The VII International Scientific Conference
“Mathematics. Information Technology.
Education”

Open online courses for engineering subjects

Yuriy Skorenkyy, Ihor Baran, Nataliia Kunanets, Halyna Matsiuk, Mykola Mytnyk, Volodymyr Pasichnyk, Volodymyr Yaskilka

Ternopil Ivan Puluj National Technical University
Lviv Polytechnic National University

Motivation:

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Insight Report

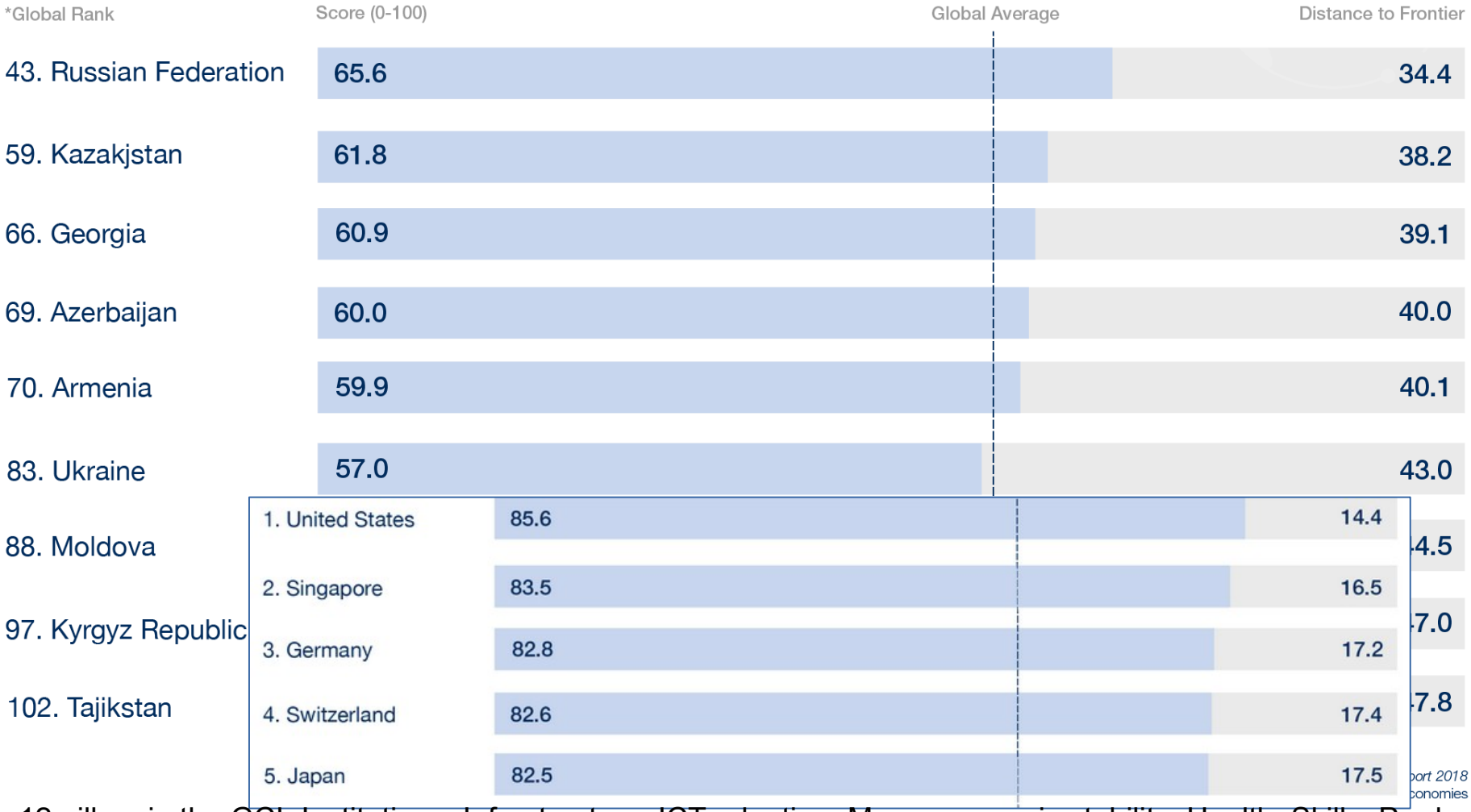
The Global Competitiveness Report 2018

Klaus Schwab, World Economic Forum

http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf

2018 Global Competitiveness Index 4.0

Economies Closest to the Competitiveness Frontier in Eurasia



12 pillars in the GCI: Institutions; Infrastructure; ICT adoption; Macroeconomic stability; Health; Skills; Product market; Labour market; Financial system; Market size; Business dynamism; and Innovation capability.

http://reports.weforum.org/global-competitiveness-report-2018/infographics/

Table 1: Global Competitiveness Index 2017–2018 rankings and 2016–2017 comparisons

Economy	GCI 2017–2018 Rank (out of 137)	GCI 2017–2018 Score (1–7)	GCI 2016–2017 Rank (out of 138)	GCI 2016–2017 Score (1–7)
Switzerland	1	5.86	1	5.81
United States	2	5.85	3	5.70
Singapore	3	5.71	2	5.72
Netherlands	4	5.66	4	5.57
Germany	5	5.65	5	5.57
Hong Kong SAR	6	5.53	9	5.48
Sweden	7	5.52	6	5.53
United Kingdom	8	5.51	7	5.49
Japan	9	5.49	8	5.48
Finland	10	5.49	10	5.44
Norway	11	5.40	11	5.44
Denmark	12	5.39	12	5.35
New Zealand	13	5.37	13	5.31
Canada	14	5.35	15	5.27
Taiwan, China	15	5.33	14	5.28
Israel	16	5.31	24	5.18
United Arab Emirates	17	5.30	16	5.26
Austria	18	5.25	19	5.22
Luxembourg	19	5.23	20	5.20
Belgium	20	5.23	17	5.25
Australia	21	5.19	22	5.19
France	22	5.18	21	5.20
Malaysia	23	5.17	25	5.16
Ireland	24	5.16	23	5.18
Qatar	25	5.11	18	5.23
Korea, Rep.	26	5.07	26	5.03
China	27	5.00	28	4.95
Iceland	28	4.99	27	4.96
Estonia	29	4.85	30	4.78
Saudi Arabia	30	4.83	29	4.84
Czech Republic	31	4.77	31	4.72
Thailand	32	4.72	34	4.64
Jamaica	70	4.25	75	4.13
Morocco	71	4.24	70	4.20
Peru	72	4.22	67	4.23
Armenia	73	4.19	79	4.07
Croatia	74	4.19	74	4.15
Albania	75	4.18	80	4.06
Uruguay	76	4.15	73	4.17
Montenegro	77	4.15	82	4.05
Serbia	78	4.14	90	3.97
Tajikistan	79	4.14	77	4.12
Brazil	80	4.14	81	4.06
Ukraine	81	4.11	85	4.00
Bhutan	82	4.10	97	3.87
Trinidad and Tobago	83	4.09	94	3.93
Guatemala	84	4.08	78	4.08
Sri Lanka	85	4.08	71	4.19
Algeria	86	4.07	87	3.98
Greece	87	4.02	86	4.00
Nepal	88	4.02	98	3.87
Moldova	89	3.99	100	3.86
Namibia	90	3.99	84	4.02
Kenya	91	3.98	96	3.90
Argentina	92	3.95	104	3.81
Nicaragua	93	3.95	103	3.81
Cambodia	94	3.93	89	3.98
Tunisia	95	3.93	95	3.92
Honduras	96	3.92	88	3.98
Ecuador	97	3.91	91	3.96
Lao PDR	98	3.91	93	3.93
Bangladesh	99	3.91	106	3.80
Egypt	100	3.90	115	3.67
Mongolia	101	3.90	102	3.84

Ukraine

81st / 137

The Global Competitiveness Index 2017-2018 edition

WORLD ECONOMIC FORUM

Key indicators, 2016

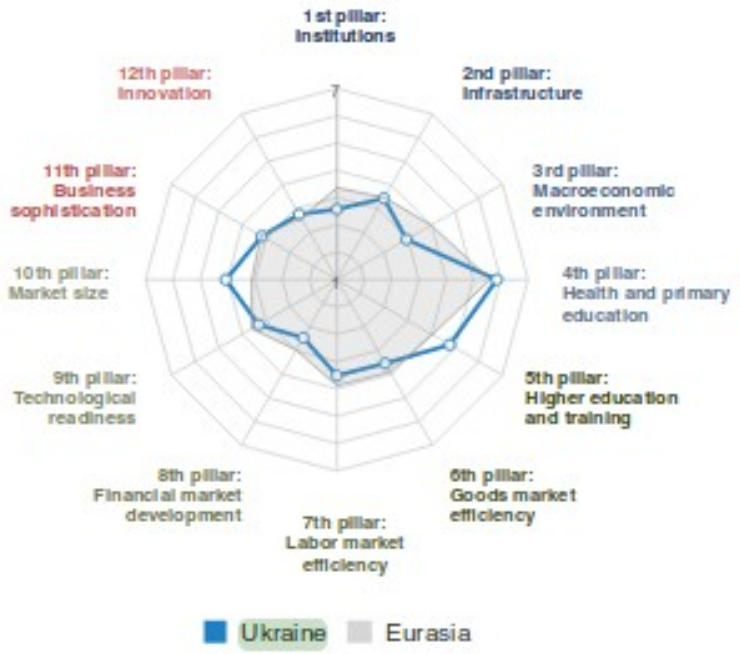
Source: International Monetary Fund; World Economic Outlook Database (April 2017)

Population millions	42.5	**GDP per capita** US$	2,194.4
GDP US$ billions	93.3	**GDP (PPP)** % world GDP	0.29

Performance overview

Index Component	Rank/137	Score (1-7)	Trend	Distance from best
Global Competitiveness Index	81	4.1		
Subindex A: Basic requirements	96	4.2		
1st pillar: Institutions	118	3.2		
2nd pillar: Infrastructure	78	3.9		
3rd pillar: Macroeconomic environment	121	3.5		
4th pillar: Health and primary education	53	6.0		
Subindex B: Efficiency enhancers	70	4.1		
5th pillar: Higher education and training	35	5.1		
6th pillar: Goods market efficiency	101	4.0		
7th pillar: Labor market efficiency	86	4.0		
8th pillar: Financial market development	120	3.1		
9th pillar: Technological readiness	81	3.8		
10th pillar: Market size	47	4.5		
Subindex C: Innovation and sophistication factors	77	3.5		
11th pillar: Business sophistication	90	3.7		
12th pillar: Innovation	61	3.4		

Edition	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rank	73 / 144	84 / 148	76 / 144	79 / 140	85 / 138	81 / 137
Score	4.1	4.1	4.1	4.0	4.0	4.1



