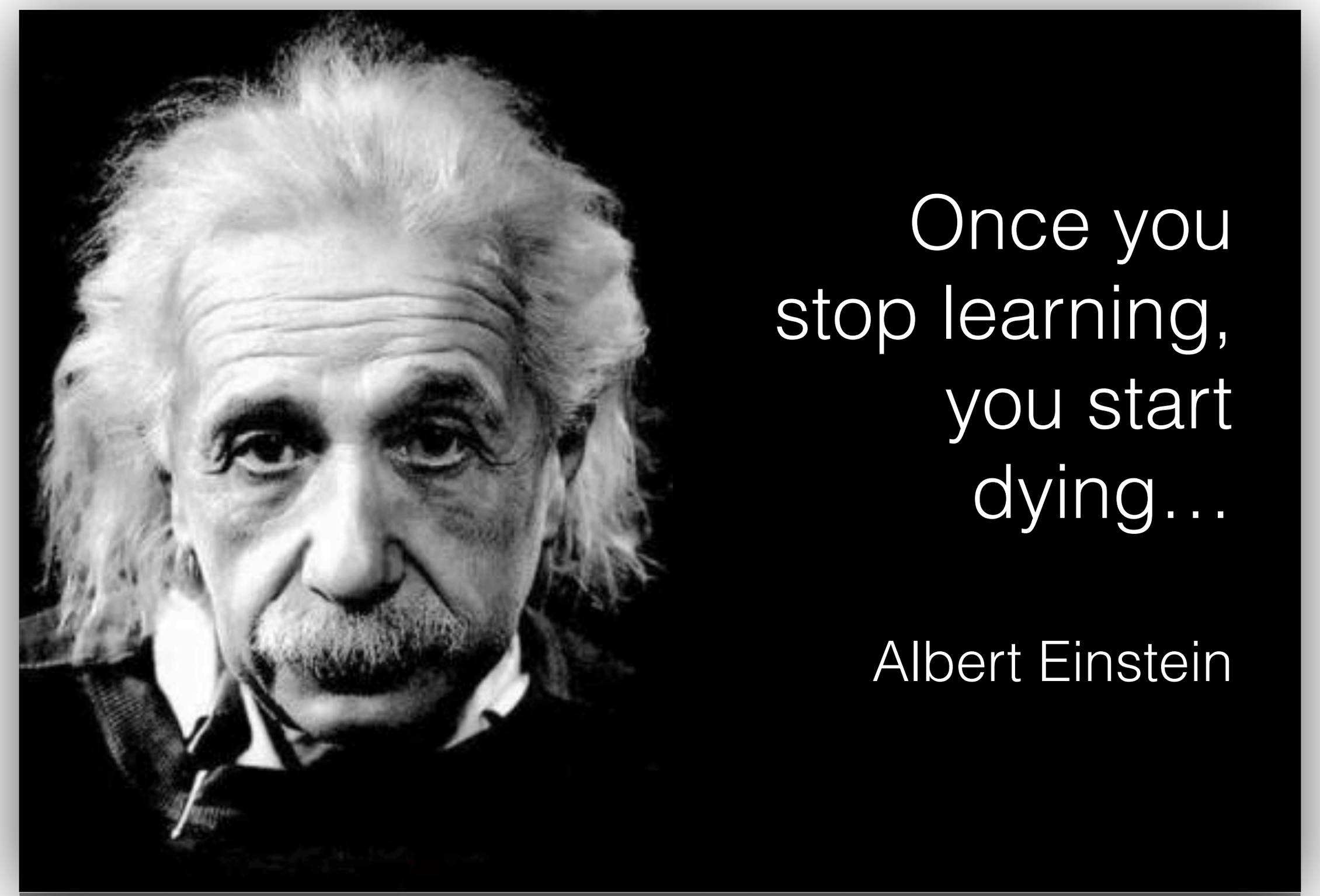
Advanced
30% Massive data volume

Mature
29% Skilled manpower

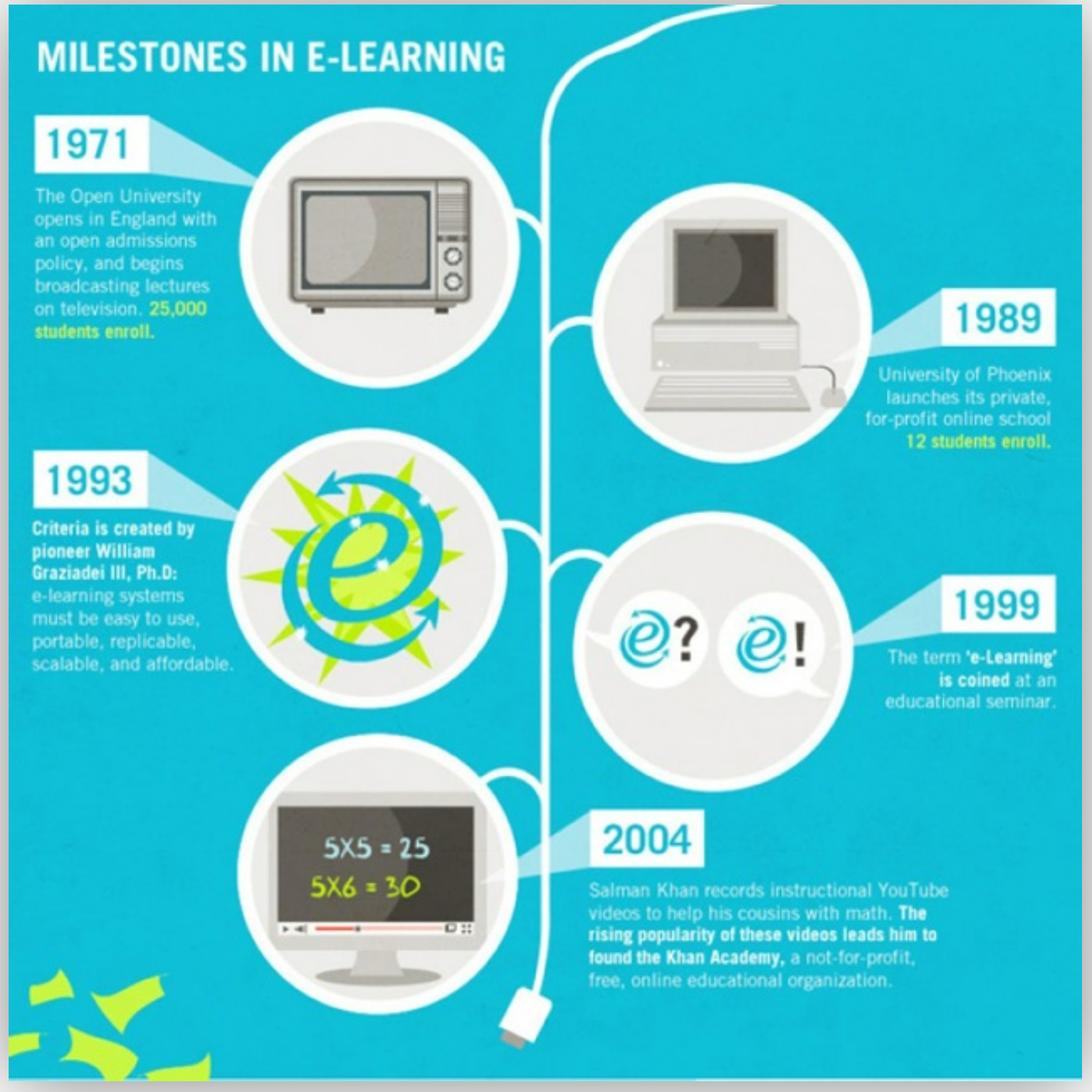
58% consider improved customer engagement and performance across all lines of business as high value.

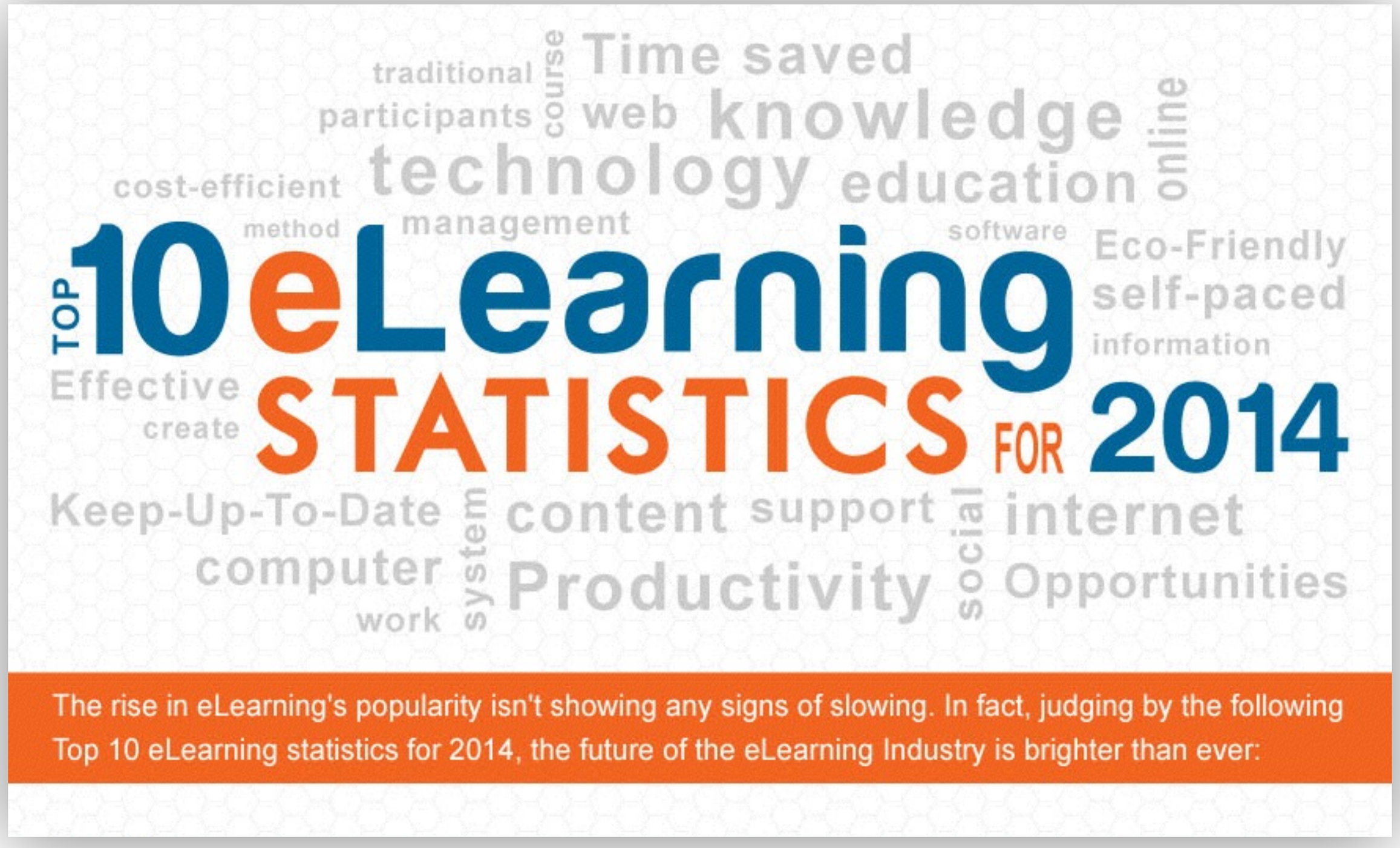
Big Education on Lifelong Learning

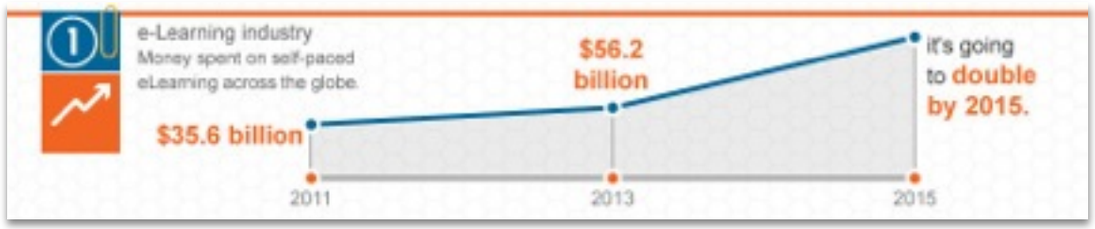

LIFELONG LEARNING
BY TERGUY
DOES LIFELONG LEARNING MEAN I HAVE TO STAY IN SCHOOL FOREVER?
WWW.BITSTRIPS.COM

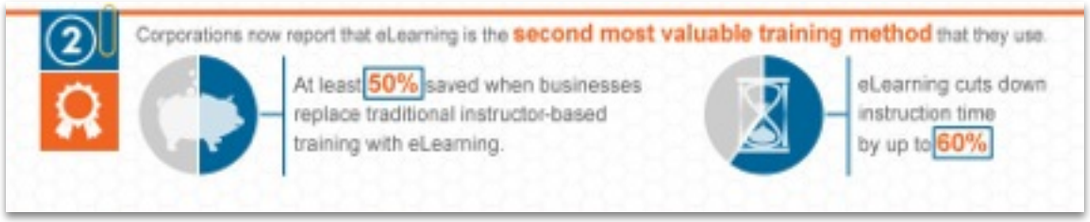

Once you
stop learning,
you start
dying…
Albert Einstein


E-LEARNING
MANAGEMENT
CONTENT
COMPUTER
LEARNING
STUDENT
WEB
TEACHING
CBTS
HIGHER
SUPPORT
VIDEO
COURSE
ELEARNING
EXAMPLE
FULLY
DELIVERED
WELL
ONLINE
TEACHER
PROVIDES
CREATE
OBJECTS
ACTIVITIES
KNOWLEDGE
USED
TERM
FORM
VIA
MORE
OFFER
SOFTWARE
SOCIAL
SCHOOLS
MANY
SECONDARY
CLASSES
ALLOW
LONG
EARLY
CLASS
COLLABORATIVE
INCLUDE
COURSES
PARTICIPANTS
DISCUSSION
ONE
EVEN
TEACHING
TIME
EDUCATION
FACE
FOCUSES
DEVICES
COMPUTERS
VIRTUAL
WORK
ONLINE
TECHNOLOGIES
TRAINING
REFER
ASSESSMENT
STANDARDS
TECHNOLOGY
BASED
USING
THROUGH
INTERNET
SYSTEMS
CLASSROOM
ENVIRONMENTS
INFORMATION
PROVIDE
ELECTRONIC
TRADITIONAL
GENERALLY
SYSTEM
LMS
MUCH
EDUCATIONAL
PROCESS
ENHANCED


