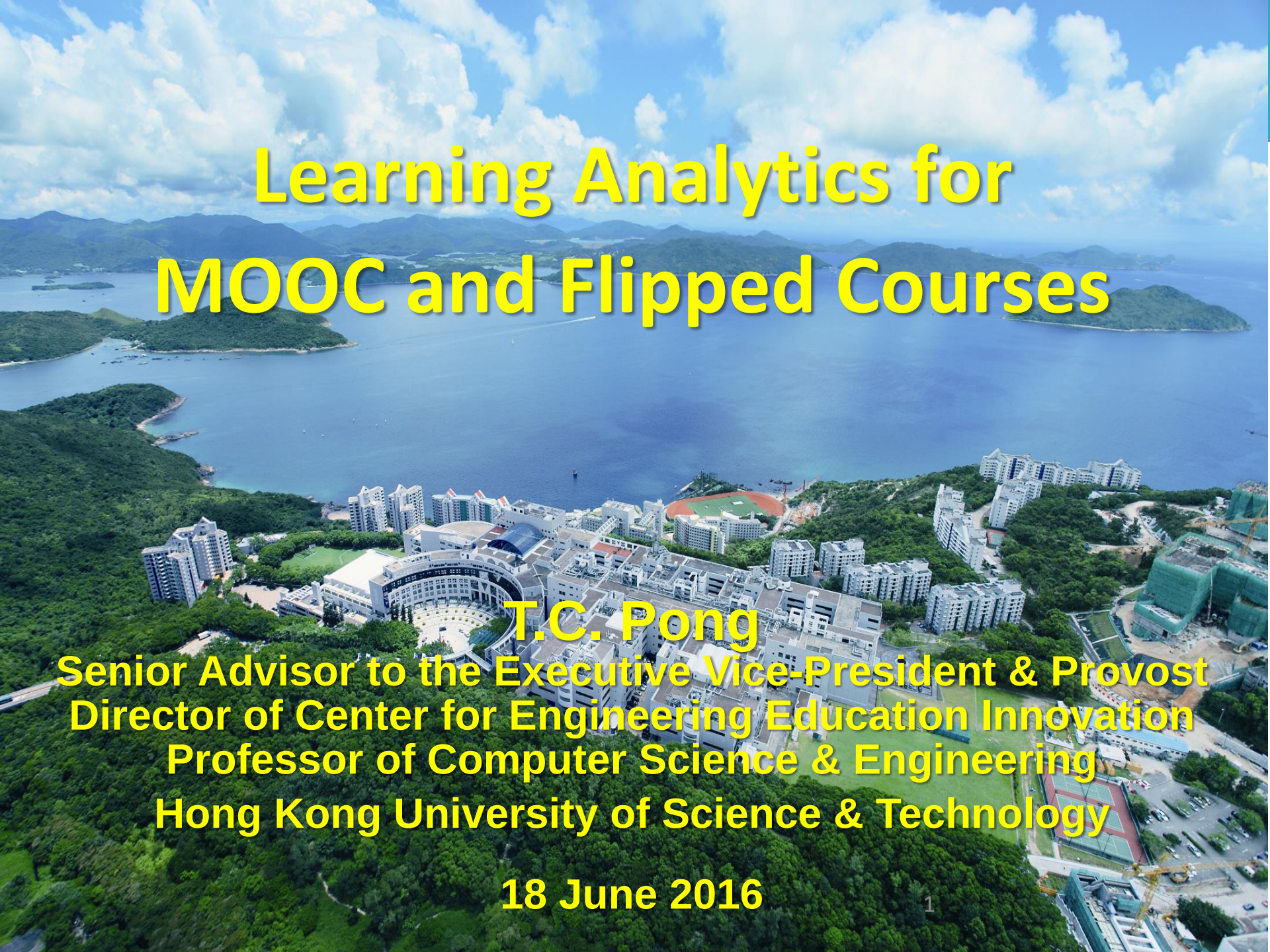


Learning Analytics for MOOC and Flipped Courses

T.C. Pong

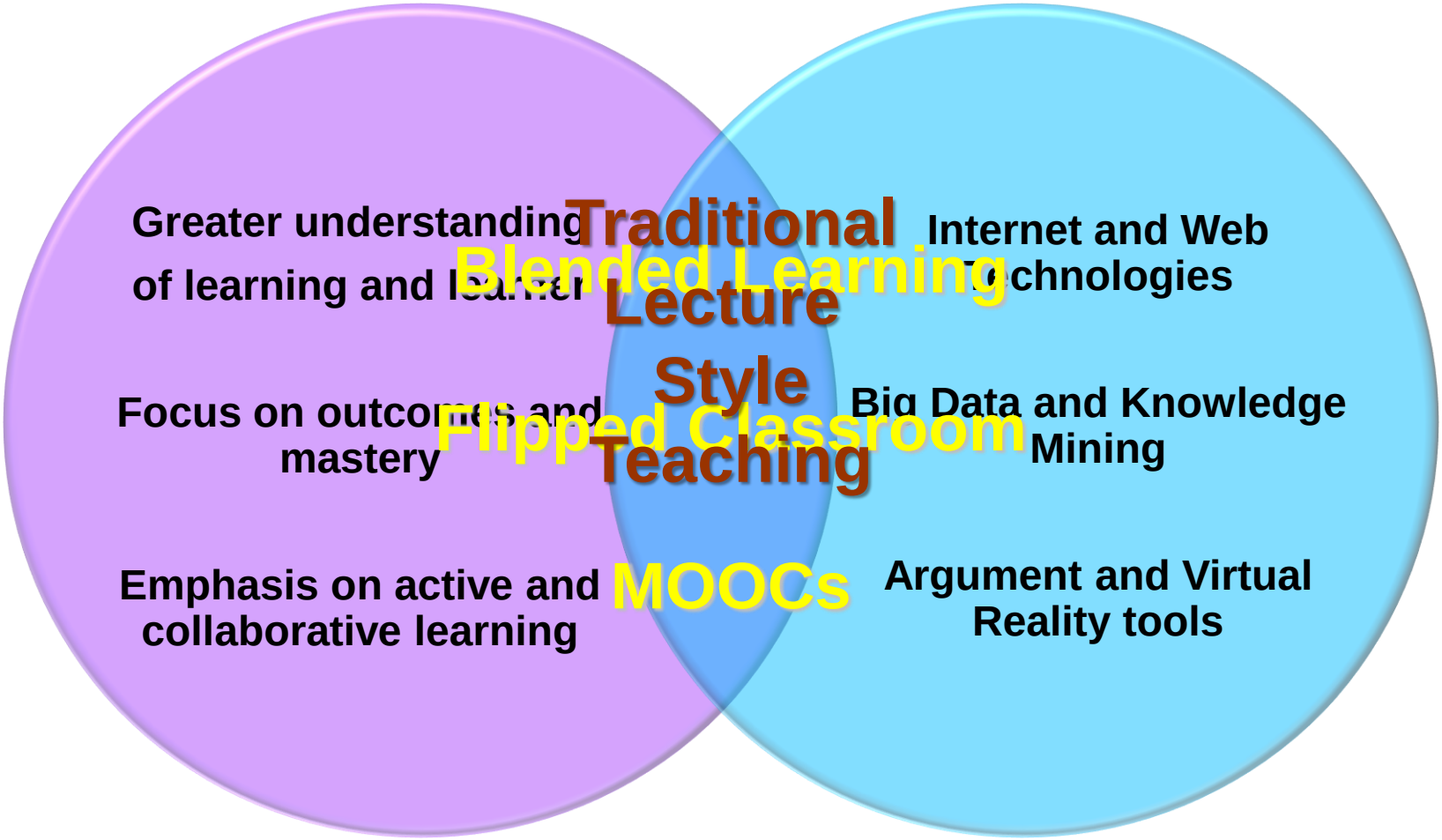
Senior Advisor to the Executive Vice-President & Provost
Director of Center for Engineering Education Innovation
Professor of Computer Science & Engineering
Hong Kong University of Science & Technology