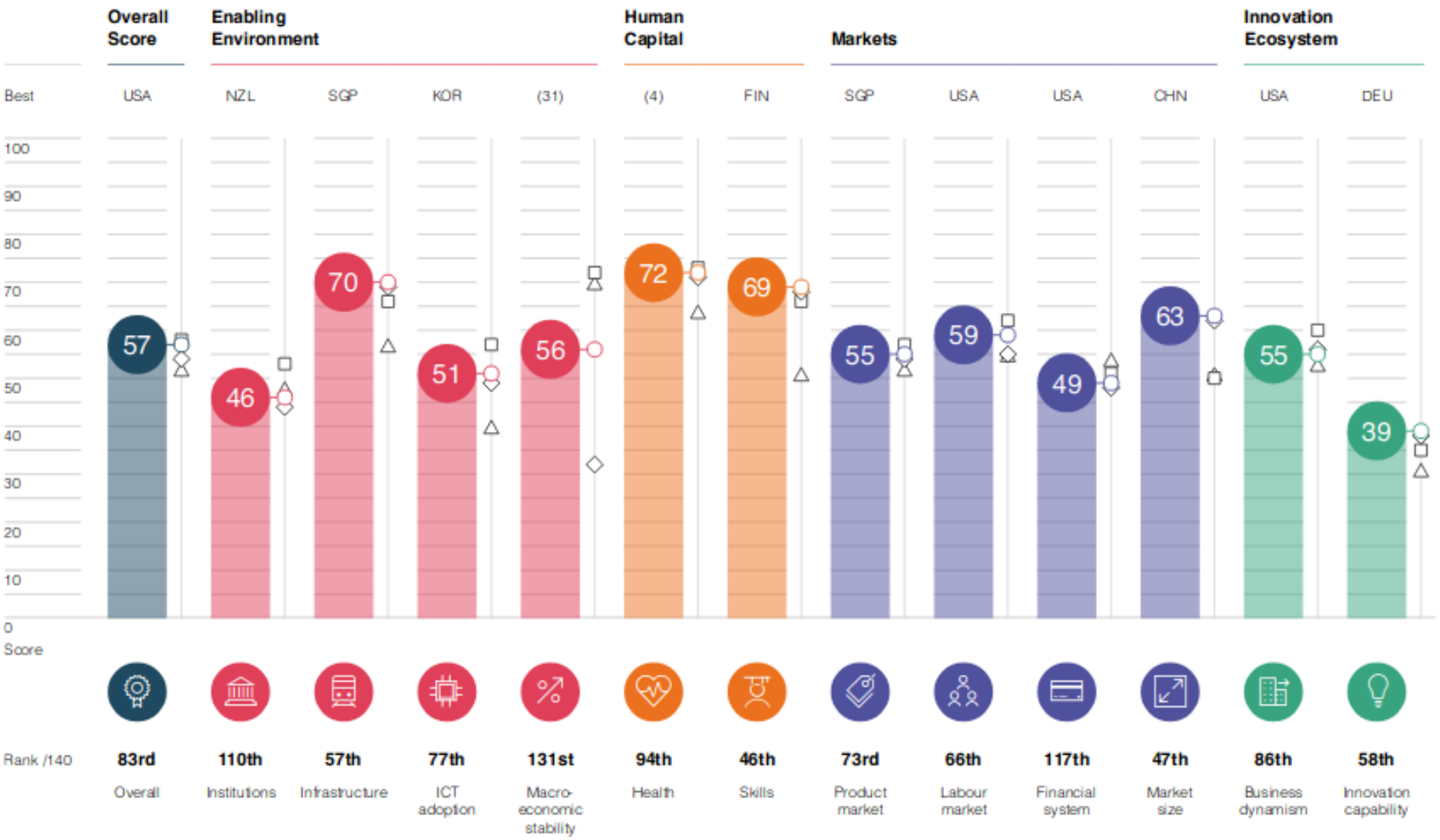
http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf

Global Competitiveness Index 4.0 2018 edition

Rank in 2017 edition: 89th/135

Performance Overview 2018

Key ◇ Previous edition △ Lower middle income group average □ Eurasia average

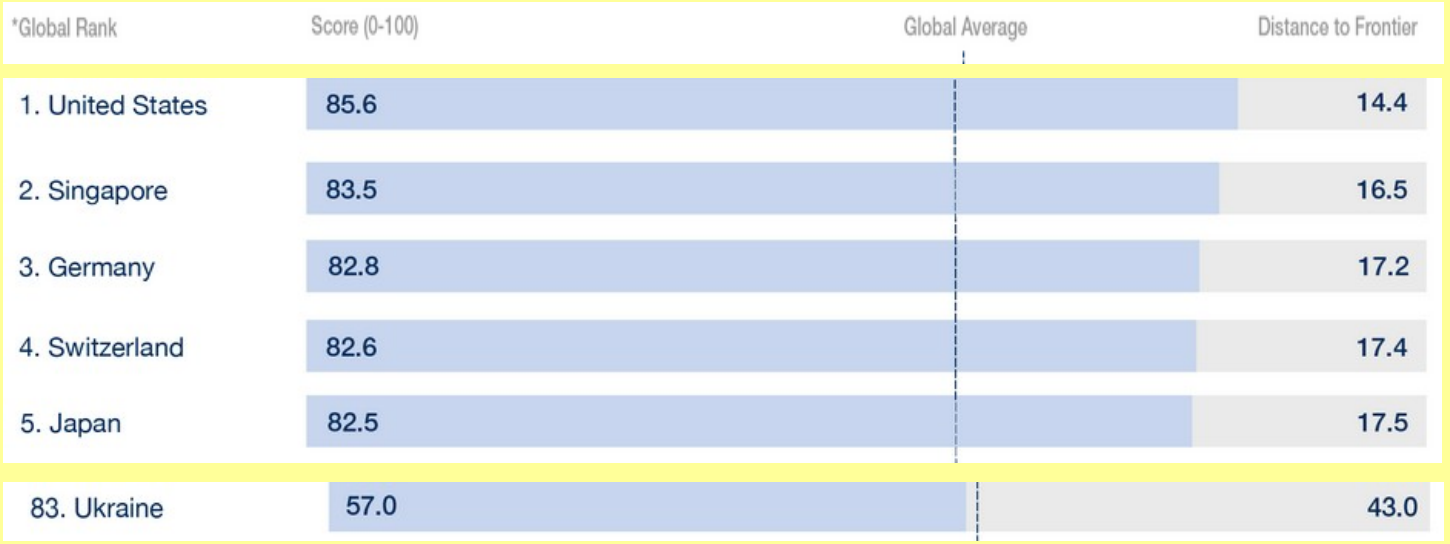


http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf

Ukraine

83rd/140

Index Component	Value	Score *	Rank/140	Best Performer
Pillar 6: Skills 0-100 (best)	-	**68.9** ↑	**46**	**Finland**
6.01 Mean years of schooling Years	10.4	69.3 =	51	Finland
6.02 Extent of staff training 1-7 (best)	3.8	46.6 ↑	74	Switzerland
6.03 Quality of vocational training 1-7 (best)	4.1	51.5 ↓	63	Switzerland
6.04 Skillset of graduates 1-7 (best)	4.1	52.1 ↓	62	Switzerland
6.05 Digital skills among population 1-7 (best)	4.4	57.2 ↓	55	Sweden
6.06 Ease of finding skilled employees 1-7 (best)	4.4	56.3 ↓	54	United States
6.07 School life expectancy Years	15.0	83.3 =	54	Multiple (9)
6.08 Critical thinking in teaching 1-7 (best)	3.8	47.1 ↓	41	United States
6.09 Pupil-to-teacher ratio in primary education Ratio	12.8	93.1 ↑	32	Multiple (6)



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openknowledge.worldbank.org/bitstream/handle/10986/28831/2-11-2017-14-55-6-UkraineInnovationandEntrepreneurshipEcosystemDiagnostic.pdf

Human Capital

While Ukraine's education system continues to have strengths in math and science, universities need fundamental reforms. Universities are weak in matching education to meet the current skill needs of employers and are insufficiently flexible and adaptive, especially in fast-moving areas such as IT. The structure of universities and training institutes, as well as their curriculum, is matched to the old economy not the fut … d entreprene

Due to lac … er countries c … ts in Ukraine … r, reflecting …

Next Steps

The purpose of this I&E ecosystem diagnosis is to serve as a platform for developing recommendations. The diagnosis suggests some priority areas.

First, it is clear that Ukraine has major systemic and structural issues to address to develop a well-functioning I&E ecosystem in the long term. These include

- **Broad governance reform,** including reducing corruption, restoring trust in government, reforming the judiciary, improving regulations, and other institutional areas;
- **Addressing issues of industrial structure,** including strengthening competition policy, reforming SOEs, supporting SMEs, and supporting technology-based industries through cluster policies or 'smart specialization'; and
- **Fundamental reforms of public research institutes and universities,** including reforming the NASU and piloting targeted programs that could bring research activities closer to the needs of local industries (for more details on reforming the NASU, see Ukraine's STI Public Expenditure Analysis Report recommendations).

Reforms in each of these areas are critical for innovation and also for the overall performance of the private sector and the investment attractiveness of the country. Developing comprehensive solutions to

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source: http://www.oeconsortium.org/about-oec/

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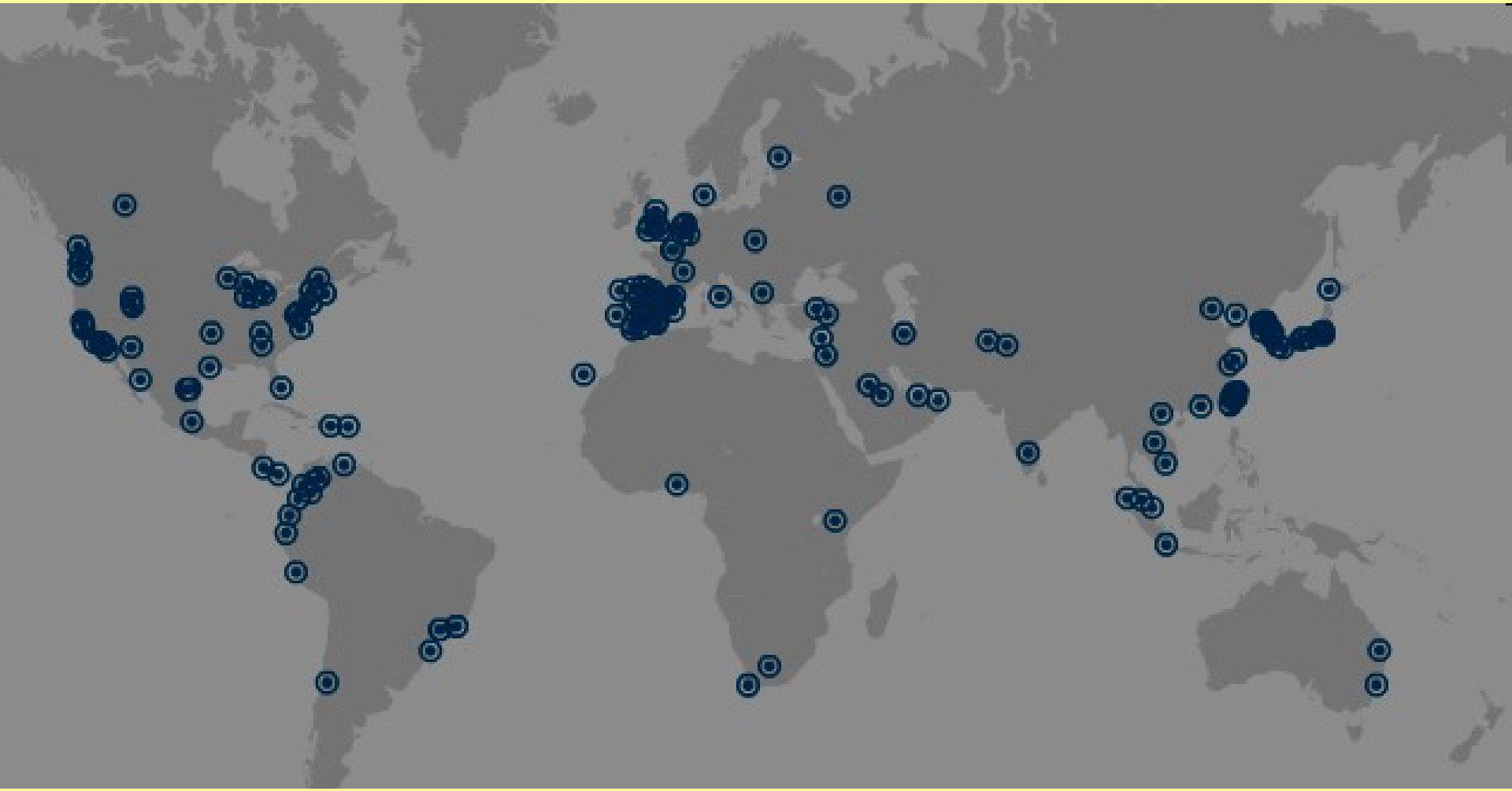