MILESTONES IN E-LEARNING
1971
The Open University opens in England with an open admissions policy, and begins broadcasting lectures on television. 25,000 students enroll.
1989
University of Phoenix launches its private, for-profit online school
12 students enroll.
1993
Criteria is created by pioneer William Graziadei III, Ph.D: e-learning systems must be easy to use, portable, replicable, scalable, and affordable.
1999
The term 'e-Learning' is coined at an educational seminar.
5X5 = 25
5X6 = 30
2004
Salman Khan records instructional YouTube videos to help his cousins with math. The rising popularity of these videos leads him to found the Khan Academy, a not-for-profit, free, online educational organization.


traditional
course
Time saved
participants
web
knowledge
online
technology
education
cost-efficient
method
management
software
Eco-Friendly
TOP 10 eLearning
self-paced
information
Effective
create
STATISTICS FOR 2014
Keep-Up-To-Date
content
support
internet
computer
system
Productivity
social
Opportunities
work
The rise in eLearning's popularity isn't showing any signs of slowing. In fact, judging by the following Top 10 eLearning statistics for 2014, the future of the eLearning Industry is brighter than ever:


1
e-Learning industry
Money spent on self-paced eLearning across the globe.
$35.6 billion
$56.2 billion
it's going to double by 2015.
2011
2013
2015

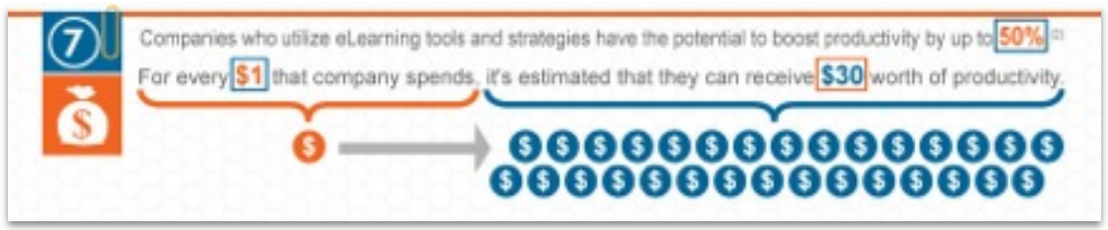

2
Corporations now report that eLearning is the second most valuable training method that they use.
At least 50% saved when businesses replace traditional instructor-based training with eLearning.
eLearning cuts down instruction time by up to 60%

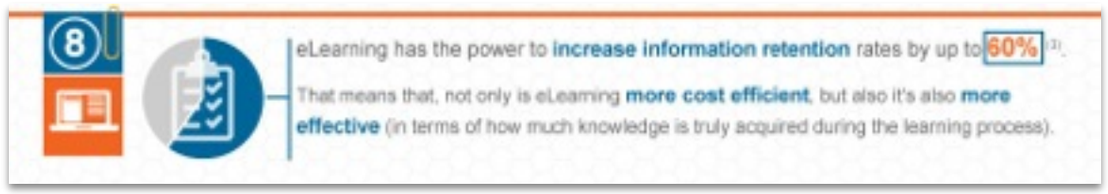

3
2013: About 4.6 out of ten college students* are taking at least one course online.
2019: Roughly half of all college classes* will be eLearning-based.

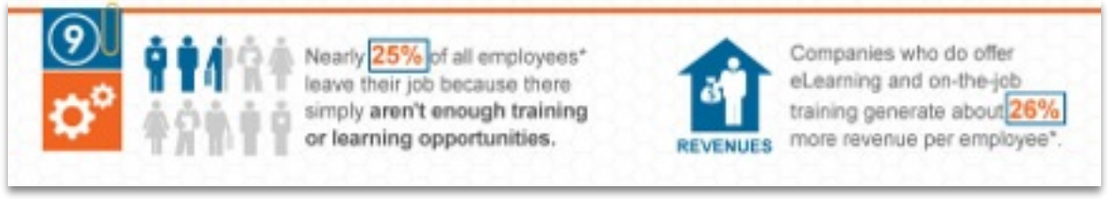

4
eLearning is Eco-Friendly (1)
ENERGY
Consumes 90% less energy than traditional education courses.
The amount of CO2 emissions (per student) is also reduced by up to 85%.
EMISSIONS
CO2


5
Over 41.7% of global Fortune 500 companies now use some form of technology to instruct employees during formal learning hours, and this is going to steadily increase in future years.
USAGE


6
Self-paced eLearning's estimated 5 year annual growth rate*
Western Europe: 5.8%
Revenues by 2015:
$8.1 billion
The world's most rapidly growing eLearning markets are:
Malaysia and Vietnam.
Asia: 17.3%
Middle East: 8.2%
Revenues by 2016:
$560.7 million
Africa: 15.4%
Revenues by 2016:
$512.8 million


7
Companies who utilize eLearning tools and strategies have the potential to boost productivity by up to 50% (2)
For every $1 that company spends, it's estimated that they can receive $30 worth of productivity.


8
eLearning has the power to increase information retention rates by up to 60% (3).
That means that, not only is eLearning more cost efficient, but also it's also more effective (in terms of how much knowledge is truly acquired during the learning process).


9
Nearly 25% of all employees* leave their job because there simply aren't enough training or learning opportunities.
REVENUES
Companies who do offer eLearning and on-the-job training generate about 26% more revenue per employee*.


10
72% of companies who were included in a recent survey stated that eLearning helps them to keep up-to-date with changes in their industry, which helps them to remain competitive within their niche. (4)
Companies and organizations that did have a strong learning culture did better in their market than those who do not. For example:
These organizations are 46% more like to be the leader in their industry
34% increase in their ability to respond to the needs of the customer
17% more likely to become the market share leader.

BIG MONEY

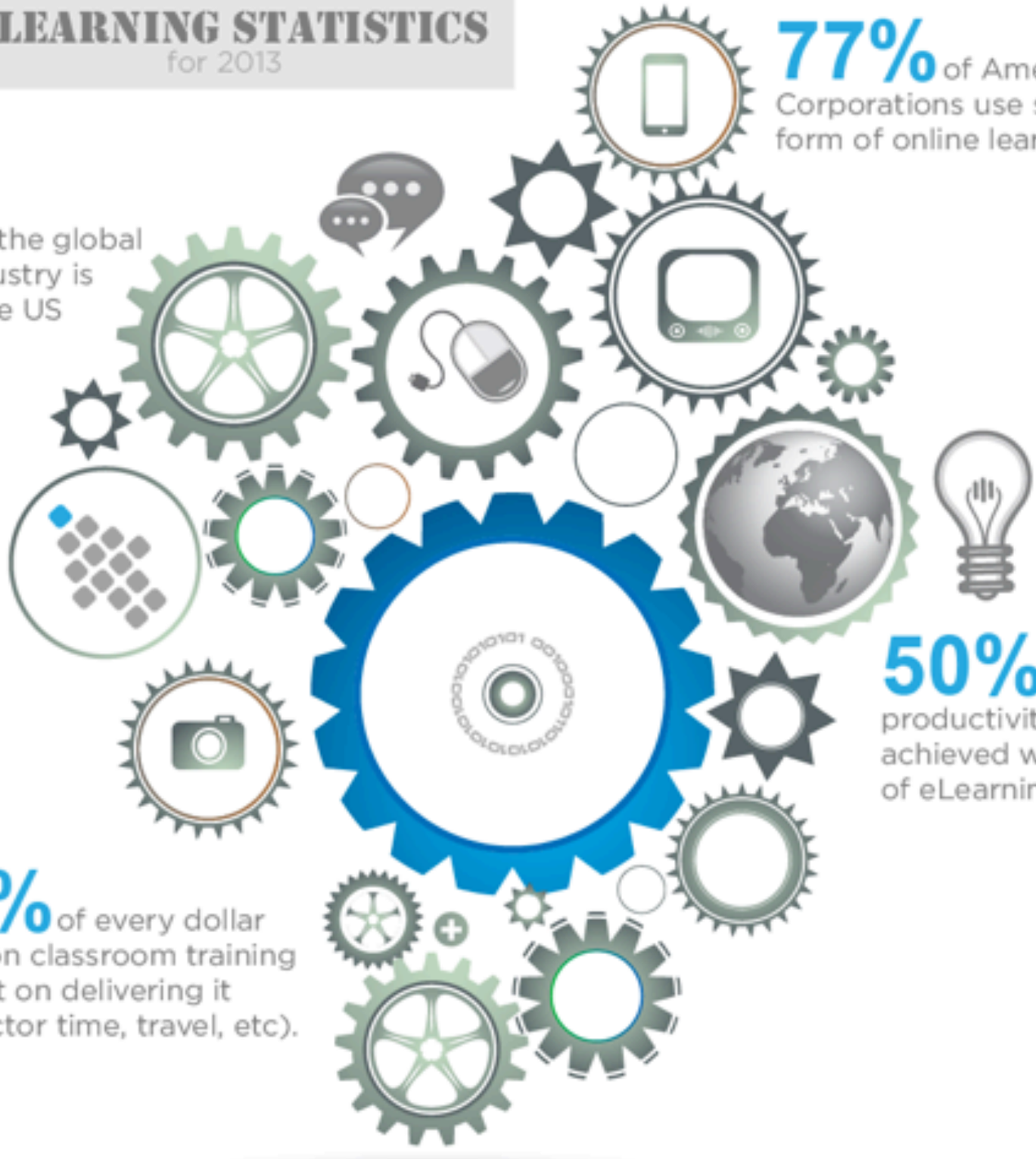
BIG USERS

BIG IMPROVEMENT

TOP 10 ELEARNING STATISTICS
for 2013

77% of American Corporations use some form of online learning.

70% of the global eLearning industry is made up of the US and Europe.



50% more productivity can be achieved with the help of eLearning.

85% of every dollar spent on classroom training is spent on delivering it (instructor time, travel, etc).


TURNIT IN
CLASS BLOGS
e-booKS
VIRTUAL PROFESSOR
SOCIAL NETWORK
eMAILS
BLACKBOARD DISCUSSIONS
TEAM'S INSTANT MESSAGES
CHAT
PODCASTS
WIKI
WI-FI
GPS
iPhone
CD
FM
XM
HD BACK
UPS
E-LEARNING OVERLOAD
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The task of the modern educator is not to cut down jungles, but to irrigate deserts.

C.S. Lewis

Trends in Big Education

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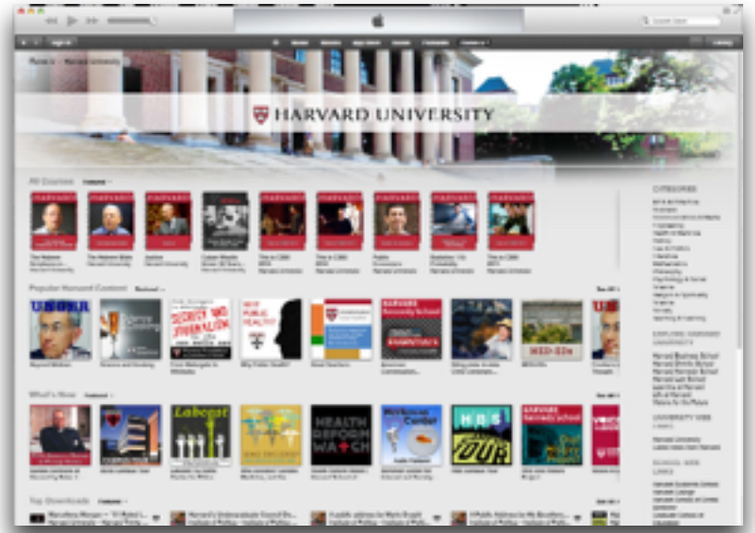
Cost effectiveness