18 June 2016

Outline

- Overview on recent trends and development in education
- Recent developments in MOOC and blended learning
- Learning Analytics for MOOC and blended courses
- Concluding remarks

Trends and Development in Education



Criticism of Lecture Style Teaching

The criticisms of lecture style teaching can be summarized by a quote attributed to Mark Twain:

- College is a place where a professor's lecture notes go straight to the student's lecture notes, without passing through the brains of either.
- How to make teaching and learning more effective?
- Chinese proverb (Xun Zi 荀子):

  Tell me and I will forget (闻之不若见之) ,

  Show me and I will remember (见之不若知之) ,

  Involve me and I will understand (知之不若行之) .

Active Learning

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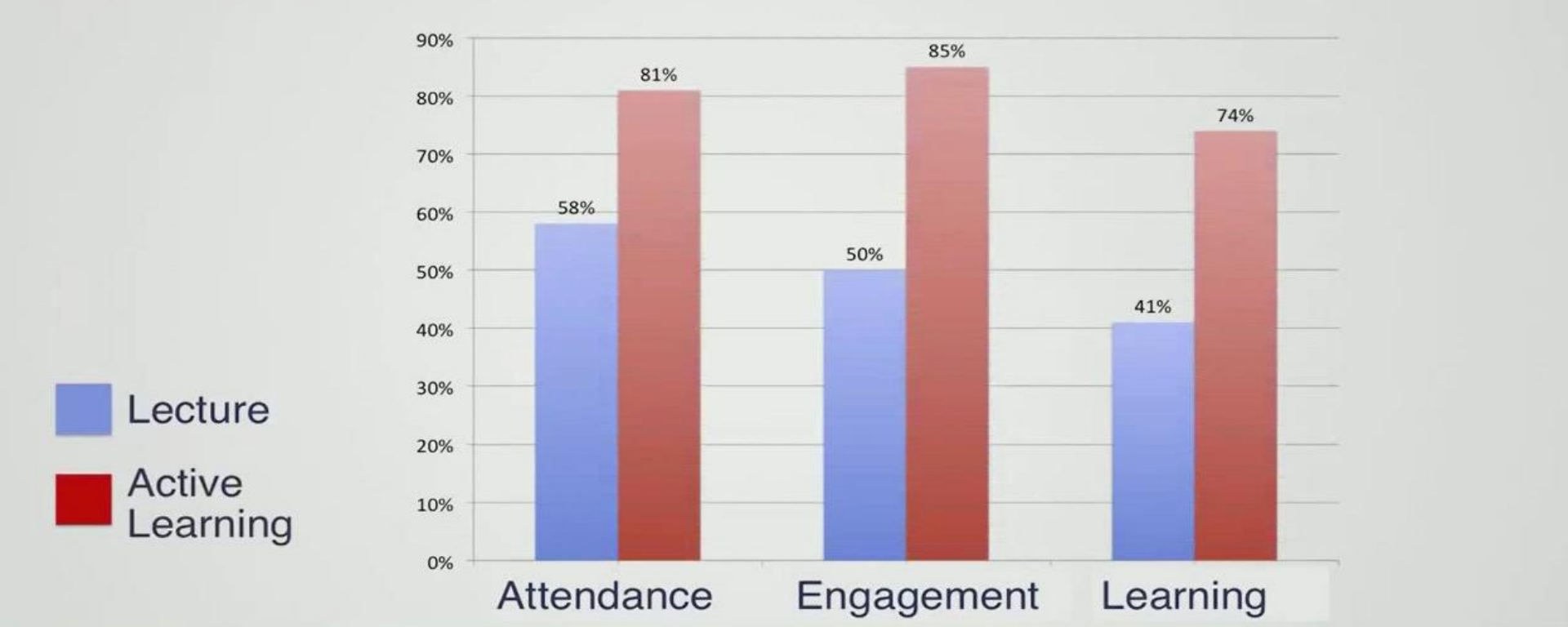
"Improved Learning in a Large-Enrollment Physics Class,"
Louis Deslauriers, Ellen Schelew and Carl Wieman, Science (2011).