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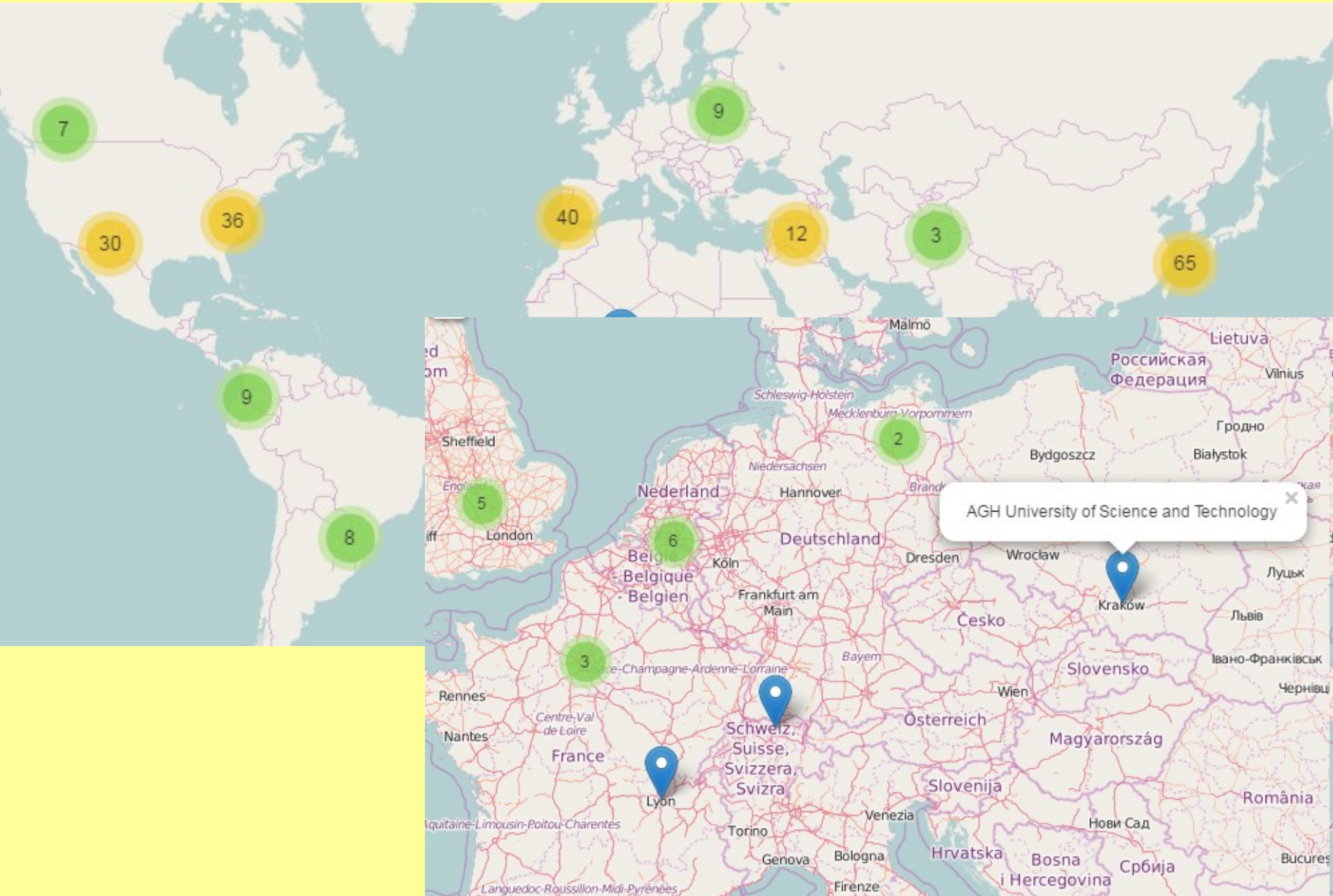

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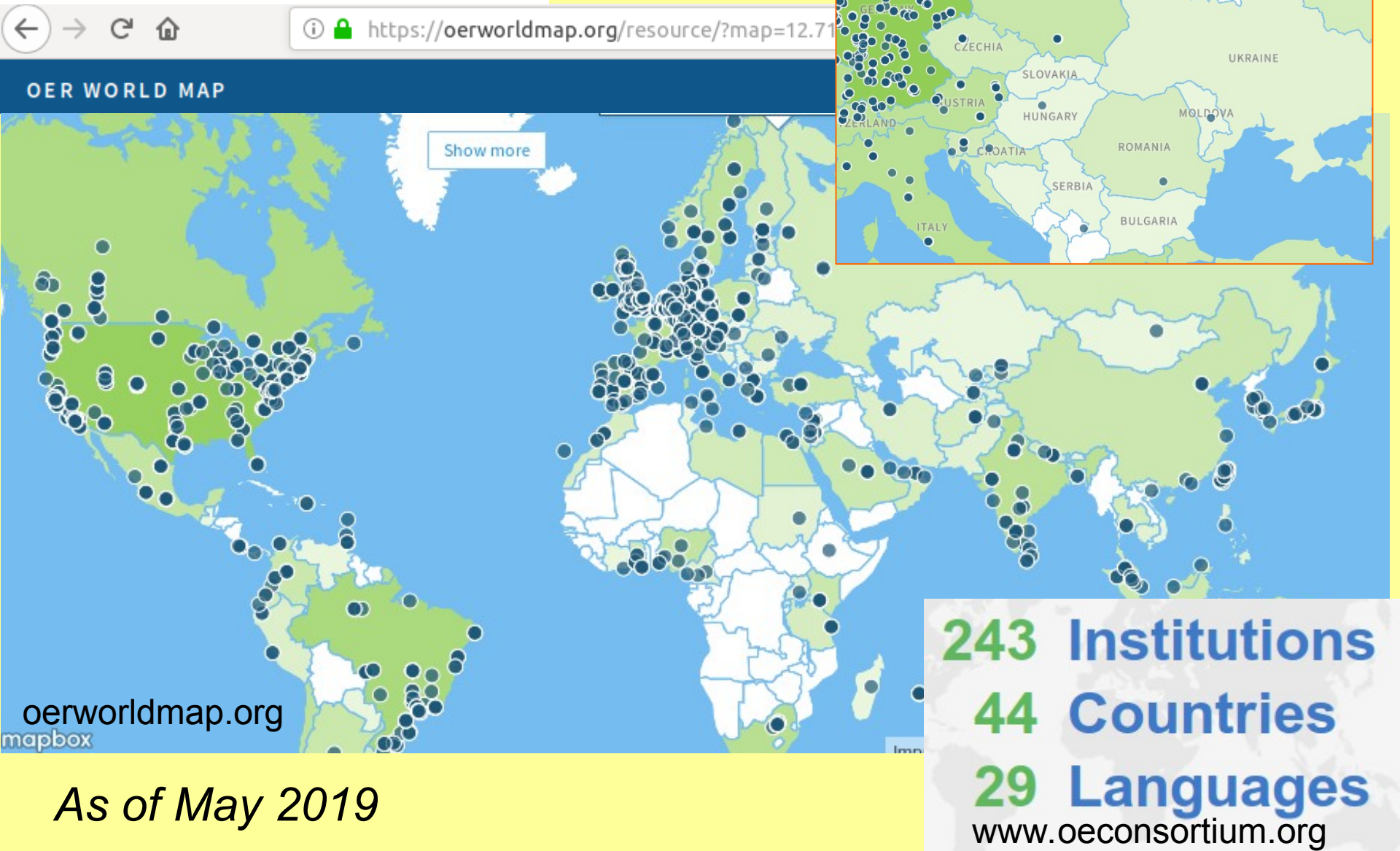

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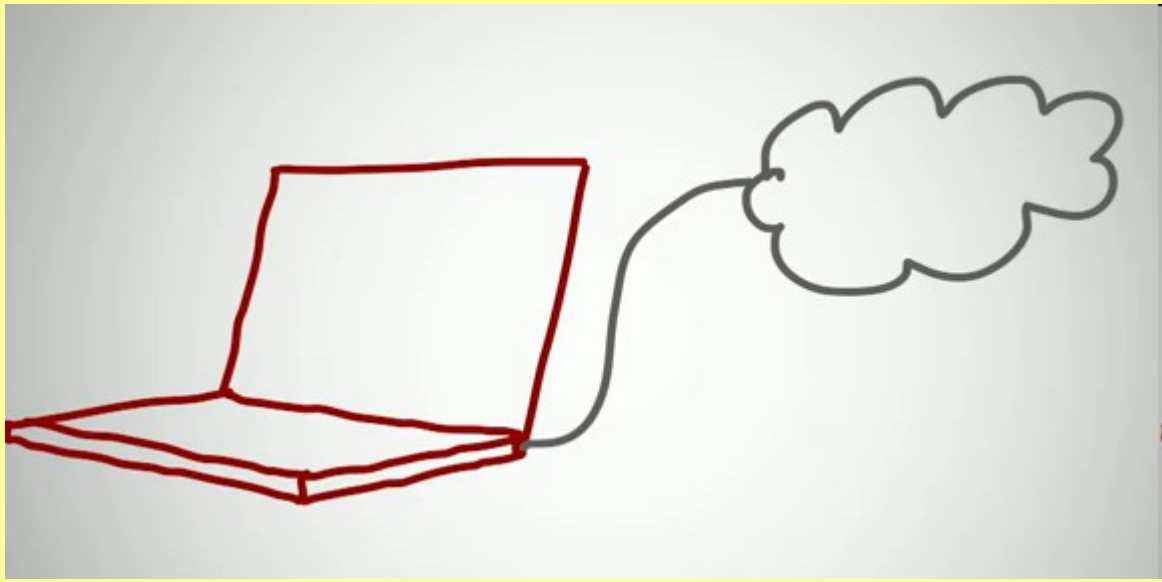

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(Dave Cormier, What is a MOOC?)

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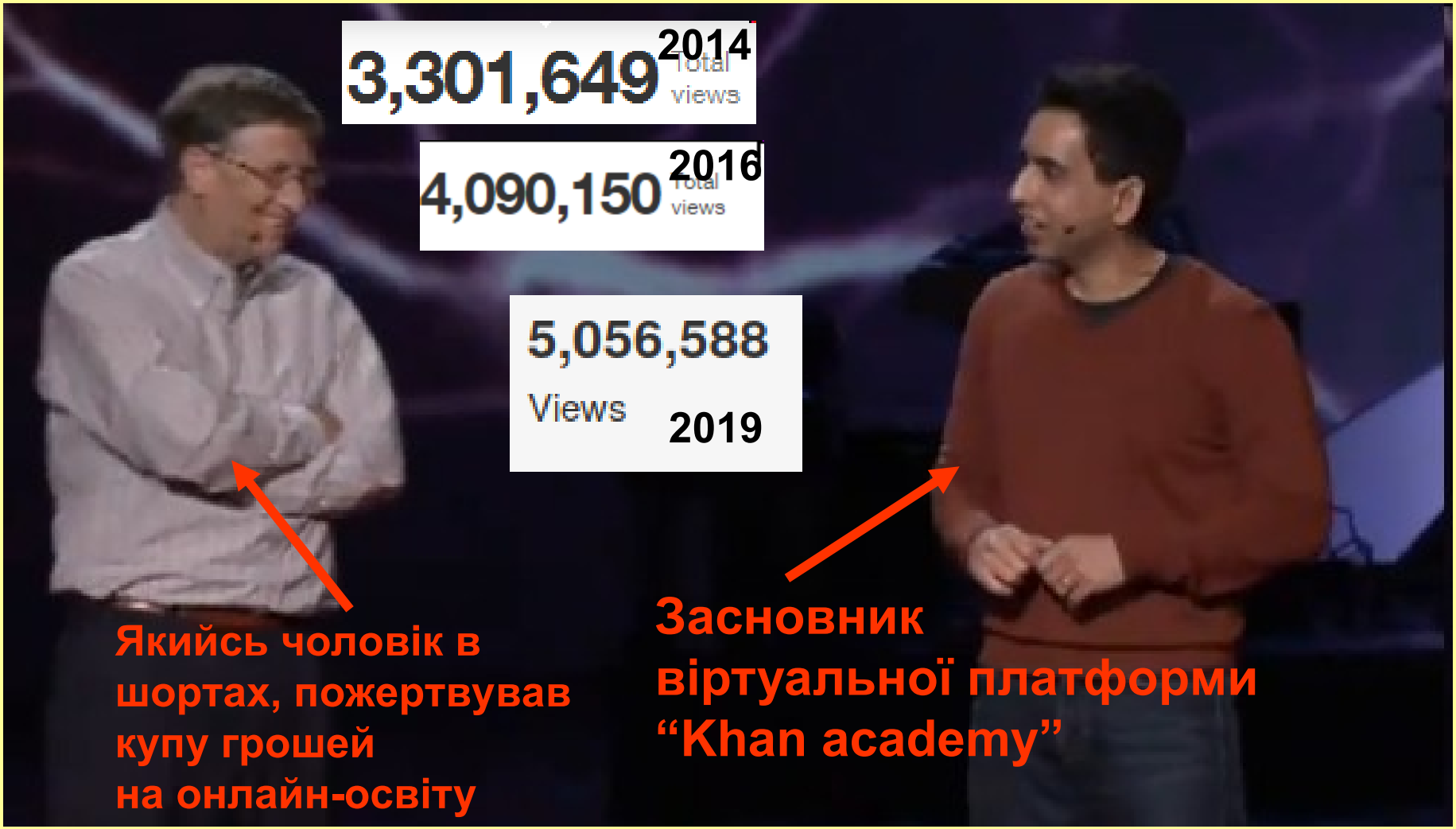
Salman Khan:
Let's use video to reinvent education
Березень 2011 р.