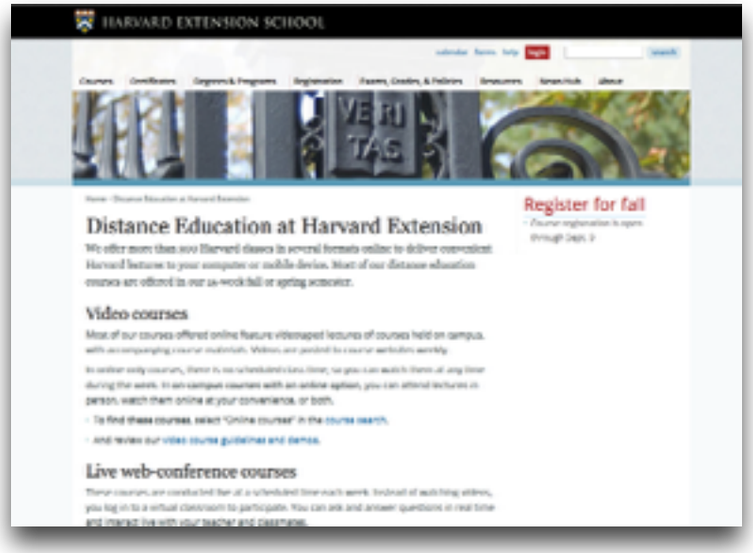
Collaboration

Customization

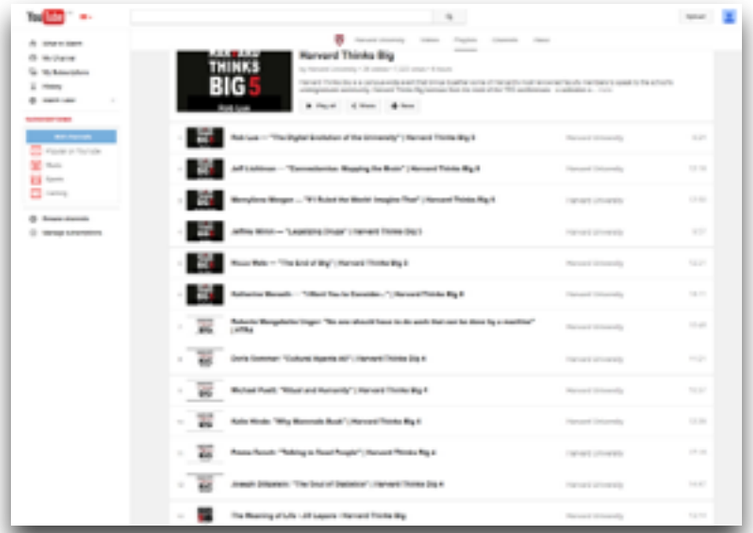
Multimodal Learning



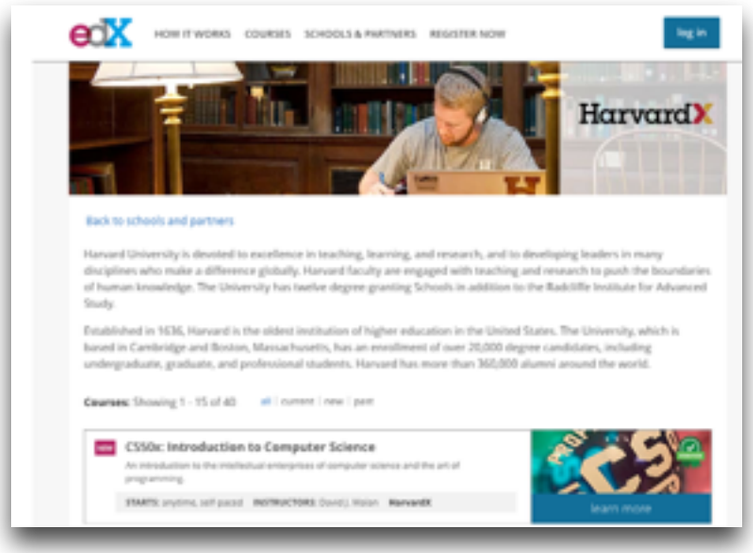
Harvard @ iTunes U



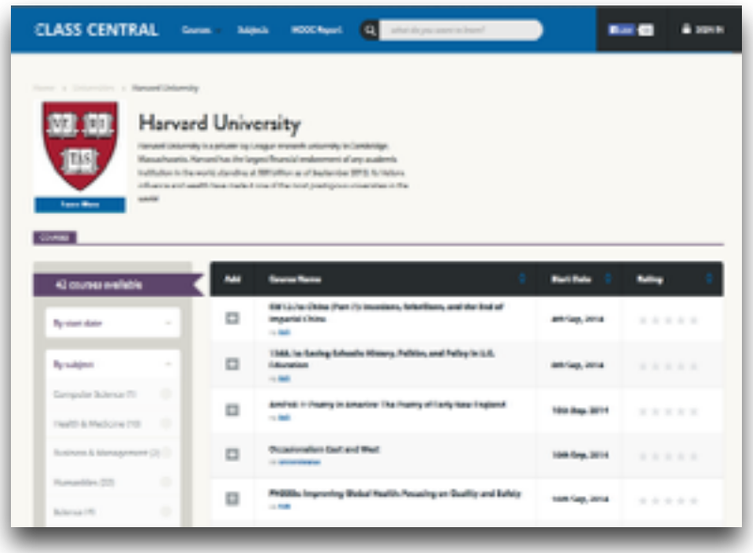
harvard.edu



Harvard @ YouTube



Harvard @ edX



Harvard @ Class Central

MOOC

Massive Open Online Course

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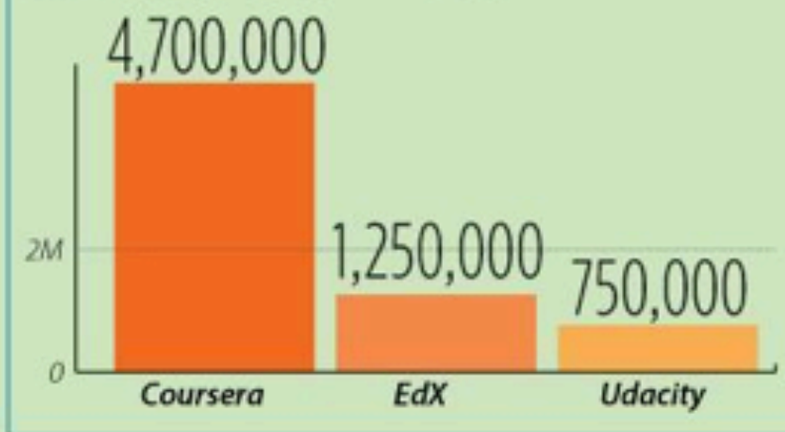
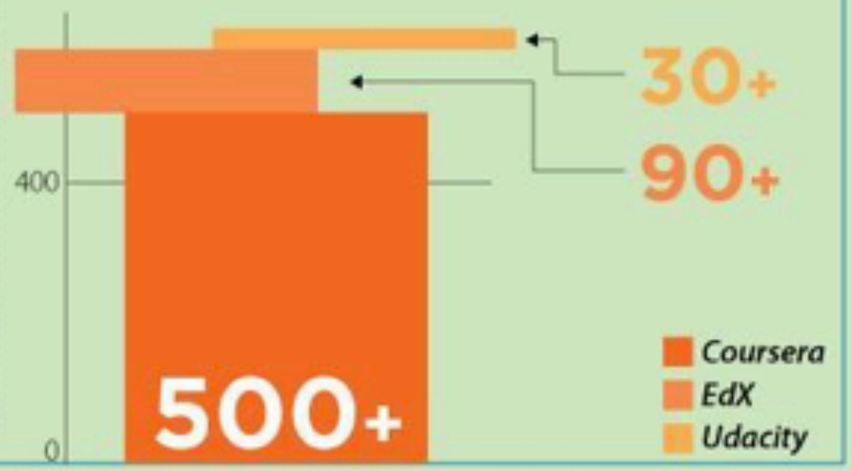
MASSIVE

Students enrolled in MOOCs



Courses offered by major platforms

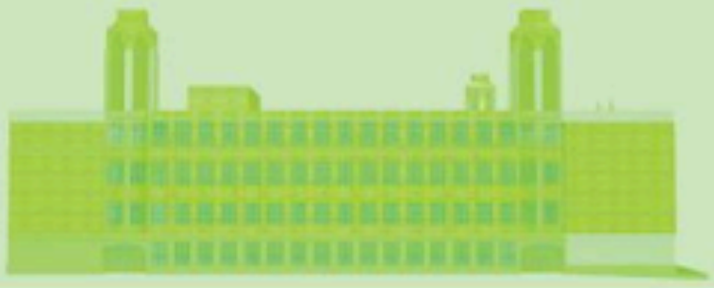


OPEN

These courses are provided by many different universities and open to anyone who wishes to enroll.

87

The number of academic partners that offer courses on Coursera's platform

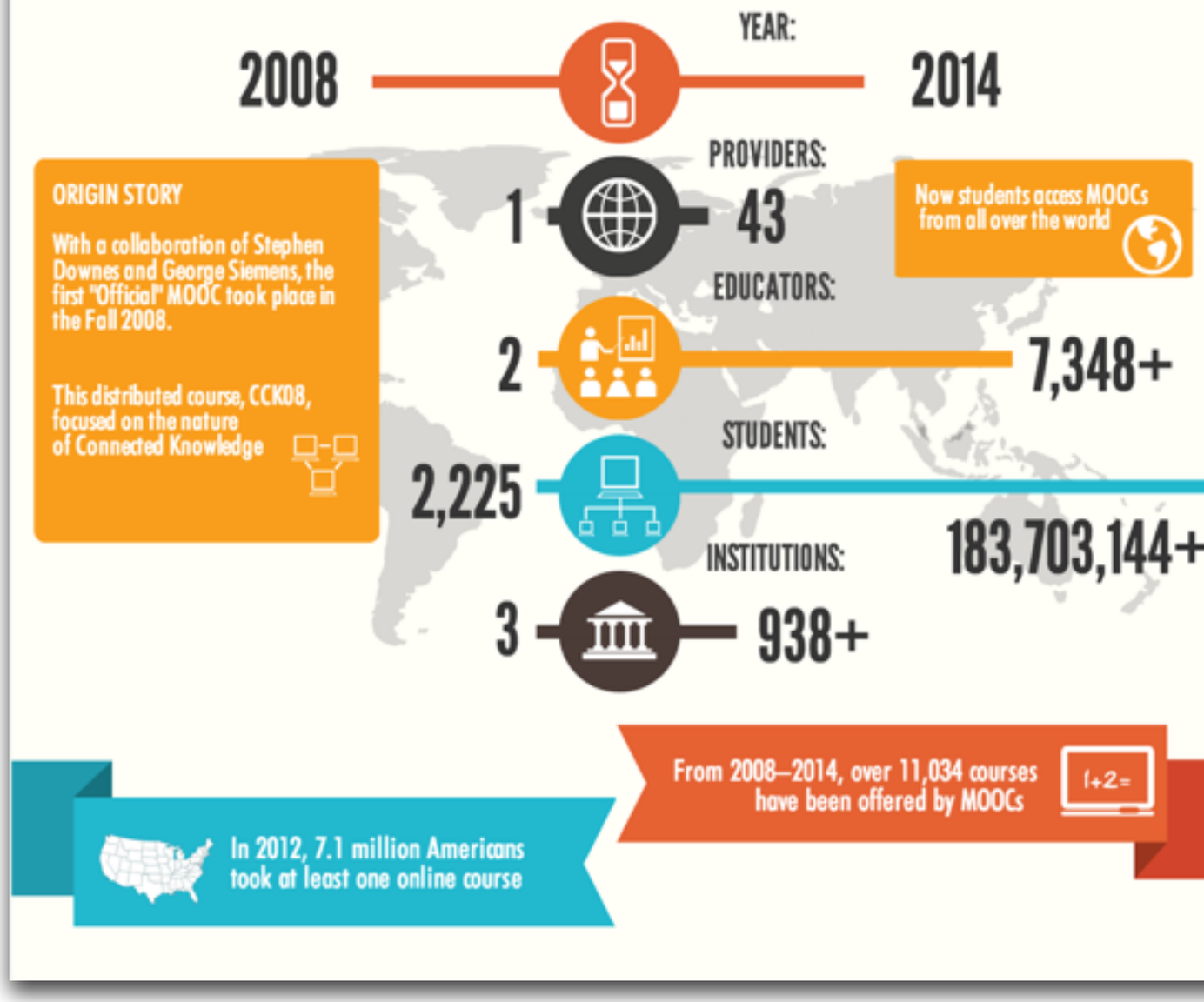


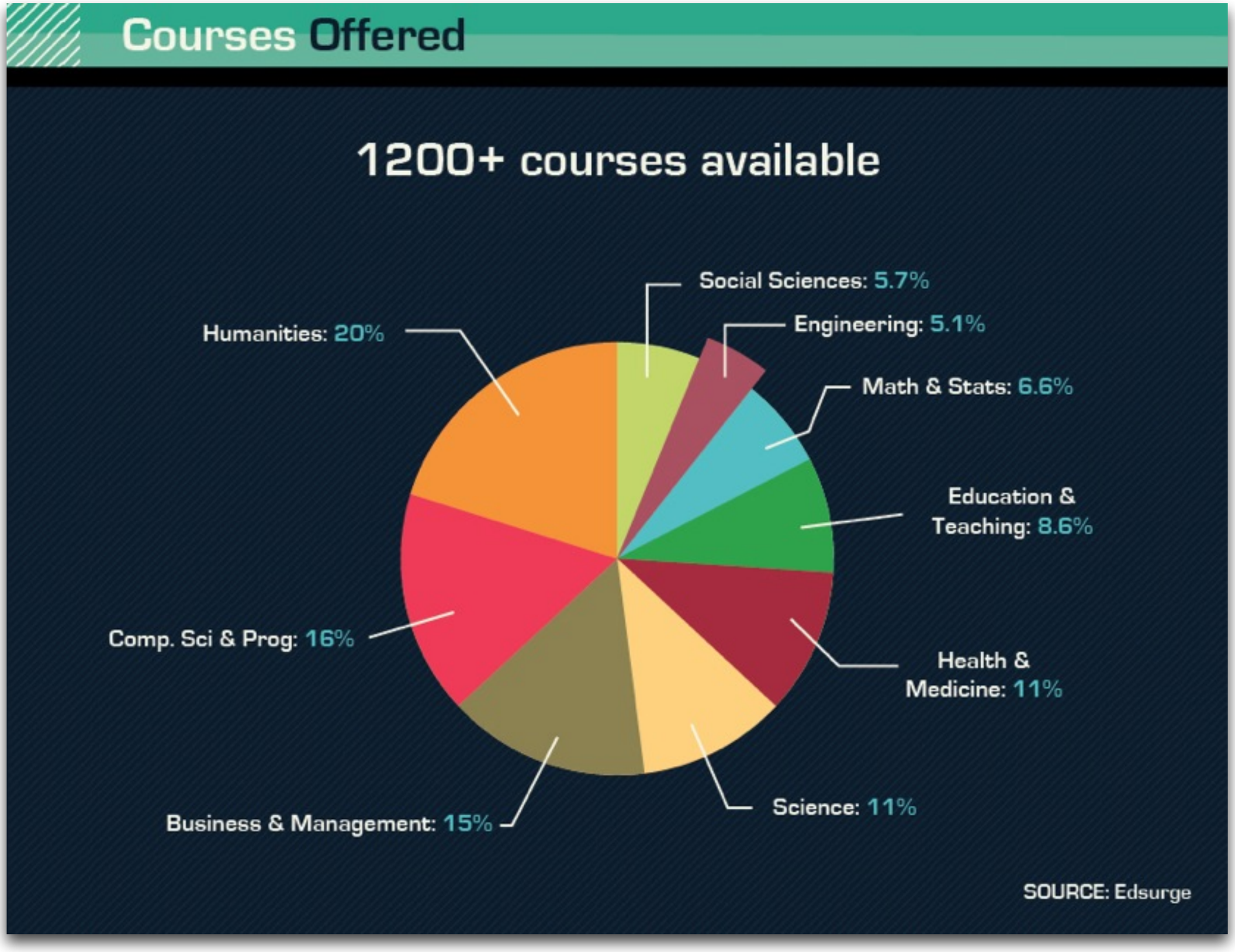
ONLINE

Courses are even reaching as far as developing countries like Mongolia, where high school students are taking courses from:

MINI MOOC GUIDE: 2014 TOP U.S. MOOC PROVIDERS

OVERVIEW OF MASSIVE OPEN ONLINE COURSES'




Courses Offered
1200+ courses available
Social Sciences: 5.7%
Engineering: 5.1%
Humanities: 20%
Math & Stats: 6.6%
Education & Teaching: 8.6%
Comp. Sci & Prog: 16%
Health & Medicine: 11%
Business & Management: 15%
Science: 11%
SOURCE: Edsurge

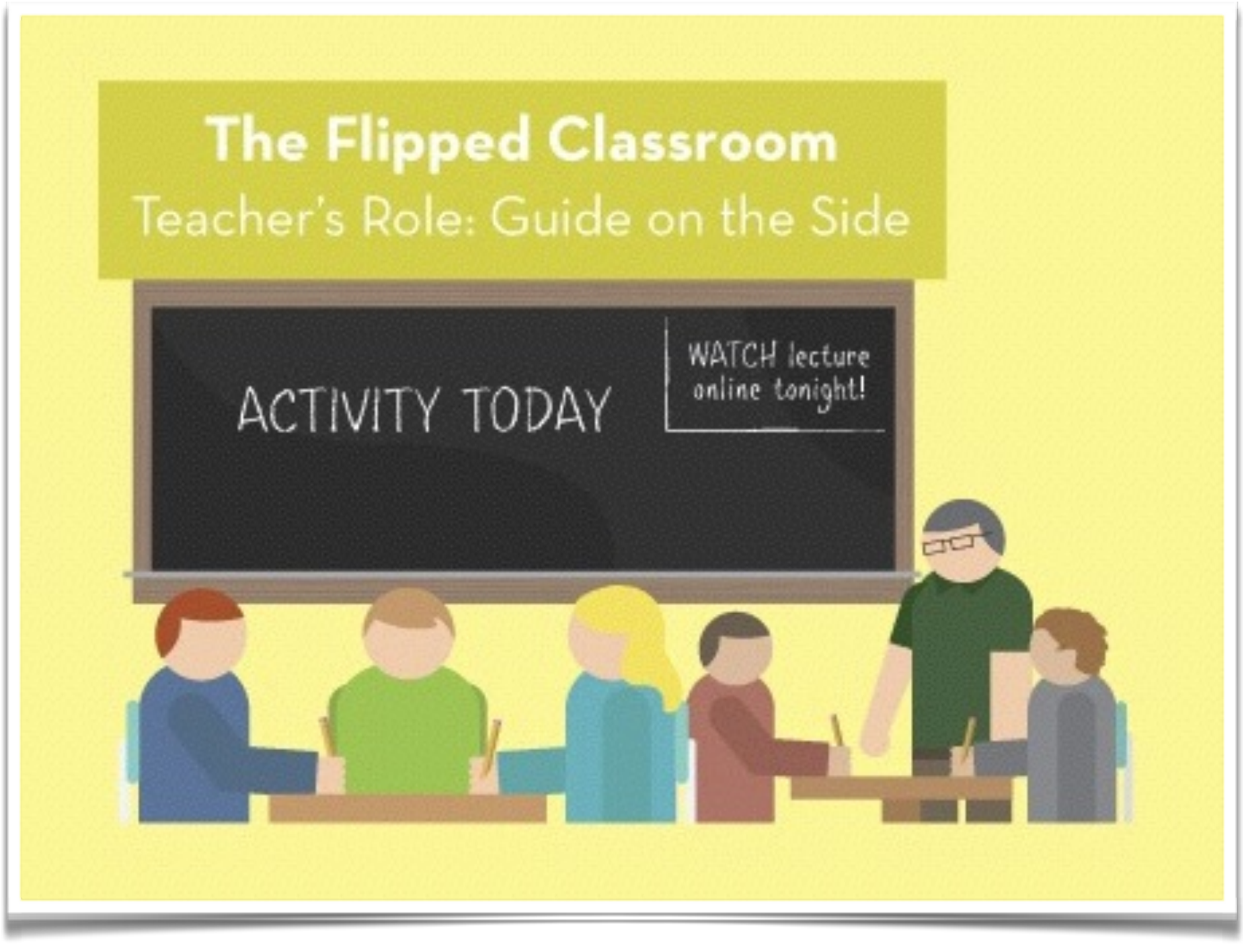
Small Private Online Course (SPOC) with Degree