TEAL Project at MIT

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The TEAL (Technology Enhanced Active Learning) Project at MIT

Flipped Classroom

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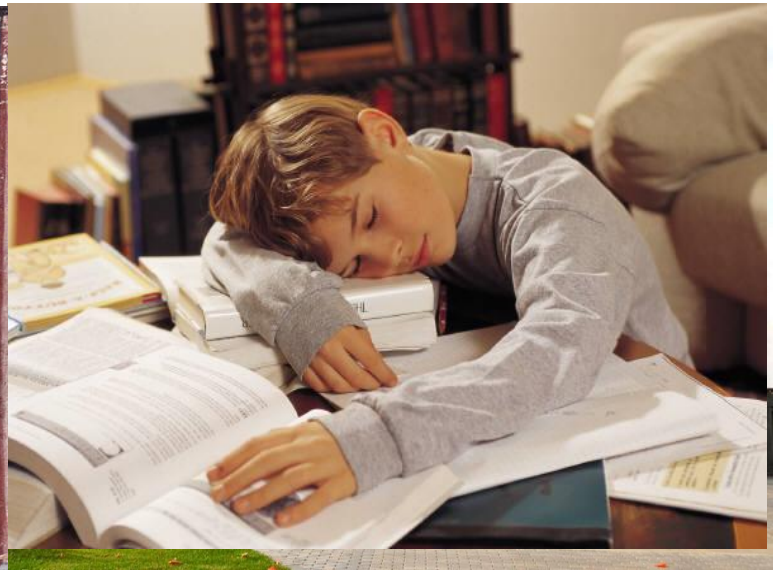
Flipped Classroom pedagogy inverts traditional teaching

In classroom

At home



Flipped Classroom

Flipped Classroom pedagogy inverts traditional teaching

At home

In classroom

- Students can learn from each other
- More personal attention from teacher

Massive Open Online Courses

A **massive open online course** (**MOOC**) is a type of online course aimed at large-scale participation and open access via the Internet.

- In addition to online video lectures, learners are involved actively in the learning process
- MOOCs go beyond just offering courses and content. Learning analytics allow us to understand how students learn and how teachers can improve their teaching.

MOOC Platforms

Major MOOC platforms:

- Coursera and edX in the US
- FutureLearn in the UK
- France Université Numérique (France Digital University) in France
- Iversity in Germany
- Open2Study in Australia
- XuetangX & CNMOOC in China
- JMOOC in Japan
- KMOOC in Korea
- HKMOOC in Hong Kong

HKUST's MOOC Experience

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coursera | Global Partners Courses Partners About ▾ | S Pong ▾

The Hong Kong University of Science and Technology

HKUST - A dynamic, international research university, in relentless pursuit of excellence, leading the advance of science and technology, and educating the new generation of front-runners for Asia and the world.

The Science of Gastronomy
Jul 10th 2013

A New History for a New China, 1700-2000: New Data and New Methods, P...
Jul 22nd 2013

Science, Technology, and Society in China I: Basic Concepts
Date to be announced.

Science, Technology, and Society in China II: History of S&T in Chinese Soc...
Date to be announced.

Science, Technology, and Society in China III: The Present & Policy Implica...
Date to be announced.