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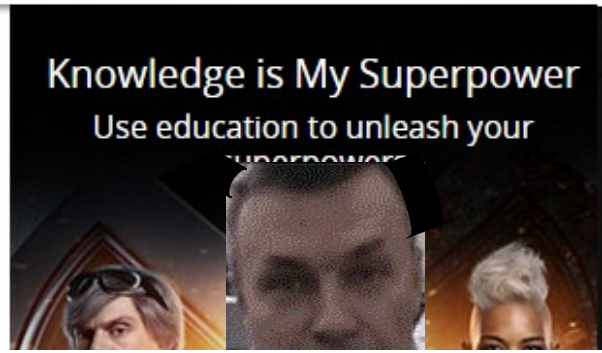

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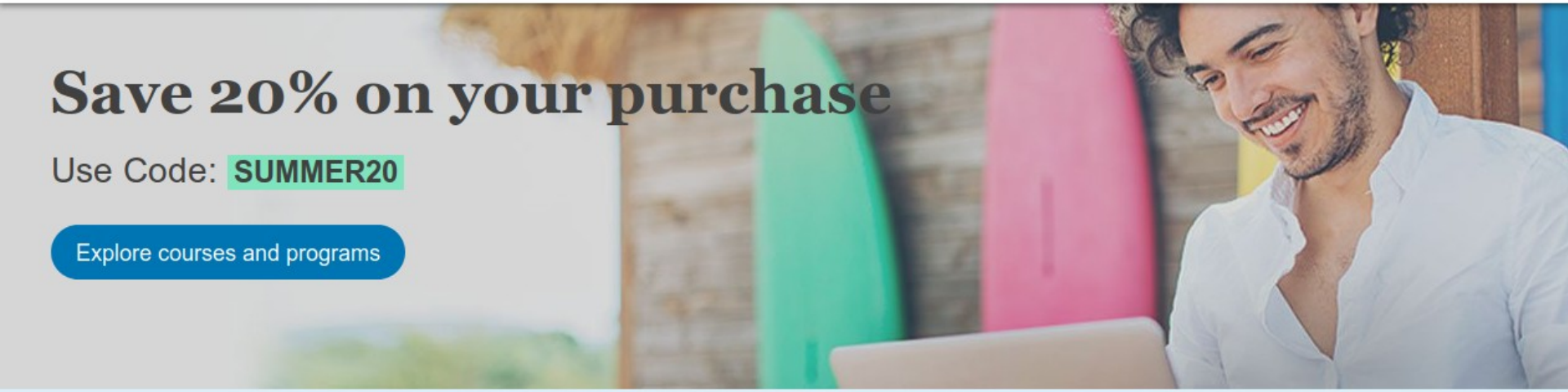

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лаб РТ-11

лаб СБ-11

лаб СБ-11

лаб СБ-11

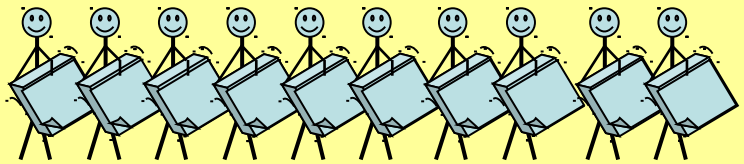
лек СБ, СІ-1

експоненціального розподілу, а третій - це показник, що відповідає за стискання або розтягування розподілу. Змодельована система протягом всього часу отримала на вхід 15 вимог та опрацювала їх без затримок. Завантаженість серверів - 69% та 71%.