UDACITY

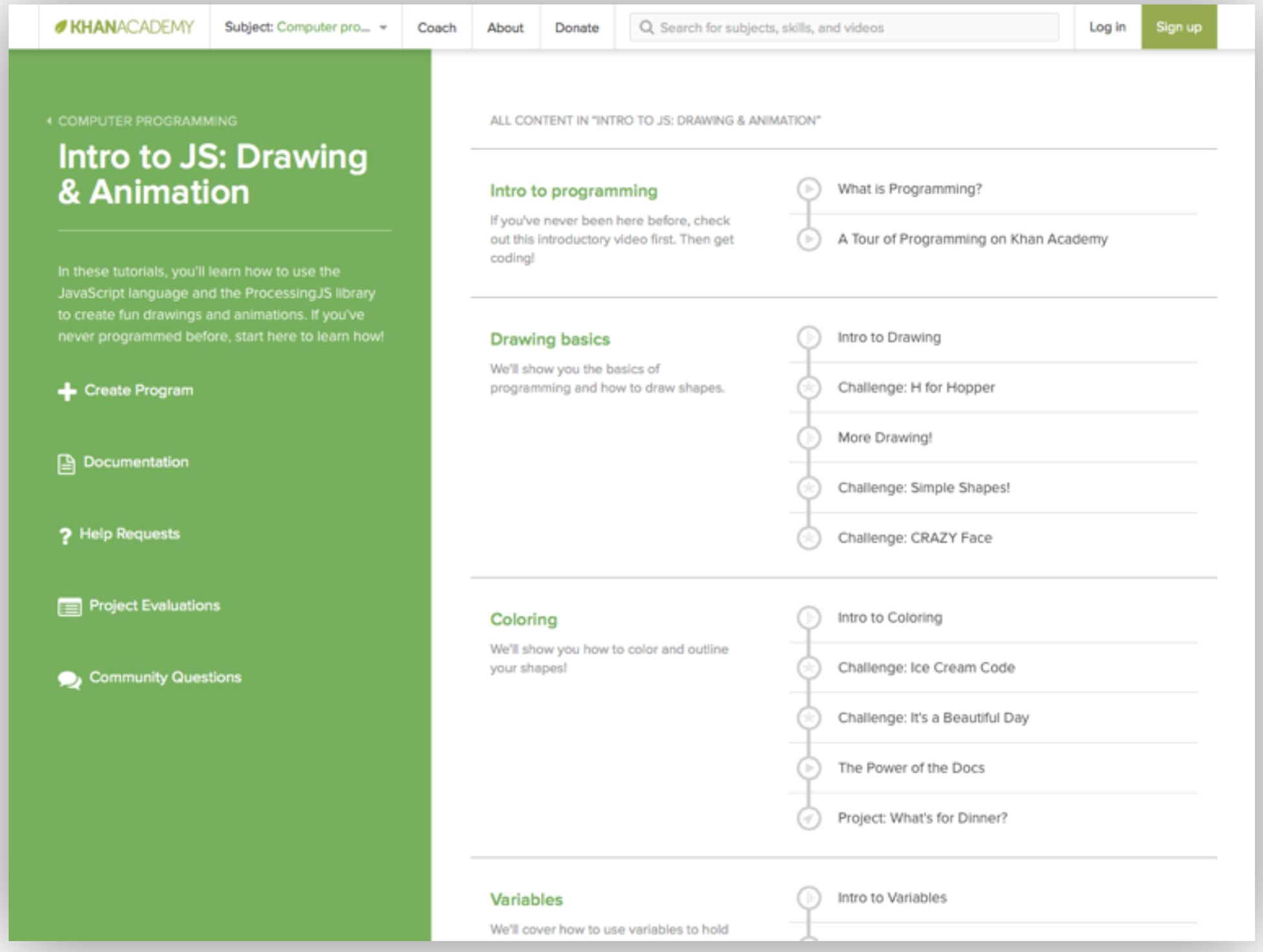
Georgia Tech College of Computing

at&t

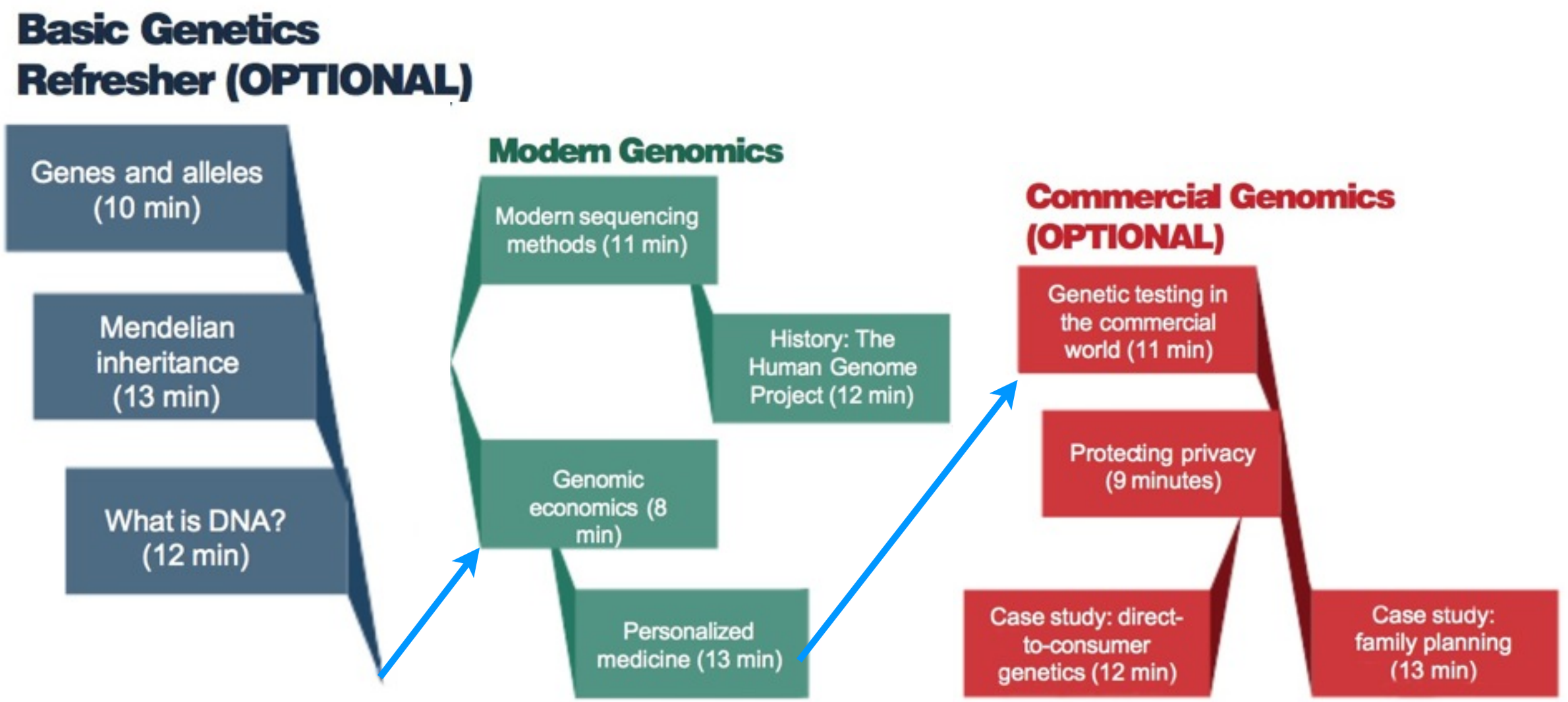
Flipped Classroom



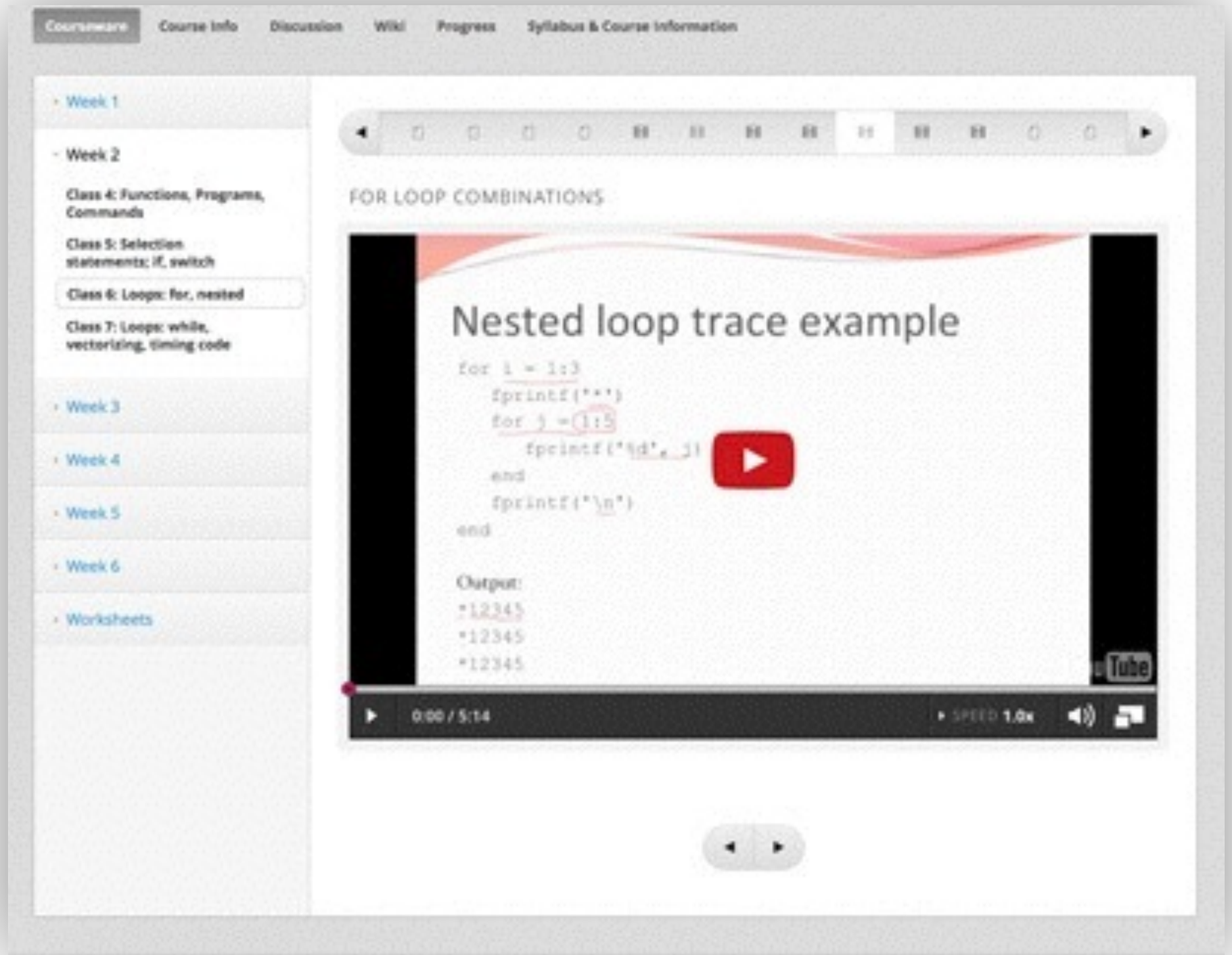
Microlearning



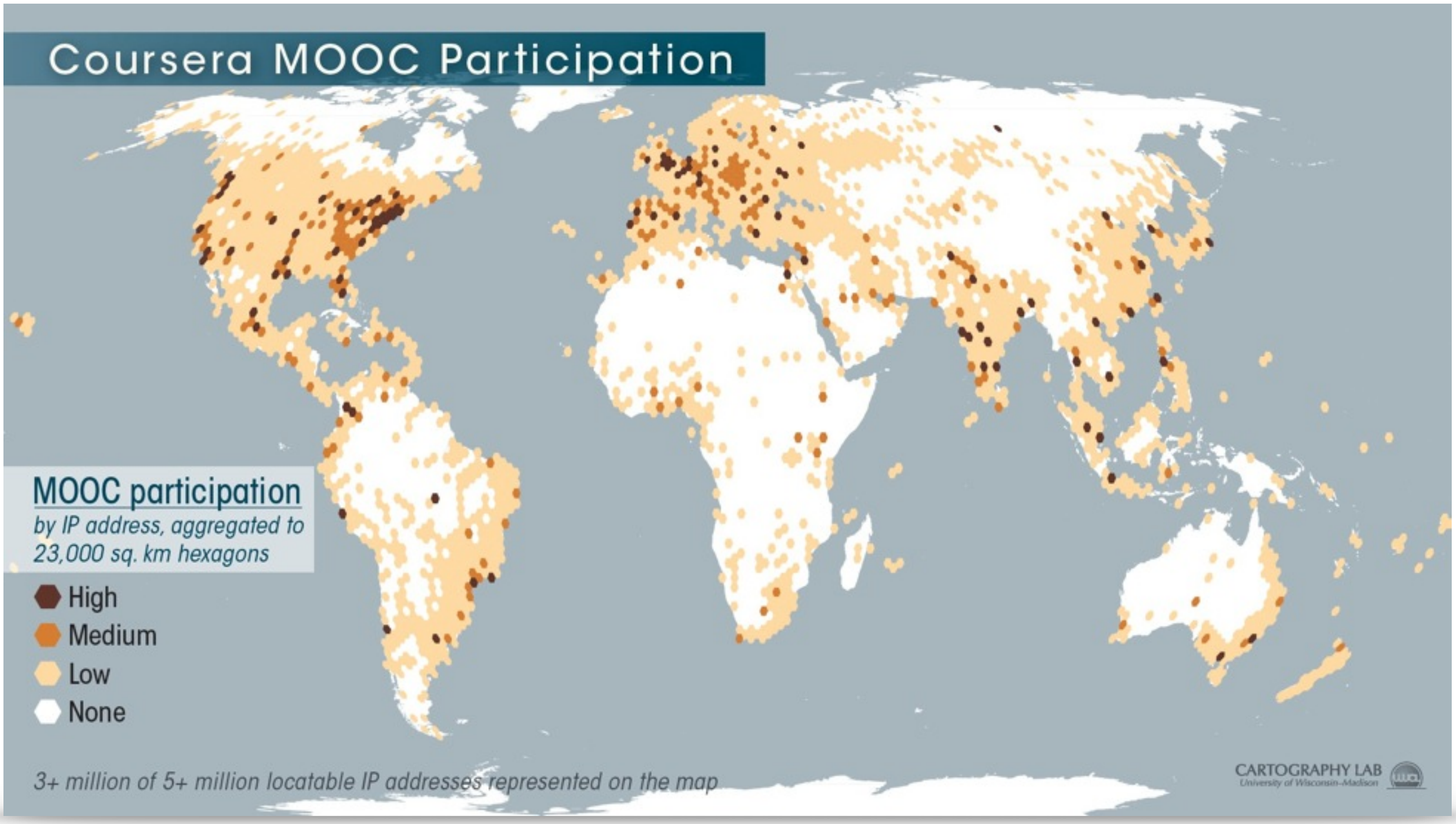
Personalized Learning



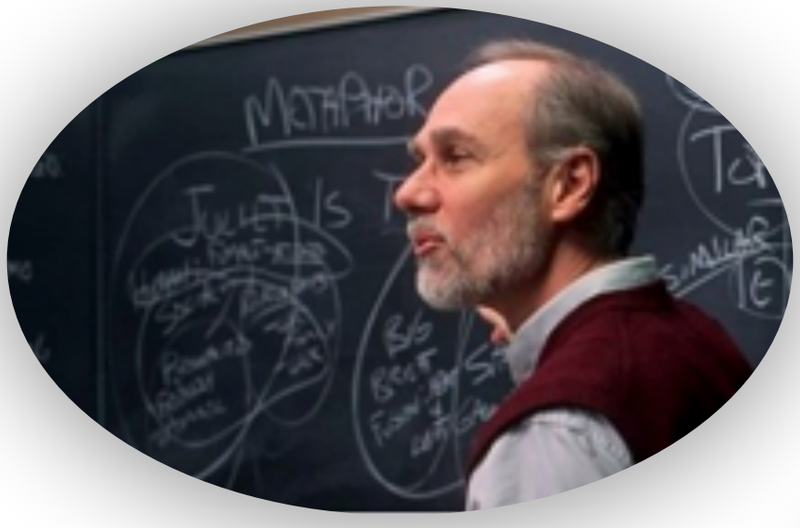
Active Learning



Peer Learning



Who Really Cares?



Instructors

Big Education Stakeholders

Students

Administrators

Providers

3rd Parties

Save Money

Test Mastery

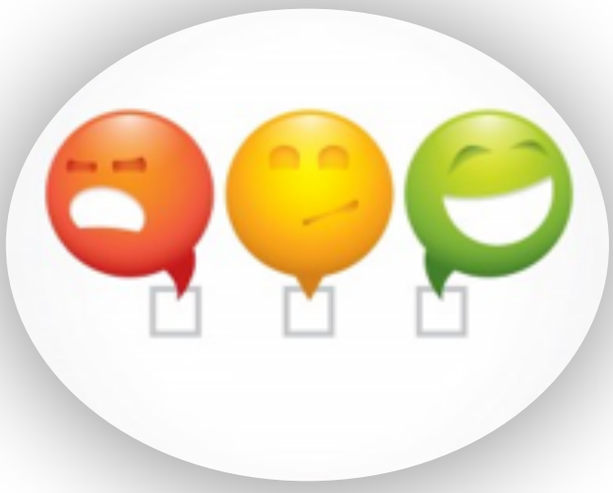
Interactive and Collaboration

Self-paced Learning

Students

Access on Multiple Devices

Keep Focused



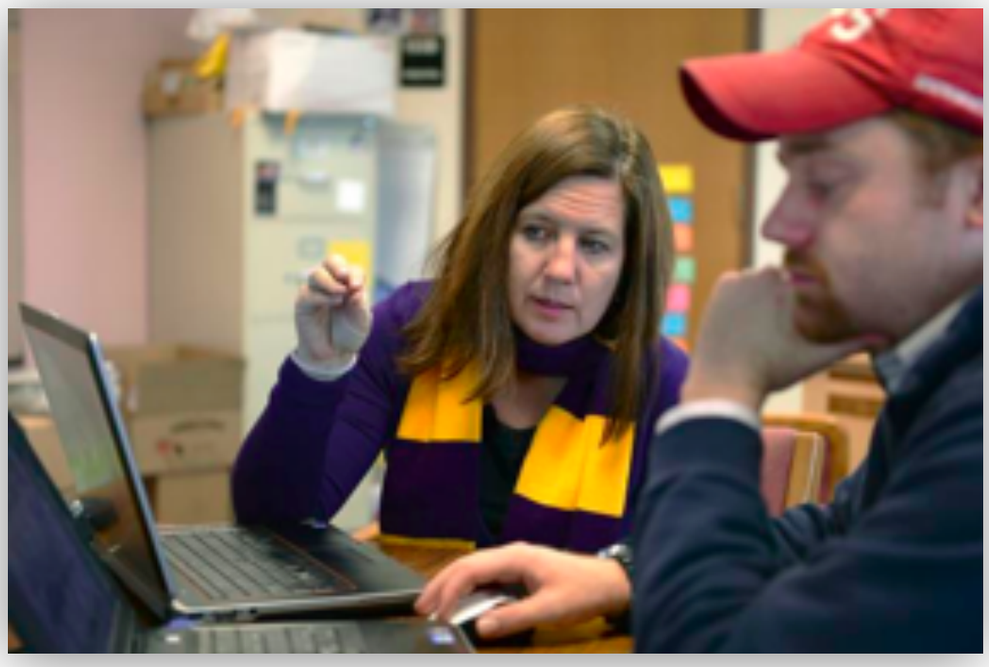
Get Quick Feedback

Access from Anywhere

Release heavy teaching workload

Focus on interaction with students in the classroom

Instructors

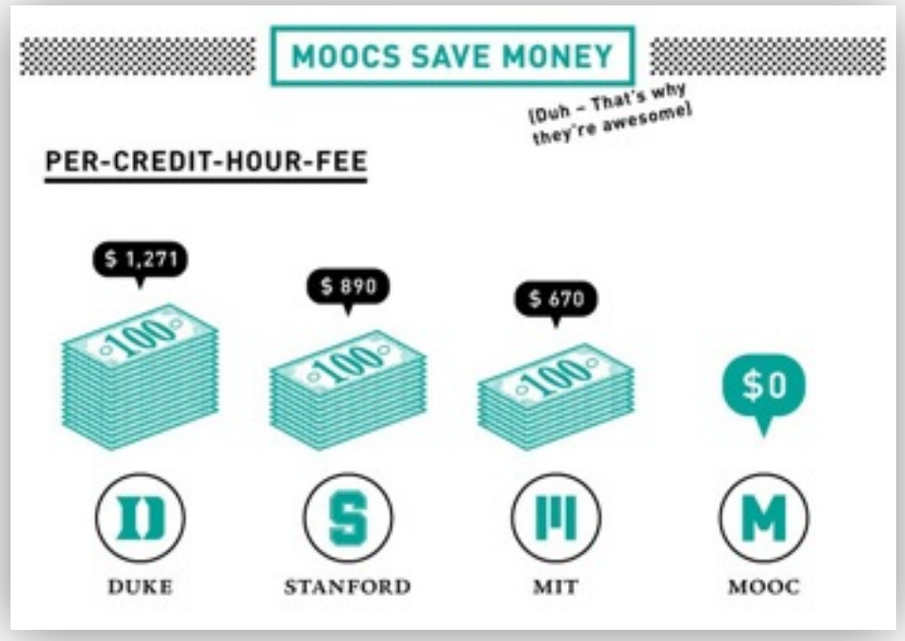


Provide personalized help

Track student performance

Faculty


So what's in it for them?
3 OUT OF 4 professors were inspired to change the way they taught in the traditional classroom after teaching a MOOC

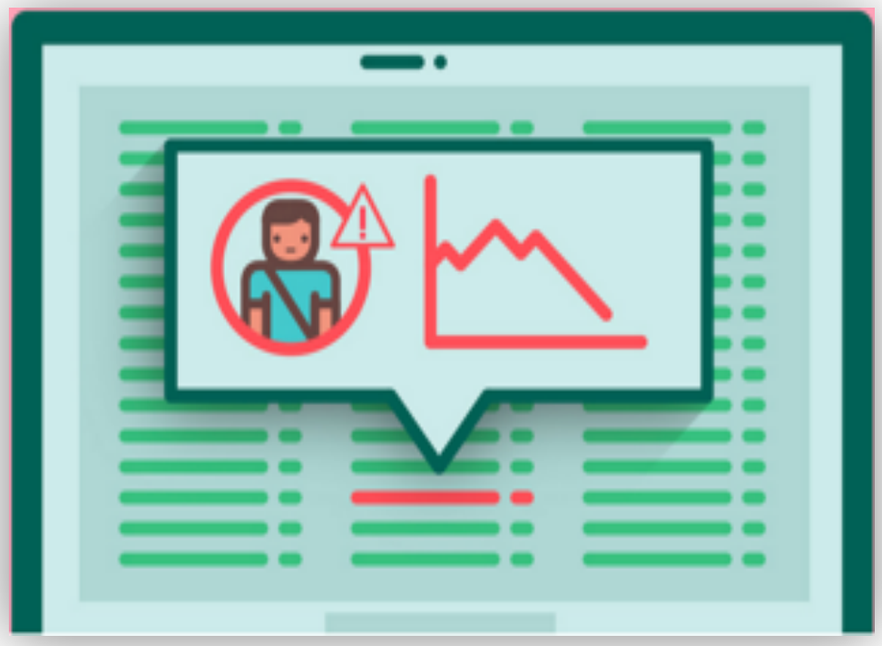


Save money

Improve engagement rate

Administrators

Reduce failure rate



Track student performance

Case Studies

Predict Student Performance

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Case Study 1: Cortez P, Silva A M G. Using data mining to predict secondary school student performance[J]. 2008.