HKUST's MOOC Experience

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edX HOW IT WORKS COURSES SCHOOLS REGISTER NOW log in

HKUSTx
ELEC1200.2x
A System View of Communications: From Signals to Packets (Part 2)
Starting Soon
Starts: October 27, 2015

HKUSTx
ELEC1200.3x
A System View of Communications: From Signals to Packets (Part 3)
Upcoming
Starts: January 11, 2016

HKUSTx
COMP102.1x
Introduction to Java Programming – Part 1
Current
Self-Paced

Over 700,000 learners have registered for 20 MOOCs offered by HKUST

HKUSTx
ELEC1200.1x
A System View of Communications: From Signals to Packets (Part 1)
Current
Starts: August 25, 2015

HKUSTx
COMP107x
Introduction to Mobile Application Development using Android
Archived
Starts: July 28, 2015

HKUSTx
EBA102x
English for Doing Business in Asia- Writing
Archived
Starts: June 2, 2015

Massive Open Online Program (MOOP)

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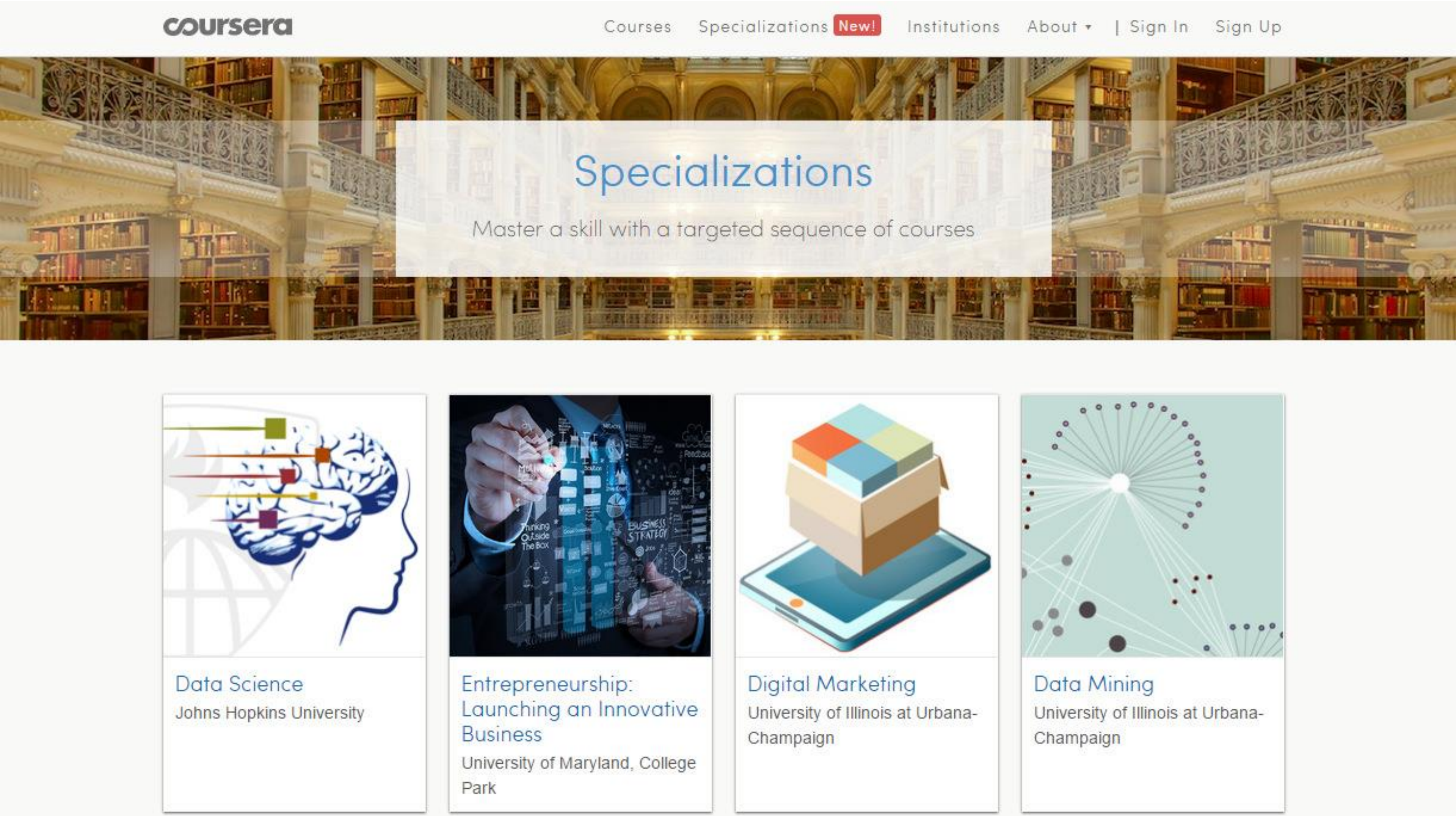