Кокота

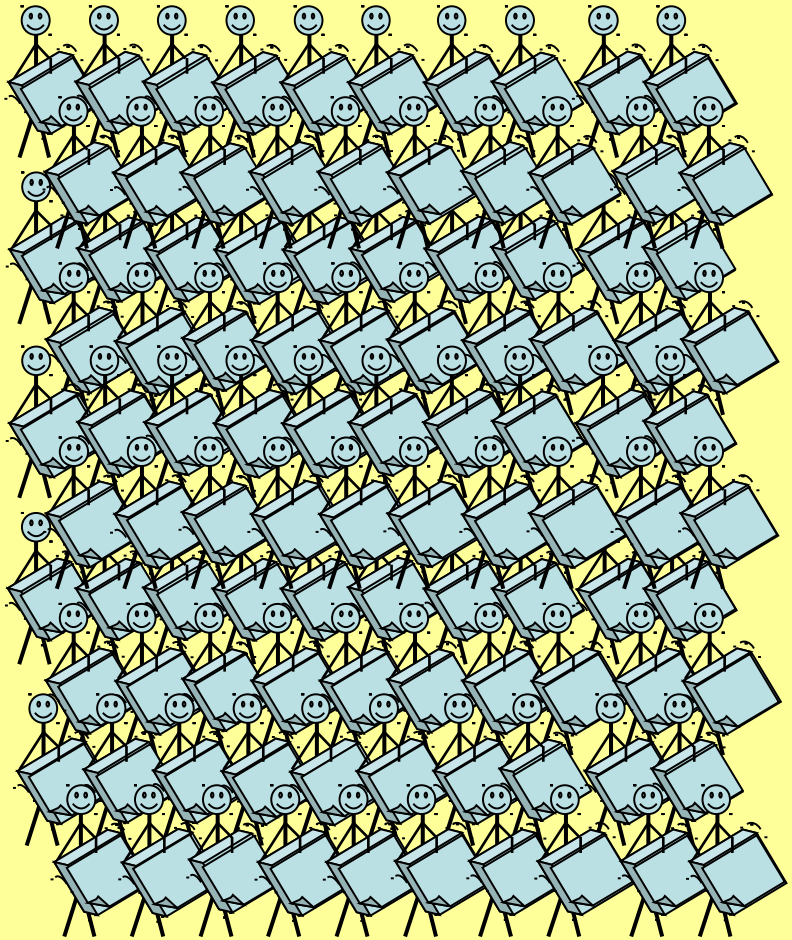
Королик Віталій Олегович СН-31

group



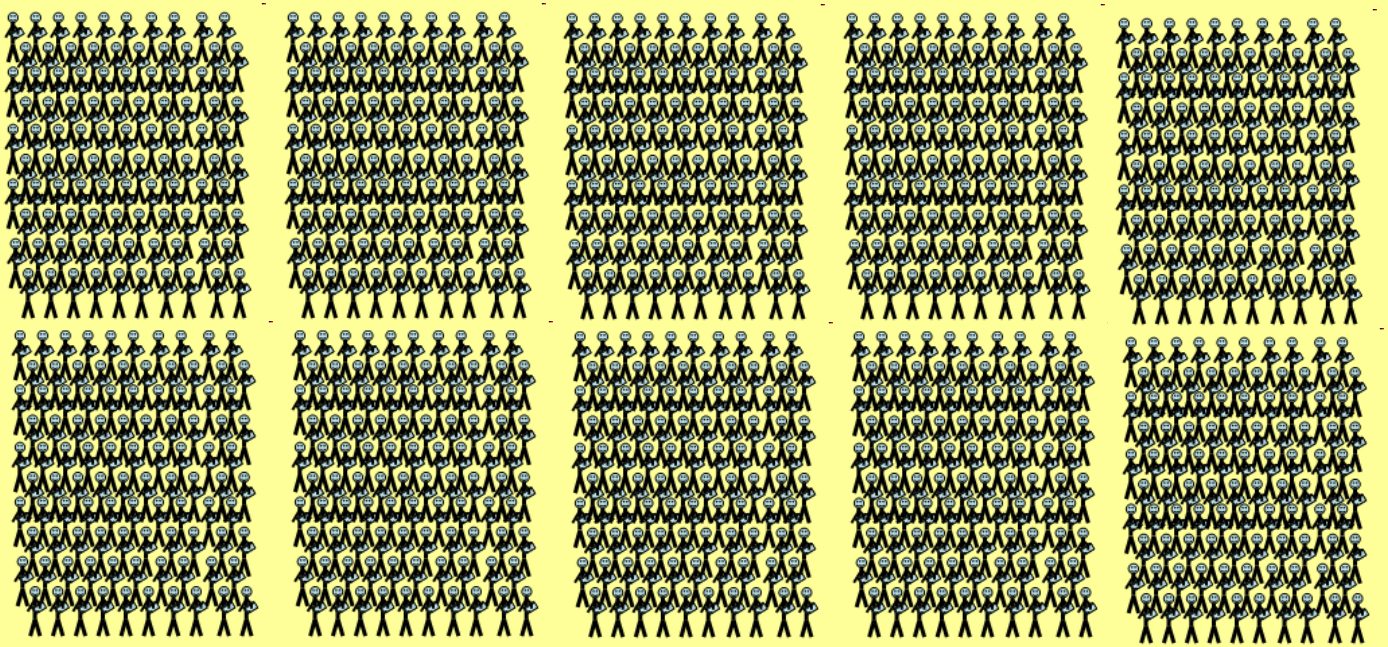
10

class

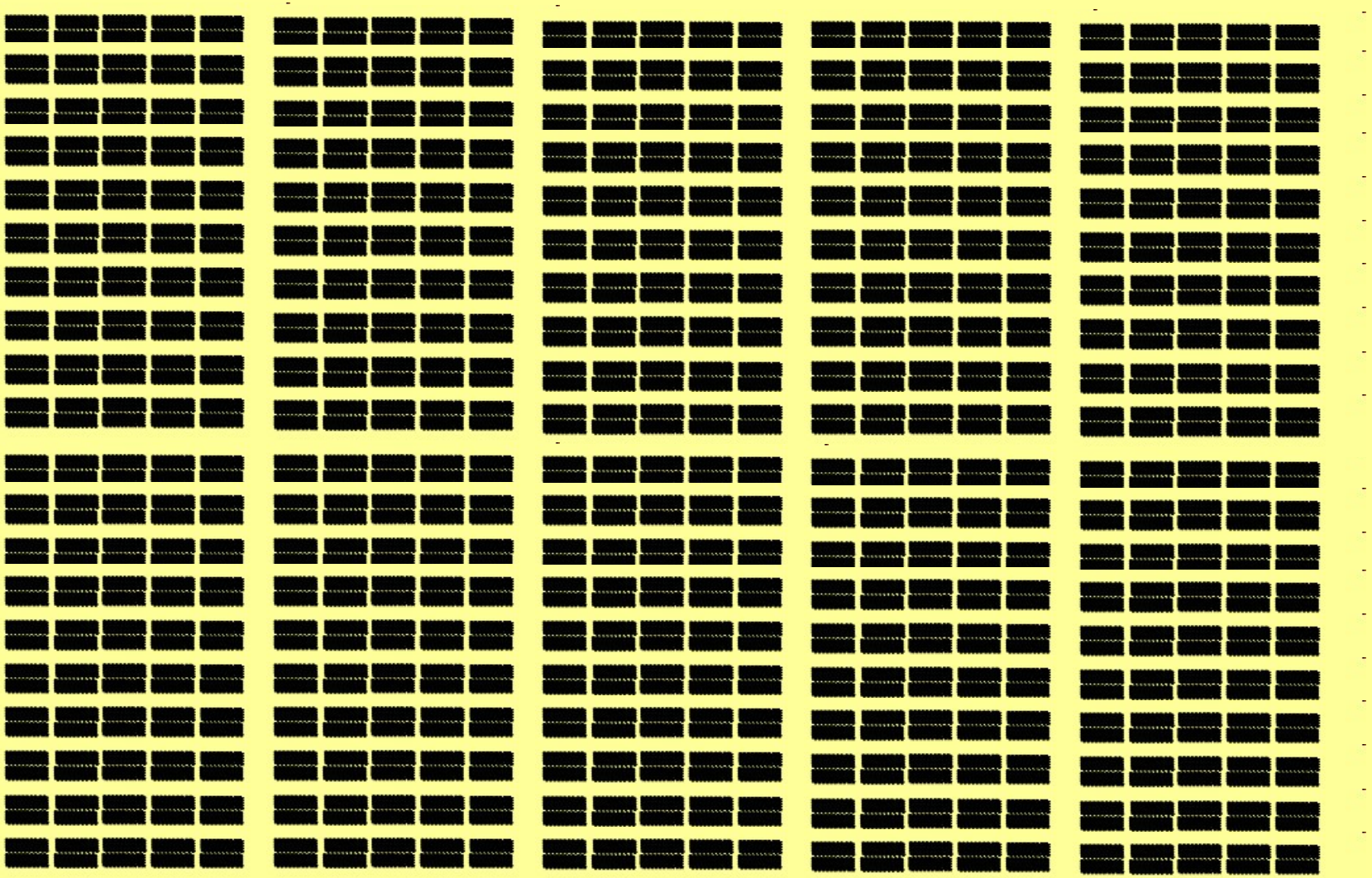


$10^2 = 100$

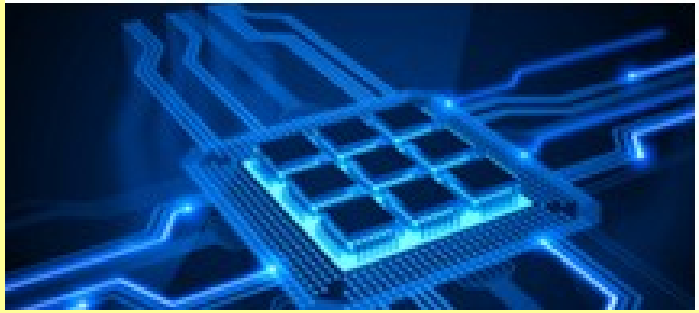
open online course $10^3 = 1000$



Massive open online course $10^5 = 100000$



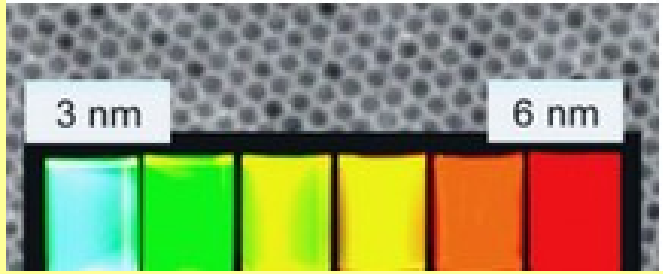
coursera



Rice University

Fundamentals of Electrical Engineering

Ended a month ago

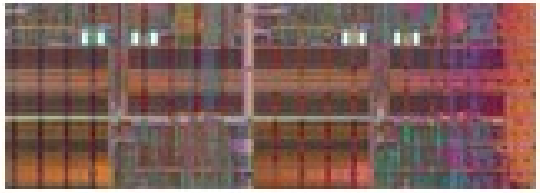


Rice University

Nanotechnology: The Basics

Ended 4 months ago

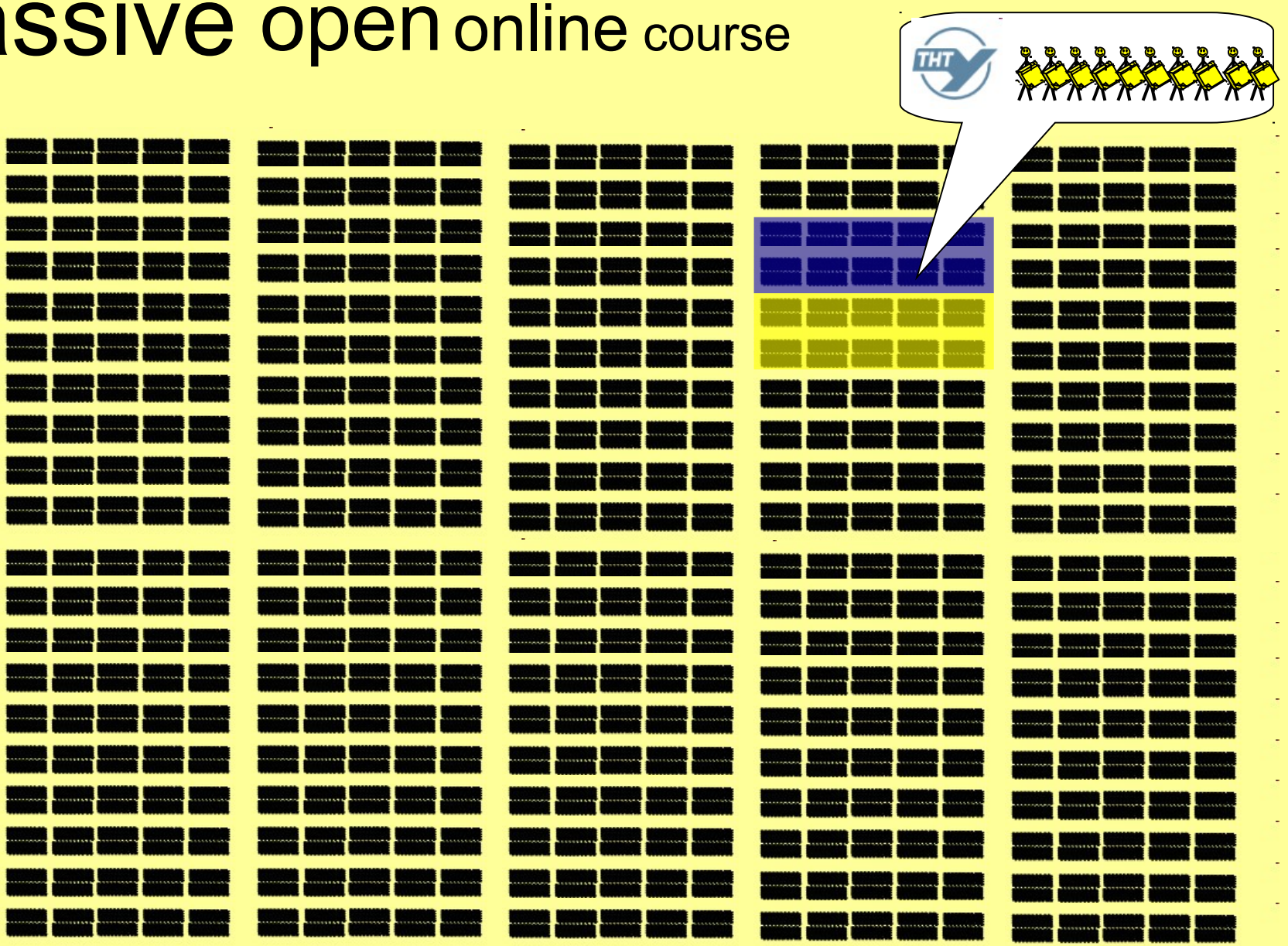
edX



MITx

6.002x Circuits and Electronics

Massive open online course



Do massive open online course platforms challenge the legitimacy of modern universities?

Subscribe for email updates.

legitimacy × mooc × neo-institutionaltheory × DanielAMcFarland × + Add Tag

Daniel McFarland INSTRUCTOR · 2 months ago

How does a MOOC like Coursera potentially challenge our notions of what a legitimate university is? Just to stir the pot - online credentials are on their way (with checks for cheating), and what if these courses are merely 50% as effective as a face-to-face one but a fraction of the cost – what does that mean for the modern university and its future?

What of community colleges and other online universities like the University of Phoenix? Will Coursera and elite university offerings put them out of business?

↑ 192 ↓ · flag

Michael R. Montgomery · 5 days ago

I think it is a challenge and will certainly grow as people get used to the concept of on-line learning. However I observe a high drop out rate among participants indicating that many people either struggle with the level of self motivation involved or simply are not from the generation that have embarked upon IT formatted learning. (among all the other reasons people drop out from a course of course.) I reflect on how much 'brand' will influence this emerging market and will a fully operational physical campus not remain central to its footprint?

↑ 51 ↓ · flag

Philippa Jane Slone · 5 days ago

Its easy to "bite off more than you can chew". Dropping out doesn't necessarily mean that the student isn't motivated. It could mean that a) the course was much harder than expected, b) that the student doesn't have access to the technical resources required for some courses or c) find that other courses become available which are exactly what the student requires and a choice has to be made - there are only so many hours in the day.
I have been astounded at the quality of teaching and how much I have learnt. Yes, I've dropped out of a couple of courses. I found the subjects very difficult "first time round" while at university and in-service training, but "second time around" was no better and I cut my losses. These courses should help younger students to "try before they buy", test out their true interests and get a feel for their preferred universities before embarking on a residential degree course. This must be the ultimate public relations/advertising opportunity for universities ever invented. Local educational establishments could allow students to use their facilities for on-line study. The existing staff could then take on a tutoring role and more subjects could be offered.

↑ 44 ↓ · flag

coursera

RICE

Nanotechnology: The Basics
by Professor Vicki Colvin, Daniel Mittleman

Quizzes

Syllabus

Help

Nanotechnolo

Week 1: Sma
discipline has
pantheon tha

Week 2: Elect
in everything
limits are to m

Home

Week 1: Nanotechnology

Week 2: Nanoelectronics

Week 3: Nanom

Week 4: Nanopl

Final Exam and

Forums / General Discussion

Practical Problems with Nanotech Water Filters

Subscribe for email updates.

No tags yet. + Add Tag

Sort replies by: Oldest first | Newest first | M

Sven Rasidi · 6 months ago

If you manufacture filters containing nanoscale carbon particles, I'm wondering how you would contain them in the cartridge while still keeping it permeable for water. Since they are so small, wouldn't they leak out of the cartridge and get everywhere, including your body, and cause all kinds of unwanted effects?

↑ 1 ↓ · flag

Natalia Gonzalez Pech STAFF · 6 months ago

Hi Sven.
this is a really good questions. One of the challenges of the nanotechnology is to bring these materials to use them in real world. In this particular case, nanoparticles are great for water purification of different contaminants. However, its use is limited by what you mentioned. One important issue in nano- environmental engineering is the use of the suitable support matrixes to avoid this kind of problems. Some of them are already in the market but for other technologies are still in development.

Question 3

What type of magnetic behavior i

single best answer.

Your Answer

- Multiple domain.
- Magnetized.
- Demagnetized.
- Superparamagnetic.
- Single domain.