- Input

demographic information	sex, age, school, address, habit, health status, parents' education, job, family size, income
social information	romantic relationship, free time after school, going out with friends, weekend/workday alcohol consumption
school related information	study time, past failure course, extra paid support, family support, free time after school, previous course grade

- Output
  - Binary classification (pass/fail)
  - 5-Level classification (from **I** - very good / excellent to **V** - insufficient)
  - Regression, with a numeric output that range between zero (0%) and twenty (100%)

Table 3: Binary classification results (PCC values, in %; underline – best model; **bold** – best within the input setup)

Input Setup	Mathematics NV	NN	SVM	DT	RF	Portuguese NV	NN	SVM	DT	RF
A	**91.9**$^{\dagger}_{\pm 0.0}$	88.3$_{\pm 0.7}$	86.3$_{\pm 0.6}$	90.7$_{\pm 0.3}$	91.2$_{\pm 0.2}$	89.7$_{\pm 0.0}$	90.7$_{\pm 0.5}$	91.4$_{\pm 0.2}$	**93.0**$^{\dagger}_{\pm 0.3}$	92.6$_{\pm 0.1}$
B	**83.8**$^{\dagger}_{\pm 0.0}$	81.3$_{\pm 0.5}$	80.5$_{\pm 0.5}$	83.1$_{\pm 0.5}$	83.0$_{\pm 0.4}$	87.5$_{\pm 0.0}$	87.6$_{\pm 0.4}$	88.0$_{\pm 0.3}$	88.4$_{\pm 0.3}$	**90.1**$^{\dagger}_{\pm 0.2}$
C	67.1$_{\pm 0.0}$	66.3$_{\pm 1.0}$	**70.6**$^{*}_{\pm 0.4}$	65.3$_{\pm 0.8}$	70.5$_{\pm 0.5}$	84.6$_{\pm 0.0}$	83.4$_{\pm 0.5}$	84.8$_{\pm 0.3}$	84.4$_{\pm 0.4}$	**85.0**$^{*}_{\pm 0.2}$

† – statistical significance under pairwise comparisons with other methods.
∗ – statistical significance under a pairwise comparison with NV.

Table 4: Five-level classification results (PCC values, in %; underline – best model; **bold** – best within the input setup)

Input Setup	Mathematics NV	NN	SVM	DT	RF	Portuguese NV	NN	SVM	DT	RF
A	**78.5**$^{\dagger}_{\pm 0.0}$	60.3$_{\pm 1.6}$	59.6$_{\pm 0.9}$	76.7$_{\pm 0.4}$	72.4$_{\pm 0.4}$	72.9$_{\pm 0.0}$	65.1$_{\pm 0.9}$	64.5$_{\pm 0.6}$	**76.1**$_{\pm 0.2}$	73.5$_{\pm 0.2}$
B	**69.5**$^{\dagger}_{\pm 0.0}$	49.8$_{\pm 1.2}$	47.9$_{\pm 0.7}$	57.5$_{\pm 0.8}$	52.7$_{\pm 0.6}$	58.7$_{\pm 0.0}$	52.0$_{\pm 0.6}$	51.7$_{\pm 0.6}$	**62.9**$_{\pm 0.2}$	55.3$_{\pm 0.4}$
C	32.9$_{\pm 0.0}$	30.4$_{\pm 1.0}$	31.0$_{\pm 0.7}$	31.5$_{\pm 0.6}$	**33.5**$_{\pm 0.6}$	31.0$_{\pm 0.0}$	33.7$_{\pm 0.6}$	34.9$_{\pm 0.5}$	32.8$_{\pm 0.6}$	**36.7**$^{\dagger}_{\pm 0.6}$

† – statistical significance under pairwise comparisons with other methods.

Table 5: Regression results (RMSE values; underline – best model; **bold** – best within the input setup)

I. S.	Mathematics NV	NN	SVM	DT	RF	Portuguese NV	NN	SVM	DT	RF
A	2.01$_{\pm 0.00}$	2.05$_{\pm 0.02}$	2.09$_{\pm 0.02}$	1.94$_{\pm 0.04}$	**1.75**$^{\dagger}_{\pm 0.01}$	**1.32**$_{\pm 0.00}$	1.36$_{\pm 0.04}$	1.35$_{\pm 0.01}$	1.46$_{\pm 0.03}$	**1.32**$_{\pm 0.00}$
B	2.80$_{\pm 0.00}$	2.82$_{\pm 0.02}$	2.90$_{\pm 0.02}$	2.67$_{\pm 0.04}$	**2.46**$^{\dagger}_{\pm 0.01}$	1.89$_{\pm 0.00}$	1.88$_{\pm 0.02}$	1.87$_{\pm 0.01}$	**1.78**$^{*}_{\pm 0.03}$	1.79$_{\pm 0.01}$
C	4.59$_{\pm 0.00}$	4.41$_{\pm 0.03}$	4.37$_{\pm 0.03}$	4.46$_{\pm 0.04}$	**3.90**$^{\dagger}_{\pm 0.01}$	3.23$_{\pm 0.00}$	2.79$_{\pm 0.02}$	2.76$_{\pm 0.02}$	2.93$_{\pm 0.02}$	**2.67**$^{\dagger}_{\pm 0.01}$

† – statistical significance under pairwise comparisons with other methods.
∗ – statistical significance under a pairwise comparison with NV.

Case Study 3: Erkan E. Identifying At-Risk Students Using Machine Learning Techniques: A Case Study with IS 100. 2012.

- Use three machine learning algorithms(instance-based learning Classifier, Decision Tree, and Naive Bayes) to predict students' performance
  - Three steps
    - 1st step: Attendance information for first four weeks, grade of 1st assignment,
    - 2nd step: Attendance information for first seven weeks, grade of 1st, 2nd assignments, midterm grade
    - 3rd step: Attendance information for first ten weeks, grade of 1st, 2nd and 3rd assignments, final exam grade, midterm grade.

Case Study 3: Erkan E. Identifying At-Risk Students Using Machine Learning Techniques: A Case Study with IS 100. 2012.

- Algorithms
  - K-Star
    - One of the instance-based classifiers
  - C4.5
    - An extension to ID3 algorithm
  - Naive Bayes
  - Three decision schemas
    - DS1: if at least one of the algorithms classifies student as a failure than this student will be considered as failure
    - DS2: if at least two algorithms classify student as a failure than this student will be considered as failure
    - DS3: if all three algorithms classify student as a failure than this student will be considered as failure

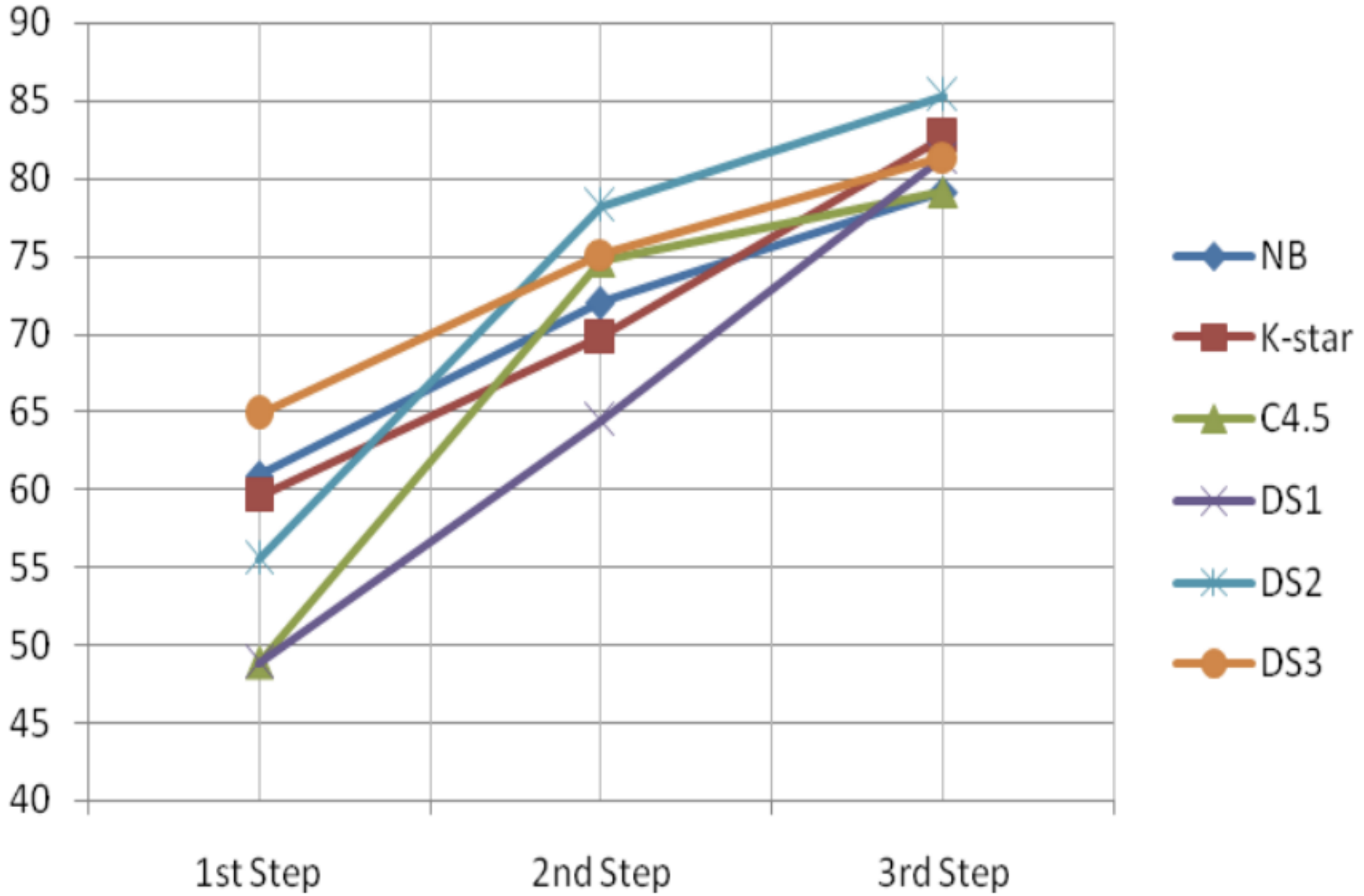


Fig. 1. Overall accuracy of results.