Coursera Specifications Request for Proposals

Coursera issued Request for Proposals (RFPs) in topics of high demand among learners:

- Software Development with Google
- Full Stack Web Development → **HKUST**
- Professional Sales
- Product Management
- Social Media Marketing
- People Management
- Business Strategy
- Data for Managers
- Introduction to Analytics (Business Analytics)
- Data Analysis Fundamentals
- Video Game Design
- iOS Application Development and Design

HKUST's MOOC Experience

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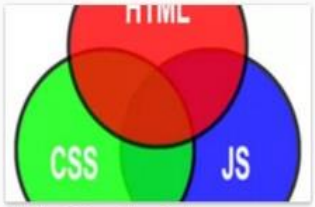


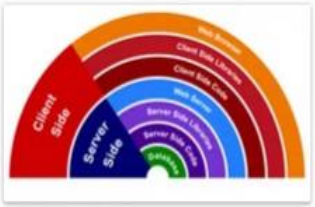
HTML, CSS and JavaScript
On-Demand

Server-side Development with NodeJS
On-Demand

Multiplatform Mobile App Development with Web Technologies
On-Demand

Front-End Web UI Frameworks and Tools
On-Demand

Front-End JavaScript Frameworks: AngularJS
On-Demand



Full Stack Web Development Specialization Capstone Project
On-Demand

Massive Open Online Degree (MOOD)

The Story

The Georgia Institute of Technology, Udacity and AT&T have teamed up to offer the first accredited Master of Science in Computer Science that students can earn exclusively through the Massive Open Online Course (MOOC) delivery format and for a fraction of the cost of

The Buzz

- Presidential Double-Down: Obama Praises OMS CS for 2nd Time - Georgia Tech College of Computing
- Ga. Tech's MOOC Master's Degree Program Off to Solid Start - WABE Atlanta

The first MBA on Coursera from the University of Illinois

coursera | Search catalog | Specializations | Courses | Institutions | S Pong

iMBA
University of Illinois at Urbana-Champaign

University of Illinois iMBA Program

Learn the strategic approach to management with a flexible, online MBA curriculum. A high-quality and affordable program from the University of Illinois, built on Coursera Specializations.

About the Course

START WITH A SPECIALIZATION, BUILD TOWARD A REAL DEGREE

Master corporate finance, strategy, marketing, social responsibility, and more— learn everything you need to excel in today's global business environment.

About the iMBA

The University of Illinois is partnering with Coursera to launch the first online MBA delivered in part through the Coursera platform. This program is ideal if you're interested in an MBA, or if you're simply interested in the individual Specializations in the program.

Sessions

Future Sessions

Add to Watchlist

Course at a Glance

English

Instructors

MITx MicroMaster

Blended Learning and MOOC at HKUST: Introduction to Computing with Java

- Offered as a flipped course in Spring 2014
  - The course is divided into two sections of 45 and 65 students.
  - Students watch online lecture videos and participate in online quizzes before class.
  - Classes start with Q&A and then redo some of the online quizzes.
  - Students then participate in group discussions and activities.