Total

Question Explanation

Hint: See Slide 17 in your lecture notes (or slide 18)

4. Project as a model of professional collaboration

VANDERBILT UNIVERSITY

Leading Strategic Innovation in Organizations
by David A. Owens

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- Download Video Lectures
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- Course Grading
- About Us

Peer Assessments / 3. Concept Definition Forms

Submission Phase	Evaluation Phase	Results Phase
1. Do assignment ☑	2. Evaluate peers 🔒	3. See results ☑

Your effective grade is 32
A 20% penalty has been applied because you did not complete the entire evaluation portion of the assessment.

Your unadjusted grade is 40, which is simply the grade you received from your peers.

See below for details.

Project Assignment 3: Concept Definition Forms (Group Assignment) - The purpose of this assignment is to teach you how to synthesize, distill, and assess a large quantity of ideas into a small number of manageable

Internal platform (as BigBlueButton) or external specialized (Google Docs, Project2Manage, ProjectPier, Bubbl.us, ...)

A project, carried out within the distance learning course

- Is documented automatically;
- Can be managed by teaching assistant/instructor;
- Allows flexible scheduling;
- Keeps records, fixes authorship, enables information exchange.

Shortcomings

- The project can be jeopardized by an inferior participant;
- Absence of direct communication.

/dl.tntu.edu.ua/mods/_standard/forums/forun

Студентське наукове дослідження

Імітаційне моделювання | Нова тема | Пошук

Скоренький Ю. Л.

https://dl.tntu.edu.ua/

Митник Олеся Миколаївна — Re: Студентське — Пн., 28 березня

Я вважаю, що за

ситуації, коли

Орнатовська Віта Вікторівна — Re: Студент — Ср., 30 бере

На мою думк

ринок), дані

Процес обсл

на зупинки у

завантажені

Дубовий Василь Ігорович — Re: Студент — Чт., 7 квітня

При дослідж

Чому?

Нехай у нас

дорозі. Тоді

Якщо ж взяти

маршуток са

До чого це я.

бачимо, що

на дорозі, у н

Дубовий Василь Ігорович — Re: Студент — Чт., 7 квітня

Записав на к

http://www.e

Сторінка: 1

Брацець Роман Володимирович

Скоренький Ю. Л.

В цій вітці прошу зразу писати свої ідеї, наприклад: як краще моделювати - з відмовами чи без; які вулиці і перехрестя треба взяти за основу і т. ін.

GPSS World - [model_full.5.sim:2 - TABLE WINDOW]

File Edit Search View Command Window Help

TBL1

Mean: 113.375 S.D.: 81.232

210

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10

TBL2

Mean: 446.372 S.D.: 255.480

20

0

10

990

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RELEASE Perehid2
TRANSFER 0.5,For
Forward SEIZE CH
ADVANCE 3.5,0.5
RELEASE CH_FORW
TRANSFER ,EndLab
S_Right SEIZE CH
ADVANCE 3.5,0.5
RELEASE CH_RIGHT

**********
* ТРЕТІЙ СВІТЛОФ
**********

QUEUE CH_M3        ;вхід машин у чергу
TEST E X$Svitlo_Avtom3,F$Perehid3   ;заборона руху машин до появи зеленого кольору світлофора
SEIZE Perehid3     ;заняття переходу
DEPART CH_M3       ;вихід з черги машин перед переходом
ADVANCE 3,0.6       ;пересічення машиною переходу
RELEASE Perehid3   ;звільнення переходу від машин