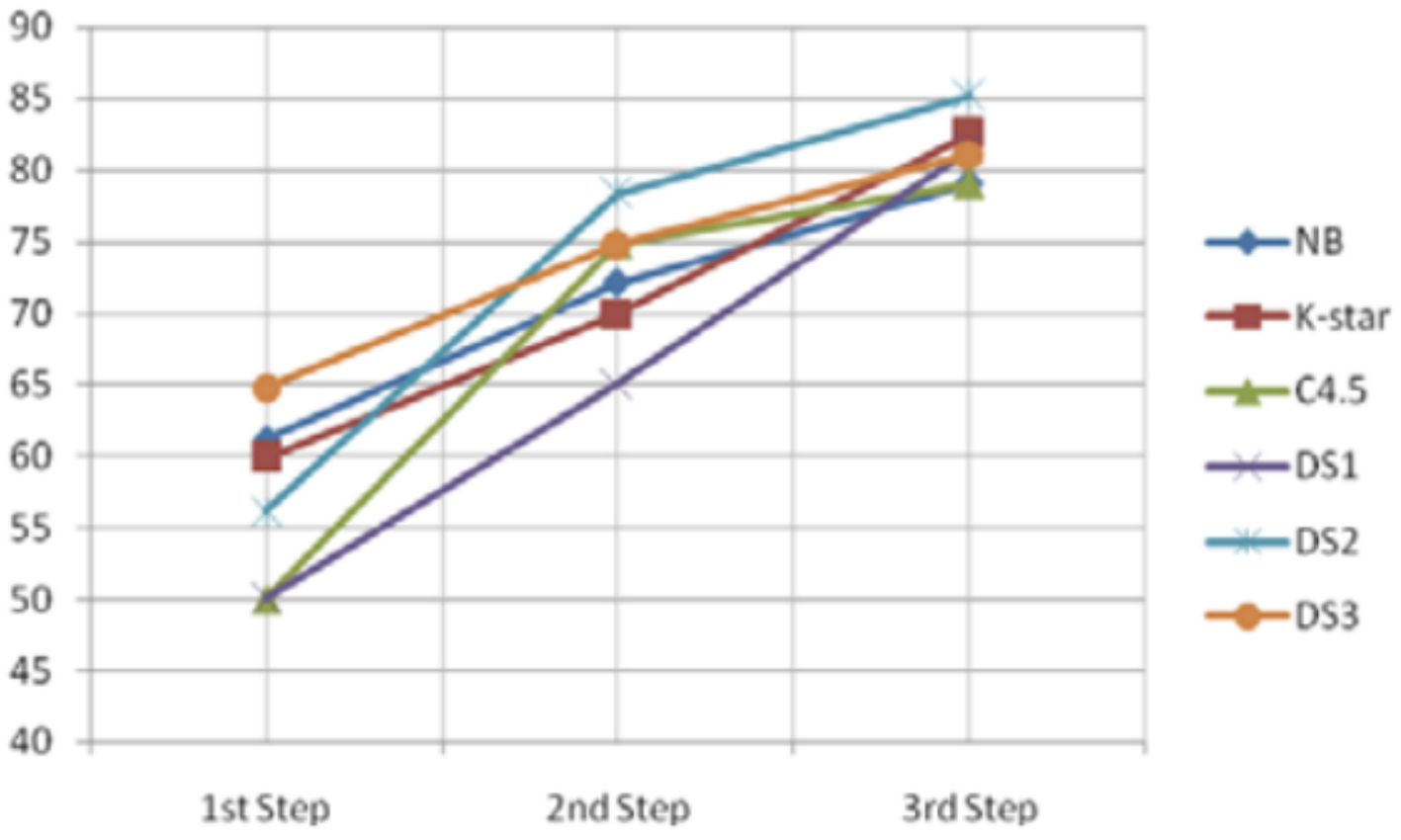
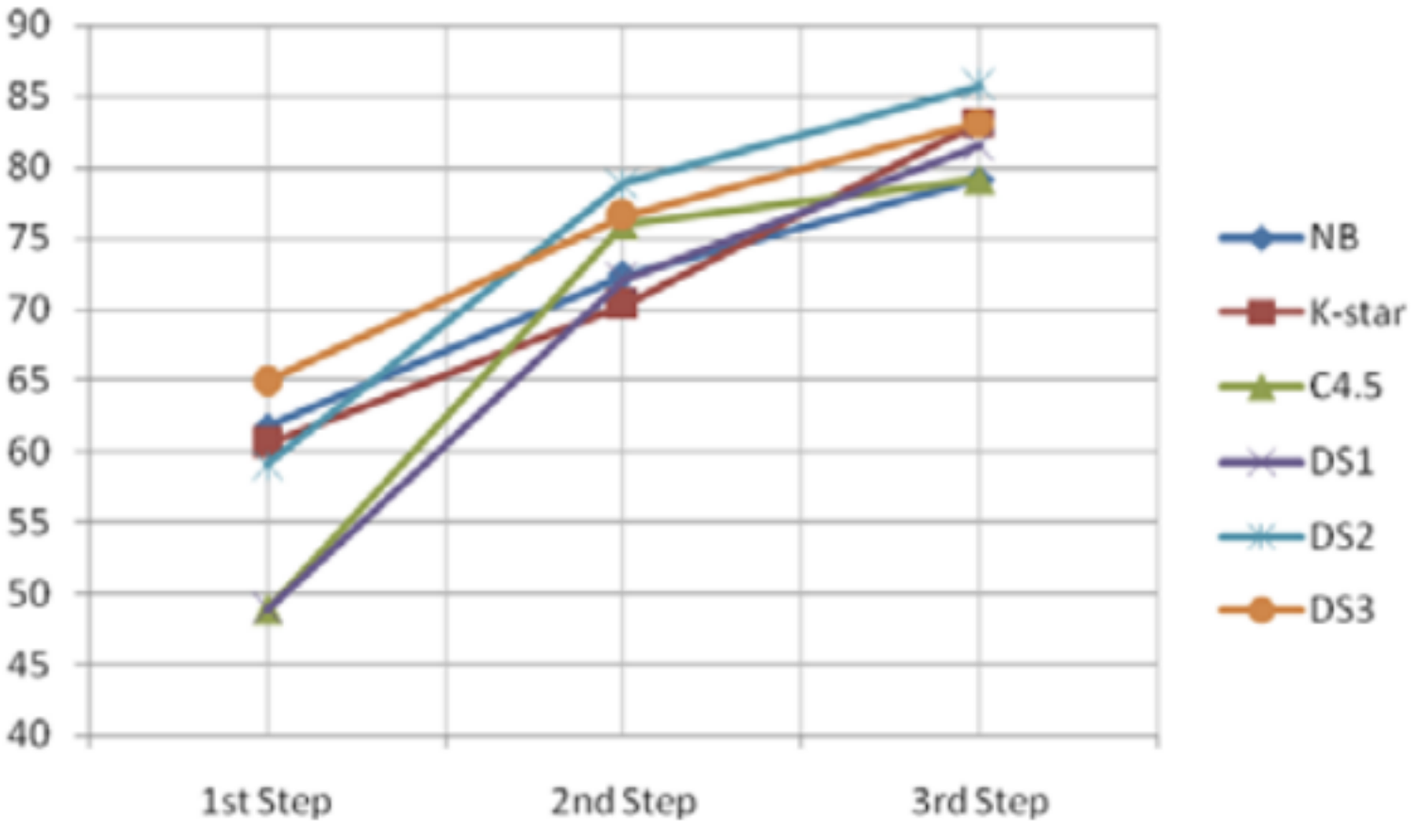


Fig. 2. Overall sensitivity of results.



B d

Fig. 3. Overall precision of results.

KEEP

Knowledge and Education Exchange Platform

KEEP

KEEP Education Cloud

- Educational resources to **anyone**, **anytime**, **anywhere**, on **any device**
- An **education cloud platform** to provide aggregated eLearning resources for teachers and students
- Big Data **analytics for education**
- **Knowledge aggregation** and **technology integration**!
- Multi-year, multi-discipline, and cross-institutional project with **strong partners and alliances**

Some Partners and Alliances

UGC 大學教育資助委員會 University Grants Committee

coursera edX

course-builder Course Builder

ewant education you want! 育網開放教育平台

UDACITY

OPENedX

xuetangX.com 学堂在线

Lingnan 嶺南大學 University

amazon web services

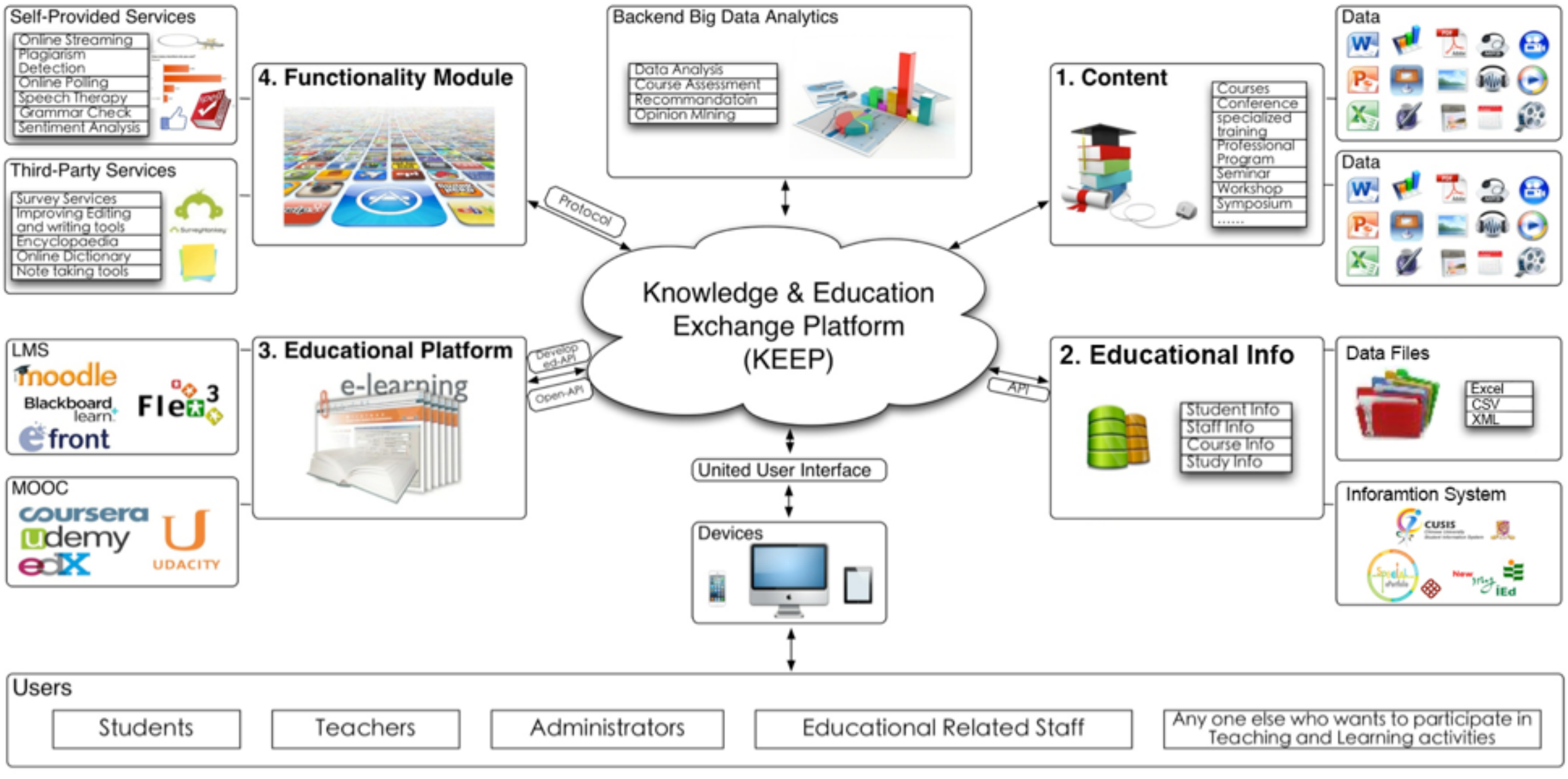
Google

android

HUAWEI

Microsoft

The KEEP Education Cloud



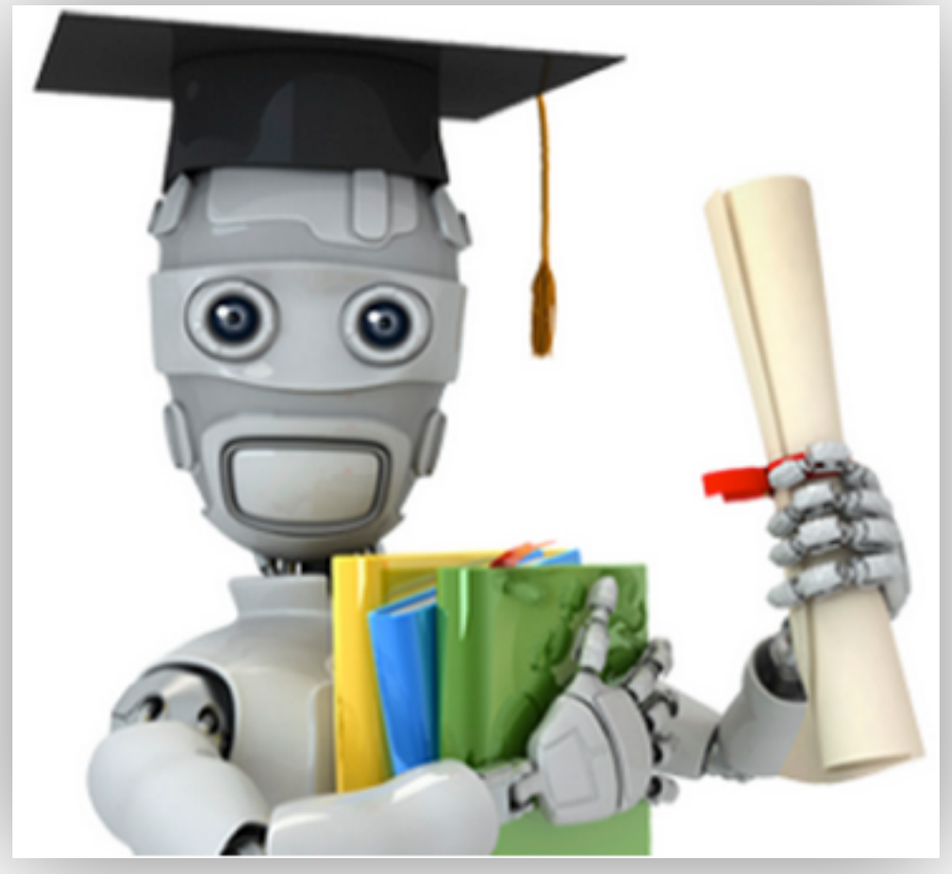
Work in Progress

&

Future Works

Big Education in the Era of Big Data @ FedCSIS 2014, September 7-10, 2014, Warsaw, Poland

Natural Language Processing



- Text and semantic analysis
- Summarization
- Sentiment analysis
- Automated grading
- Q&A systems