Classroom for Active Learning

DIY Studio

Student Performance vs Video Views

Total number of videos = 44
Average video hit counts per student per video

Student groups	No. of students	Total views	Average views
Midterm score >= 90	25	1465	1.33
Midterm score >= 80	54	2975	1.25
Midterm score >= 50	92	4846	1.20
Midterm score < 50	15	607	0.92

Student Performance vs Video Views

Total number of videos = 44
Average video hit counts per student per video

Student groups	No. of students	Total views	Average views
Final score >= 90	21	1276	1.38
Final score >= 80	44	2502	1.29
Final score >= 50	82	4231	1.17
Final score < 50	25	1138	1.03

Comparing Online and In-class Activities

Online Quiz	Correct (L1)	Correct (L2)	Correct (Overall)	L1-L2 (Online)	In-class PRS	PRS Correct (L1)	PRS Correct (L2)	PRS Correct (Overall)	L1-L2(PRS)	Improvement (L1)	Improvement (L2)	Improvement (Overall)
Online 3-1	36.2%	38.7%	37.6%	-2.5%	**PRS 3-1**	55.3%	54.8%	55.0%	0.5%	19.1%	16.1%	17.4%
Online 3-2	63.8%	61.3%	62.4%	2.5%	**PRS 3-2**	83.0%	75.8%	78.9%	7.2%	19.1%	14.5%	16.5%
Online 5-1	40.4%	43.5%	42.2%	-3.1%	**PRS 5-1**	61.7%	53.2%	56.9%	8.5%	21.3%	9.7%	14.7%
Online 5-2	89.4%	90.3%	89.9%	-1.0%	**PRS 5-2**	89.4%	87.1%	88.1%	2.3%	0.0%	-3.2%	-1.8%
Online 5-3	85.1%	87.1%	86.2%	-2.0%	**PRS 5-3**	93.6%	83.9%	88.1%	9.7%	8.5%	-3.2%	1.8%
Online 6-1	78.7%	66.1%	71.6%	12.6%	**PRS 6-1**	85.1%	74.2%	78.9%	10.9%	6.4%	8.1%	7.3%
Online 6-2	66.0%	67.7%	67.0%	-1.8%	**PRS 6-2**	76.6%	69.4%	72.5%	7.2%	10.6%	1.6%	5.5%
Online 6-3	74.5%	58.1%	65.1%	16.4%	**PRS 6-3**	74.5%	72.6%	73.4%	1.9%	0.0%	14.5%	8.3%
Online 8-1	83.0%	74.2%	78.0%	8.8%	**PRS 8-1**	89.4%	75.8%	81.7%	13.6%	6.4%	1.6%	3.7%
Online 8-2	76.6%	79.0%	78.0%	-2.4%	**PRS 8-2**	80.9%	69.4%	74.3%	11.5%	4.3%	-9.7%	-3.7%
Online 9-1	46.8%	54.8%	51.4%	-8.0%	**PRS 9-1**	80.9%	67.7%	73.4%	13.1%	34.0%	12.9%	22.0%
Online 9-2	48.9%	56.5%	53.2%	-7.5%	**PRS 9-2**	80.9%	61.3%	69.7%	19.6%	31.9%	4.8%	16.5%
Online 11-1	44.7%	30.6%	36.7%	14.0%	**PRS 11-1**	55.3%	35.5%	44.0%	19.8%	10.6%	4.8%	7.3%
Online 11-2	76.6%	71.0%	73.4%	5.6%	**PRS 11-2**	85.1%	67.7%	75.2%	17.4%	8.5%	-3.2%	1.8%
Average	65.0%	62.8%	63.8%	2.3%	**Average**	78.0%	67.7%	72.1%	10.2%	12.9%	5.0%	8.4%

Blended Learning and MOOC: Introduction to Computing with Java

- Offered as a flipped course in Spring 2014
  - The course is divided into two sections of 45 and 65 students.
  - Students watch online lecture videos and participate in online quizzes before class.
  - Classes start with Q&A and then redo some of the online quizzes.
  - Students then participate in group discussions and activities.
- Offered as a MOOC on edX started in June 2014

MOOC on edX: Introduction to Computing with Java

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https://www.edx.org/course/hkustx/hkustx-comp102x-introduction-computing-1690

edX HOW IT WORKS COURSES SCHOOLS & PARTNERS REGISTER NOW log in

Introduction to Computing with Java

Designed to equip students with the fundamental elements of programming and data abstraction using Java.