EndLable DEPART CH_M2
```

SVITLO_CH	0	999.000	
SVITLO_AVTOM3	2	0	

FEC XN	PRI	BDT	ASSEM	CURRENT	NEXT	PARAMETER	VALUE
1270	0	4294.742	1270	6	7		
1007	0	4295.715	1007	19	20		
1008	0	4295.990	1008	11	12		
1001	0	4296.180	1001	25	26		
1398	0	4297.152	1398	0	1		
2	0	4300.000	2	31	32		
3	0	4323.000	3	38	39		
4	0	4323.000	4	45	46		

(-0) RETRY
.955 0
.270 0
.203 0

For Help, press F1 | Results

RICE
Unconventional Wisdom

Fundamentals of Electrical Engi

by Don H. Johnson

Video Lecture

its application, and KVL is a statement about voltage drops around a closed path **regardless** of whether the elements are linear or not. Thus, for this simple circuit we have

$$\frac{v_{out}}{R} = I_0 \cdot \left(e^{\frac{q}{kT}(v_{in}-v_{out})} - 1\right) \quad (3.33)$$

This equation **cannot** be solved in closed form. We must understand what is going on from basic principles, using computational and graphical aids. As an approximation, when v_{in} is positive, current flows through

Question 1

What is the period of the sinusoid $s(t) = A\sin(2\pi f_0 t)$? In your answer, write A as `A` and f_0 as `f0`.

Preview Help

Question 2

The **rms** (root-mean-square) value of a periodic signal $s(t)$ is defined to be

$$\mathrm{rms}[s] = \sqrt{\frac{1}{T}\int_0^T s^2(t)dt}$$

where T is defined to be the signal's **period**: the smallest positive number such that $s(t) = s(t+T)$

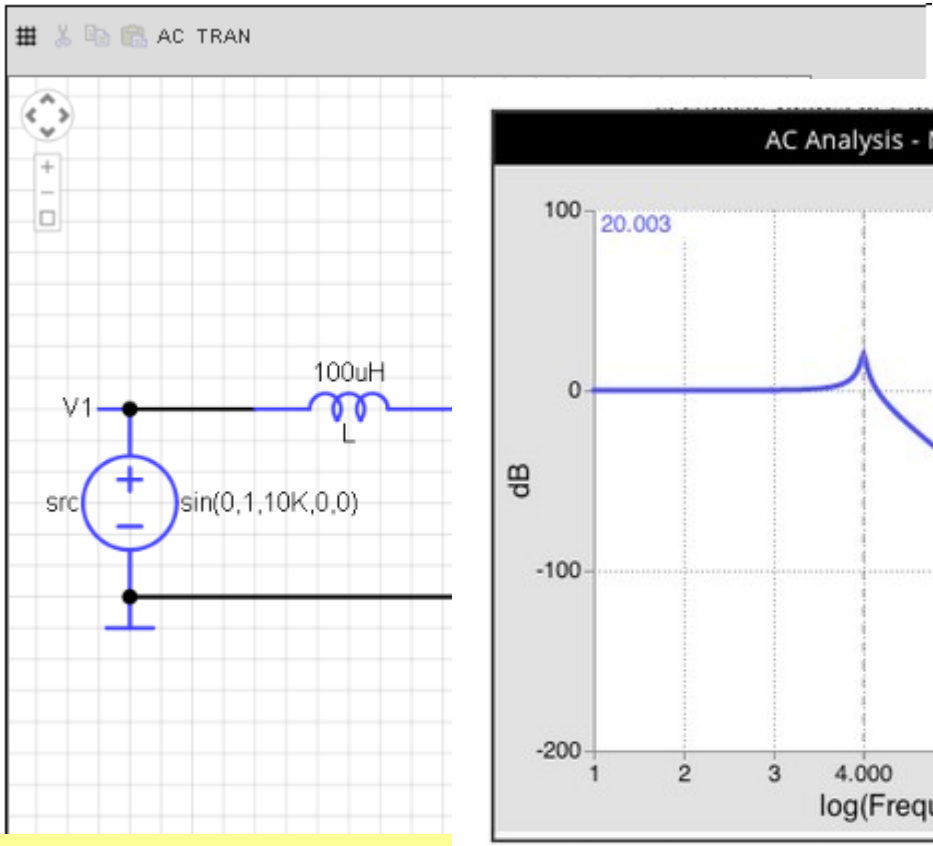
What is the rms value of the sinusoid $s(t) = A\sin(2\pi f_0 t)$? (Again, write A as `A` and f_0 as `f0`.)

Overview

Welcome to 6.002x

H9P1: RESPONSE TO A DELAYED IMPULSE (8/8 points)

Note: In this problem we have chosen numbers for the part parameters to make it easier to compute an answer :-). By the way, it is also hard to arrange zero resistance, except with superconducting materials at very



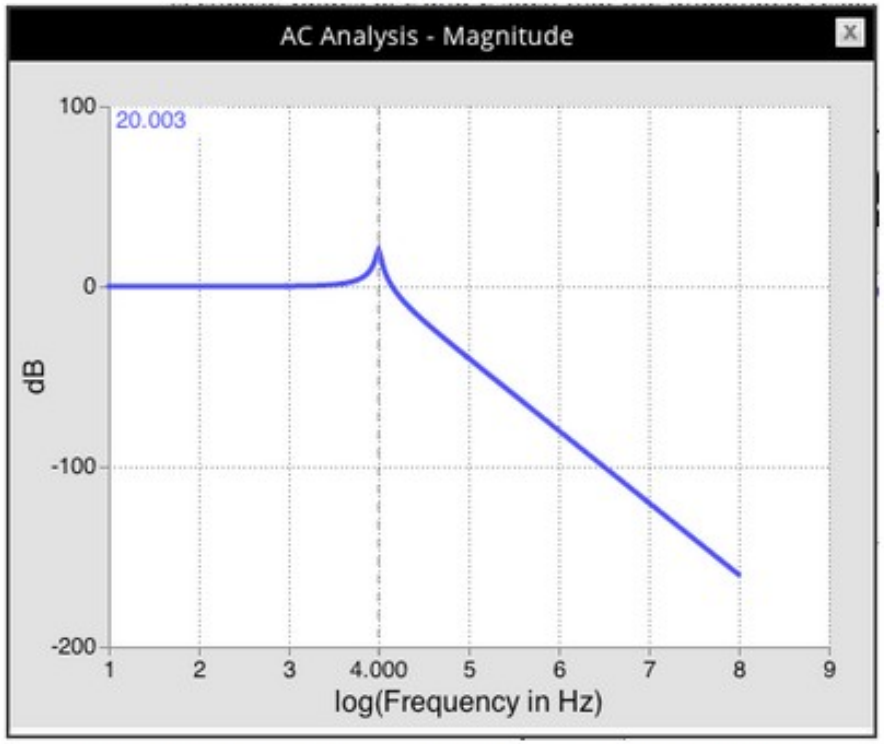


Figure 4. Frequency response with R and C interchanged.

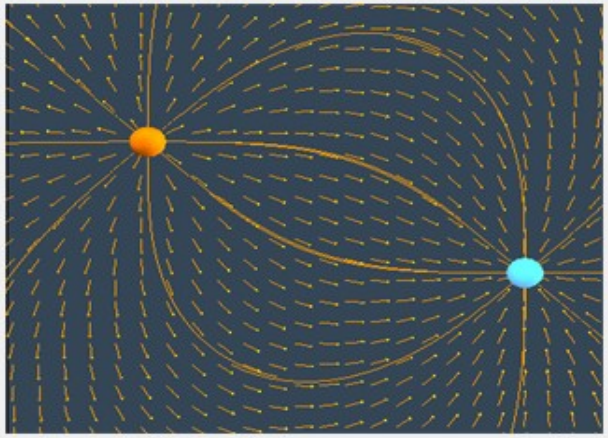
u can

nergy, in Joules, stored in the circuit?

17.5

MIT Physics 8.02
ELECTRICITY & MAGNETISM

SECTION : Electrostatics



SUBJECT: *Two Point Charges*

DESCRIPTION:

This java simulation illustrates the field pattern created by two point charges with opposite signs of charge. In this simulation, the position and charge of each particle can be modified in real time, and the field configuration will update itself accordingly.

All three field visualization techniques can be applied to show the overall electric field of the two-charge configuration: vector field, field lines, and "grass seeds".

About the TEAL/Studio Physics Project:

The TEAL (Technology Enabled Active Learning)

Start Simulation
(Note: you must have Java™ J2SE v1.4+ JRE installed)

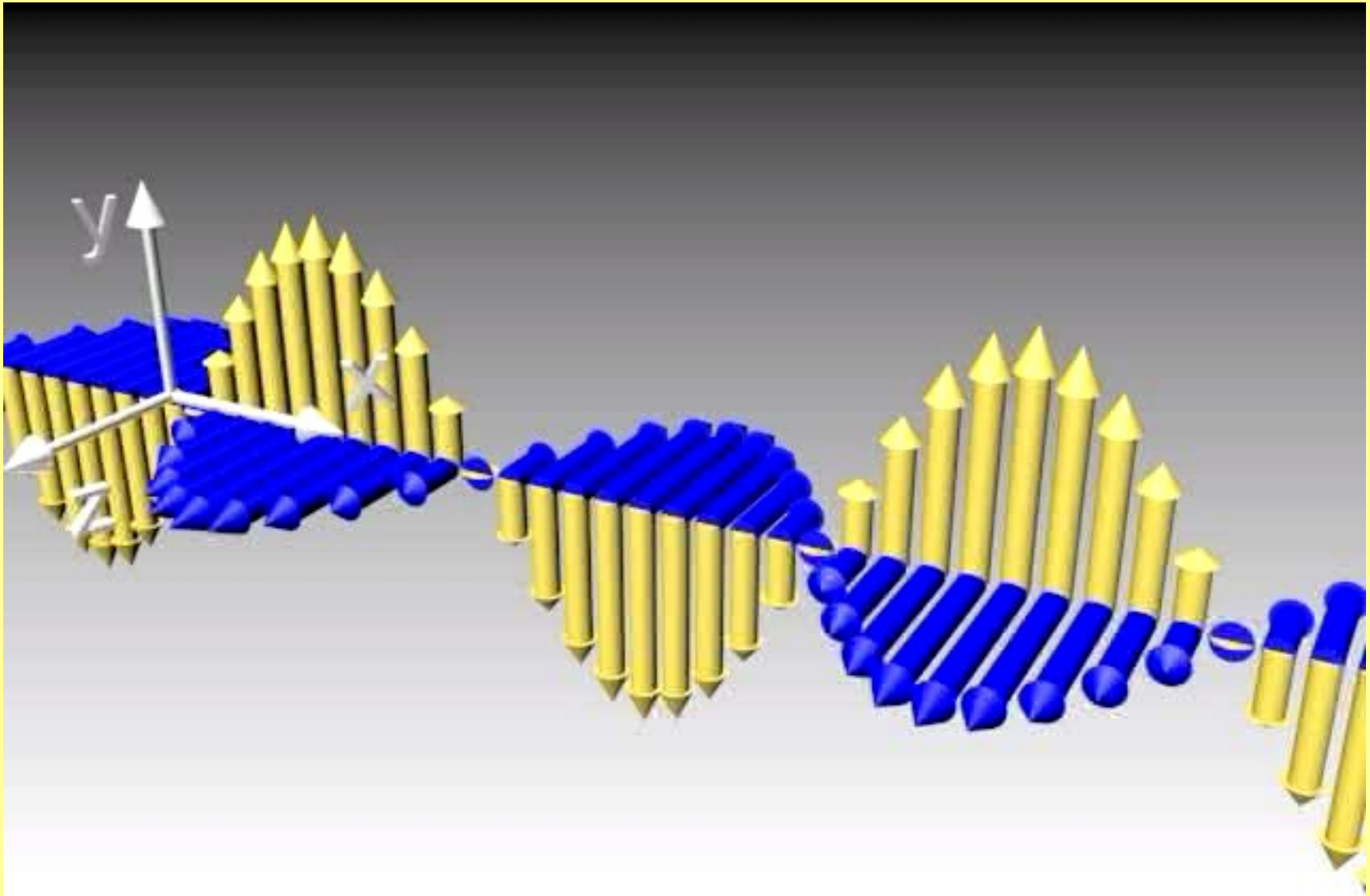
web.mit.edu/8.02t/www/802TEAL3D/visualizations/electrostatics/pcharges/pcharges.htm

Have you ever seen an electric field?


http://web.mit.edu/viz/soft/visualizations/tealsim/

Now you did!

Want more?



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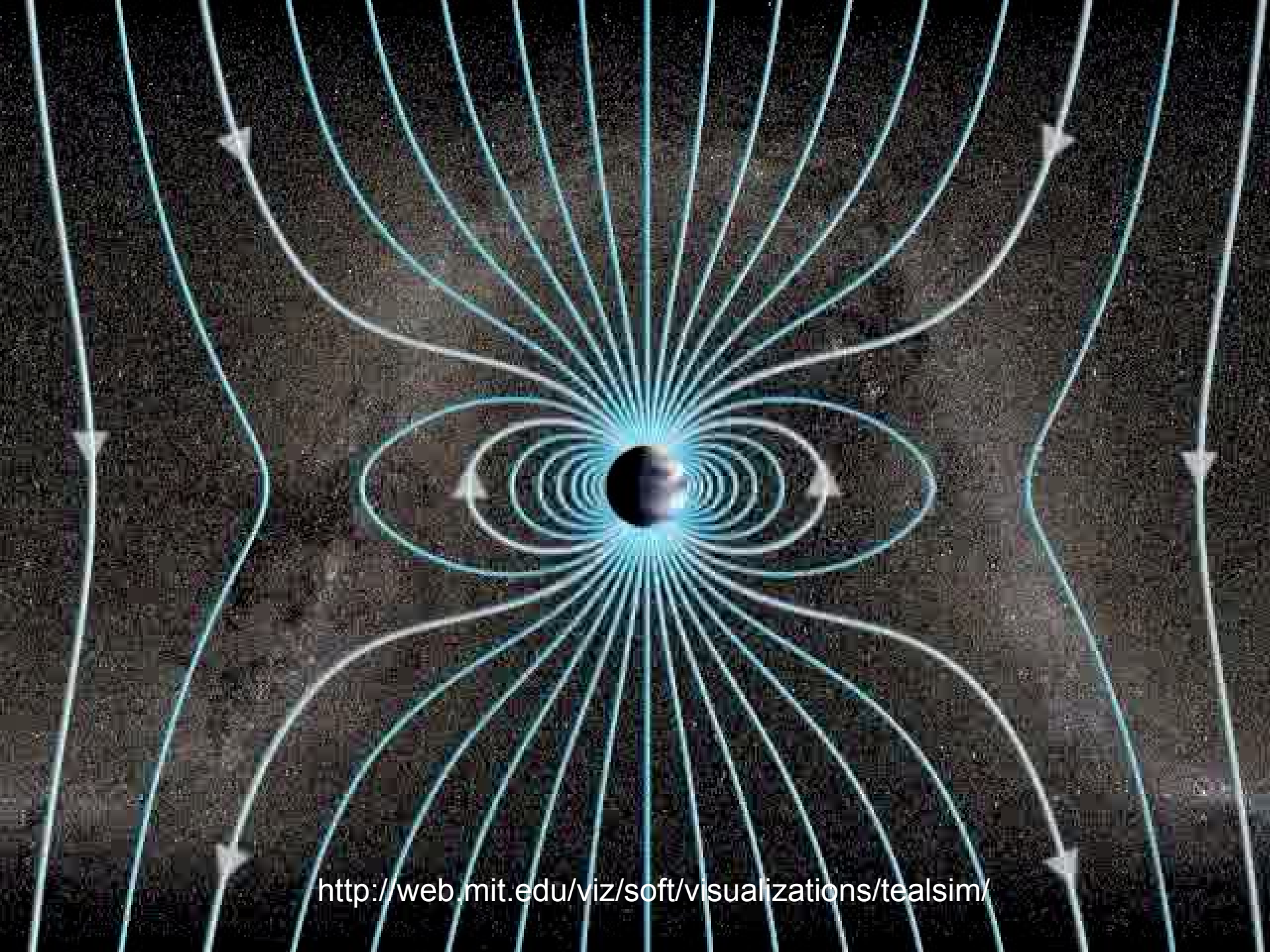
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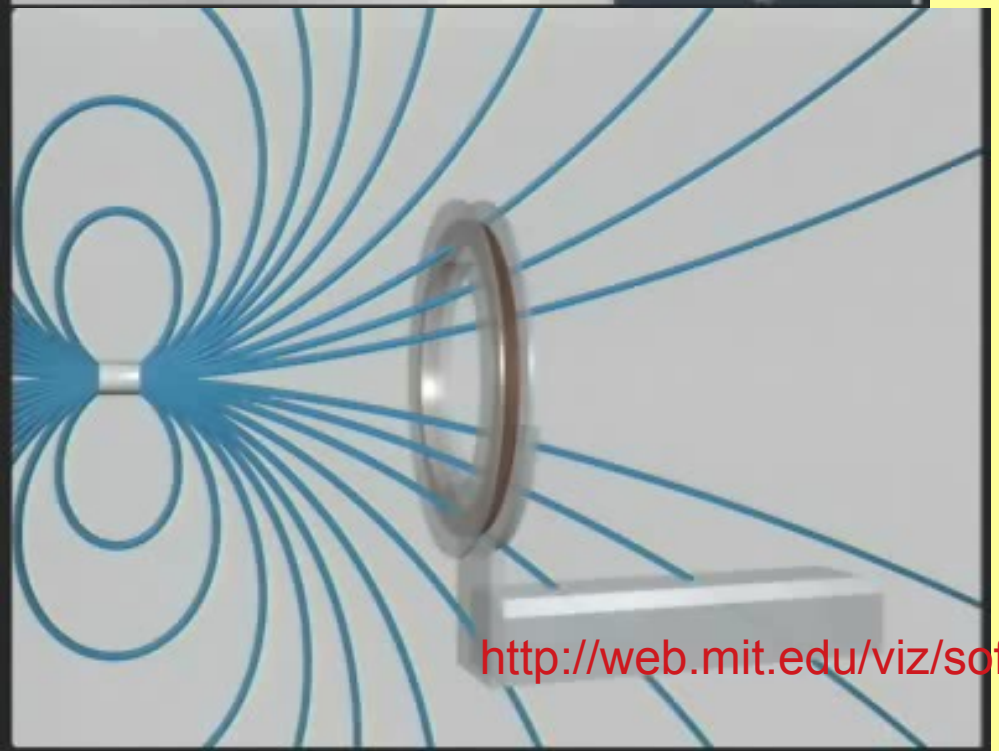
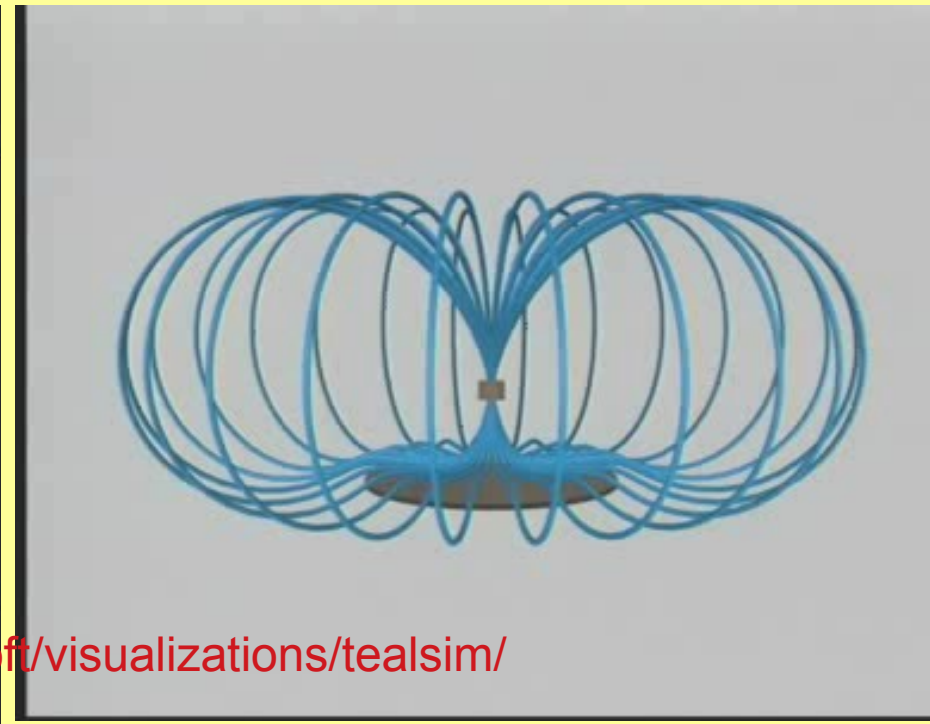
http://web.mit.edu/viz/soft/visualizations/tealsim/





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https://canvas.instructure.com/courses/1013502/pages/sds-if-you-build-it-will-they-come

OLC › Pages › SDS: If You Build It, Will They Come?

- personal barriers
  - lack of knowledge
  - lack of skills
  - lack of training
  - lack of role models
  - lack of time
- attitudinal barriers
  - unwillingness to work with technology
    - no faith in technology
- organizational barriers
  - inadequate technical support
  - hardware / software issues
  - no recognition of the value

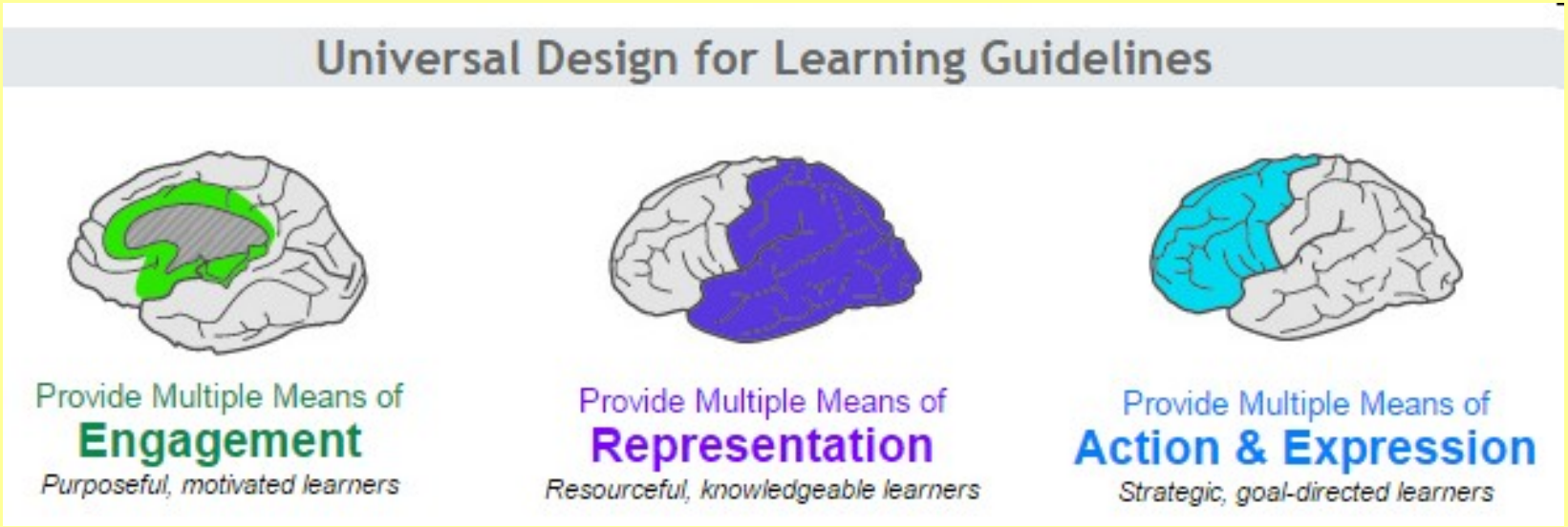
https://canvas.instructure.com/courses/1013502/pages/sds-if-you-build-it-will-they-come

http://www.udlcenter.org/aboutudl/whatisudl/3principles

Principle I: Provide Multiple Means of Representation (the "what" of learning)

Principle II: Provide Multiple Means of Action and Expression (the "how" of learn

Principle III: Provide Multiple Means of Engagement (the "why" of learning)



http://www.udlcenter.org/aboutudl/udlguidelines_theorypractice

Provide Multiple Means of

Engagement