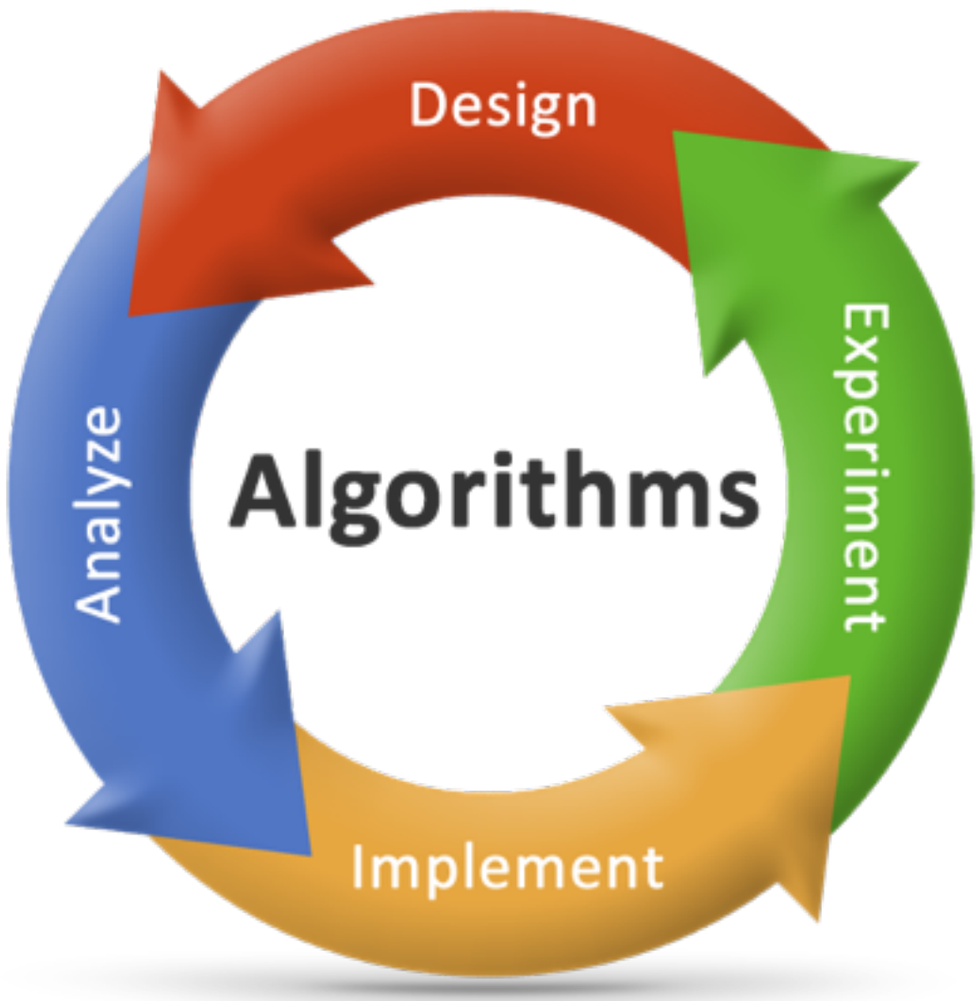
Recommendations

- Personalized learning
- Courses, tutors, peering learning partners, etc.
- Learning resources, time allocation, etc.
- Career planning

Knowledge Map

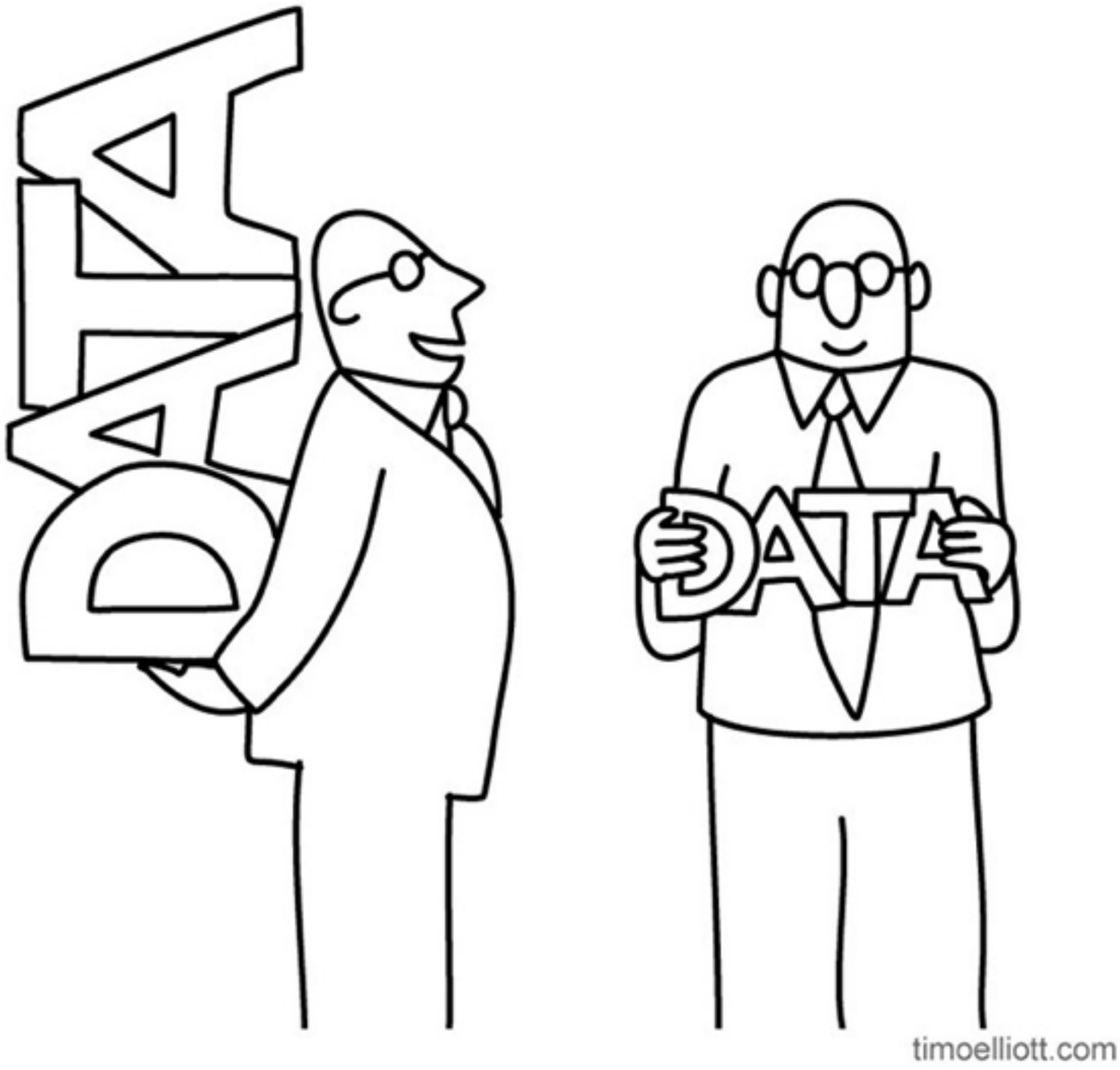
- Explore topics
- Track topic changes
- Make topic comparisons and inferences
- Better search on concepts

Algorithms & Techniques



- Machine learning
- Data analytics
- Social computing
- Web intelligence
- Multimedia information processing

Get Involved



"I think you'll find that mine is bigger..."

Concluding Remarks

- *Be Inspired*
  - Big Education is the focus!
- *Be Informed*
  - Big Data in Education is the *VALUE* proposition!
- *Be Challenged*
  - Use technologies to transform education in the Big Data Era!

BigScholar 2014

The First WWW Workshop on Big Scholarly Data: Towards the Web of Scholars

Seoul, Korea, April 8, 2014

Home | CFP | Organizers | Submission | Registration | Program | Keynote Speakers

CALL FOR PAPERS (TXT)

Researchers worldwide are currently producing more and more scholarly data of various types such as papers, books, patents, etc. Such data are big data by nature. For example, the DBLP Computer Science Bibliography provides bibliographic information on major computer science journals and proceedings. Additionally, DBLP indexes more than 2.3 million articles records containing title, pages, years and authors' information, etc. Concurrently, scholars are associated with various academic activities such as conferences, workshops, congresses, peer review, and so on. Such scenarios have motivated us to explore the Web of Scholars in the context of big scholarly data on a global scale. It is imperative and vital for researchers to drive their knowledge towards the innovative generation of values from Big Scholarly Data. The emerging worldwide Web of Scholars demands a re-evaluation of existing techniques, such as data mining, recommender systems, and social network analysis. Furthermore, there is a demand for novel ways of developing algorithms, methods and techniques to foster the analysis and interpretation of social environments such as academic collaboration networks.

In this workshop, we will explore promising areas of research in big scholarly data, with a focus on the rapidly emerging field of the Web of Scholars. This workshop also seeks to answer noteworthy research questions such as:
- How to connect scholars on the web?
- How to facilitate collaboration among scholars?
- How to find the experts in a particular field?

Researchers are welcome to submit their papers that address these questions above and other topics below which may include, but are not limited to:
- Academic social network analysis
- Scientific recommendation
- Methods and tools for analyzing big scholarly data
- Indexing, searching, and mining scholarly data
- Connecting scholars using a Web approach
- Platforms and services for the Web of Scholars
- Web tools and techniques for big scholarly data
- Paradigms to promote scientific collaboration
- Scientific trends prediction
- Applications, use cases, and evaluations of big scholarly data

IMPORTANT DATES
Paper Submission Deadline: ~~Jan 14, 2014~~ ~~Jan 28, 2014~~
Author Notification: Feb 4, 2014
Final Manuscript: Feb 12, 2014

WWW2014 Workshop on Web-based Education Technologies (WebET 2014)
April 9, 2014, Seoul, Korea

Home | About | Committee | Authors | Attendees | Program

WebET 2014

The Web has long been recognized as a powerful platform for teaching and learning. The educational community was among the early adopters of the technology and has contributed to its evolution. We are at this point at a major inflection point for Web-based Education Technologies. The convergence ("a perfect storm") of new technologies supporting search, social media, semantics, data mining (Big Data), and others along with current interest to distributed educational pedagogies such as connectivism, behaviorism, and "the flipped classroom" promises to dramatically change Web-based Education Technologies in the near future. The interest in Massive Open Online Courses (MOOCs) has been described as "a tsunami in education" and has re-kindled valuable discussions regarding the role of WebET.

Search … SEARCH

Call for Papers

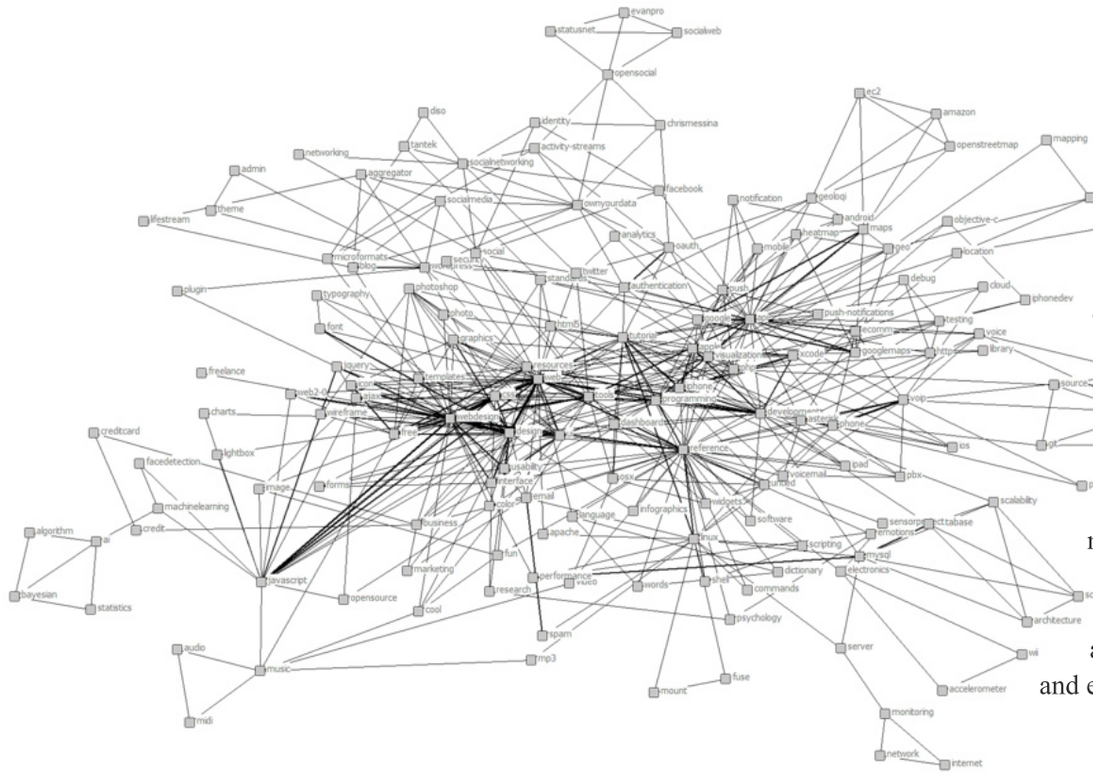
Important Dates

- Submission Deadline: Jan. 14, 2014
- Author Notification: Feb. 4, 2014
- Final Manuscript: Feb. 12, 2014

New Book Series

SOCIAL MEDIA & SOCIAL COMPUTING

CALL FOR BOOKS!



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The advent of the Internet and the Web has resulted in social interactions and behaviors through the use of technologies and web services, e.g., hardware devices such as smart phones, tablets, RFID, etc., software services such as wikis, blogs, micro-blogs, social network sites, recommender systems, social bookmarking, social news, multimedia sharing sites, etc. Analyzing these technologically-enabled interactions in their social context will benefit information providers and information consumers. However, the large volume and scale of user-generated contents require effective modeling methods and efficient algorithms to handle these chalenging problems.

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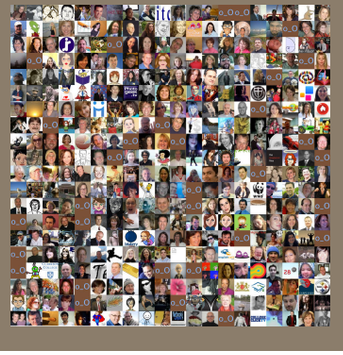

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- Xixian Chen (Ph.D.)
- Chen Cheng (Ph.D.)
- Junjie Hu (Ph.D.)
- Baichuan Li (Ph.D.)
- Guang Ling (Ph.D.)
- Haiqin Yang (Postdoc)
- Connie Yuen (Ph.D.)
- Hongyi Zhang (Ph.D.)
- Shenglin Zhao (Ph.D.)
- Tong Zhao (Ph.D.)

- Looking for more PhD students working on machine learning, Big Data, social computing, …

Acknowledgments

- Roger Cheung
- Byron Lai
- Daisy Lau
- Patrick Lau
- Sophia Man
- Lin Tsang
- Junfeng Yang
- Raymond Yuen

- Looking for more engineers, programmers, system analysts, etc. to work on KEEP…

The Chinese University of Hong Kong

CUHK Excellence

- The only university in Hong Kong having Nobel Laureates as faculty with five Distinguished Professors-at-Large

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Prof. Charles Kao Nobel Laureate in Physics

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Prof. Yau Shing-Tung, Fields Medalist

Prof. Andrew Yao, Turing Award

- **Nine** academicians of Chinese Academy of Sciences and Chinese Academy of Engineering

Q&A

Reference

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