Purposeful, motivated learners

Provide options for self-regulation

+ Promote expectations and beliefs that optimize motivation
+ Facilitate personal coping skills and strategies
+ Develop self-assessment and reflection

Provide options for sustaining effort and persistance

+ Heighten salience of goals and objectives
+ Vary demands and resources to optimize challenge
+ Foster collaboration and community
+ Increase mastery-oriented feedback

Provide options for recruiting interest

+ Optimize individual choice and autonomy
+ Optimize relevance, value, and authenticity
+ Minimize threats and distractions

Provide Multiple Means of

Representation

Resourceful, knowledgeable learners

Provide options for comprehension

+ Activate or supply background knowledge
+ Highlight patterns, critical features, big ideas, and relationships
+ Guide information processing, visualization, and manipulation
+ Maximize transfer and generalization

Provide options for language, mathematical expressions, and symbols

+ Clarify vocabulary and symbols
+ Clarify syntax and structure
+ Support decoding text, mathematical notation, and symbols
+ Promote understanding across languages
+ Illustrate through multiple media

Provide options for perception

+ Offer ways of customizing the display of information
+ Offer alternatives for auditory information
+ Offer alternatives for visual information

Provide Multiple Means of

Action & Expression

Strategic, goal-directed learners

Provide options for executive functions

+ Guide appropriate goal-setting
+ Support planning and strategy development
+ Enhance capacity for monitoring progress

Provide options for expression and communication

+ Use multiple media for communication
+ Use multiple tools for construction and composition
+ Build fluencies with graduated levels of support for practice and performance

Provide options for physical action

+ Vary the methods for response and navigation
+ Optimize access to tools and assistive technologies

http://www.udlcenter.org/aboutudl/udlguidelines_theorypractice

The Future of MOOCs
Steven Mintz
www.insidehighered.com/blogs/higher-ed-beta/future-moocs
українською:
prometheus.org.ua/mooc-future/

Challenge 1: Discussion Forums

Challenge 2: Cohorting

Challenge 3: Interactives

Challenge 4: Student Engagement and Persistence

Challenge 5: Progressive Personal Profile

Challenge 6: Personalization

Challenge 7: Data Analytics and Learning Dashboards

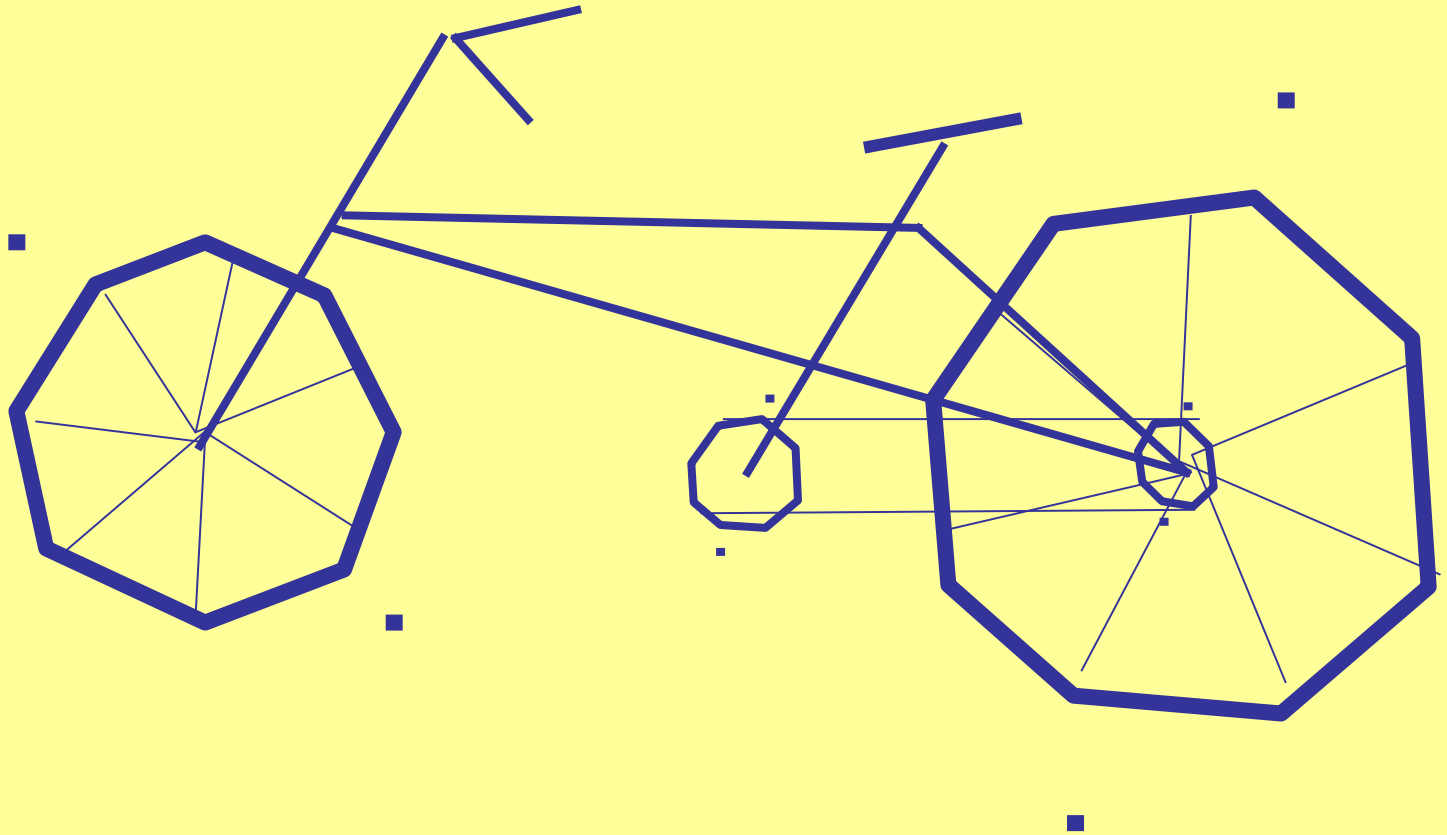
Challenge 8: The User Experience

Challenge 9: Credentialing

Challenge 10: A Sustainable Business Model

Conclusions

Bicycles already exist



Conclusions, in detail

1. Open educational resources allow substantial improvement of learning effectiveness at comparable time and efforts invested;
2. Encouraging students, both international and ukrainian, to participation in open distant learning not only fosters internationalization but also enhances learning motivation, improves comprehension and incentivate self-propelled learning;
3. There already exist ukrainian open resources with learning courses of reasonable quality, not so content-rich and diverse as international platforms but quick to expand (*inter alia*, due to our efforts);
4. Use of open educational resources will lead to increase of teaching quality, also by implementing Universal Design for Learning Guidelines.

Stanford | ONLINE

Open Yale courses

Open Education Information Center

MIT

edX

OPEN EDUCATION CONSORTIUM
The Global Network for Open Education

NATIONAL CENTER ON UNIVERSAL DESIGN for LEARNING

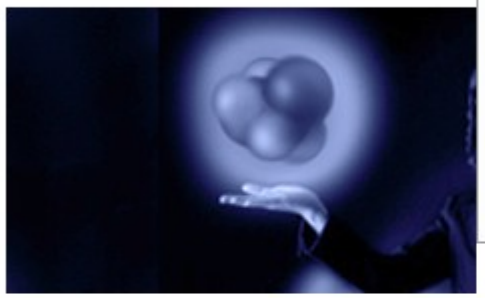
OLC ONLINE LEARNING CONSORTIUM
FORMERLY THE SLOAN CONSORTIUM

WORLD ECONOMIC FORUM

INSIDE HIGHER ED

WORLD BANK GROUP

OKR



OpenChem Project, University of California, Irvine

Computer Science, Saylor.org

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HIGHLIGHTS FOR HIGH SCHOOL

MIT Highlights for High School

TED
Ideas worth spreading

NATIONAL STEM CONSORTIUM
SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS

National STEM project

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Access. The Future of Education.

Open Textbooks in Science, OpenStax College

PhET
INTERACTIVE SIMULATIONS

PhET interactive simulations in Science, University of Colorado

coursera