School:	HKUSTx
Course Code:	COMP102x
Classes Start:	June 2014
Course Length:	10 weeks
Estimated effort:	3 - 5 hours/week

Register for **COMP102x**

About this Course

Do you wish to become a better problem solver?

This course aims to provide you with a good understanding of basic Java programming elements and data abstraction using problem representation

11:54 AM
5/14/2014

Introduction to Computing with Java: Demographic Distribution

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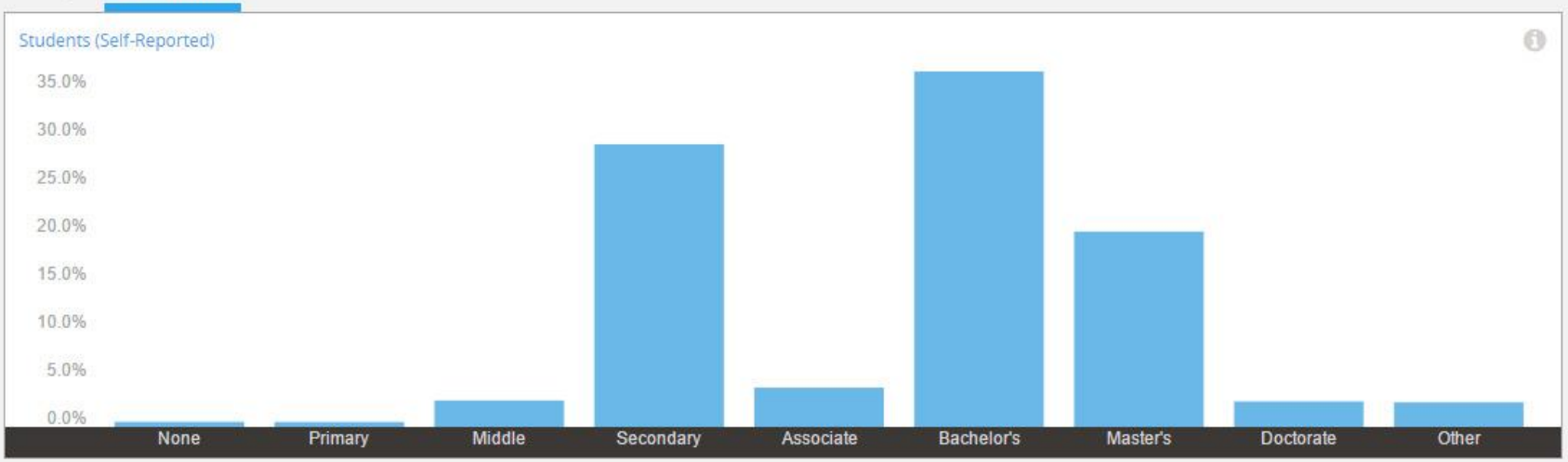
edX INSIGHTS HKUSTx/COMP102x/2T2014 Help tpong

ENROLLMENT Activity Demographics Geography

Age Education Gender

What level of education do my students have?



Education Metrics

32.7%	41.2%	23.0%
High School Diploma or Less	College Degree	Advanced Degree

Top Students from COMP102x

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Top Students with almost perfect scores

#	grade	gender	level_of_education	Location
1	100.00%	m	Master Degree	Beograd, Republic of Serbia
2	100.00%	NONE	NONE	Brisbane, Australia
3	100.00%	m	Junior High School	New Delhi, India
4	100.00%	m	Bachelor Degree	Caracas, Venezuela
5	100.00%	NONE	NONE	Brzezce, Poland
6	100.00%	m	High School	New Delhi, India
7	99.50%	f	Master Degree	United Kingdom
8	99.33%	m	Bachelor Degree	Hong Kong
9	99.20%	m	Junior High School	Polska, Poland
10	99.20%	m	Bachelor Degree	Tombolo, Italy
11	99.20%	None	None	Sao Paulo, Brazil
12	99.10%	m	High School	Hyderabad, India

Learning Analytics on MOOCs

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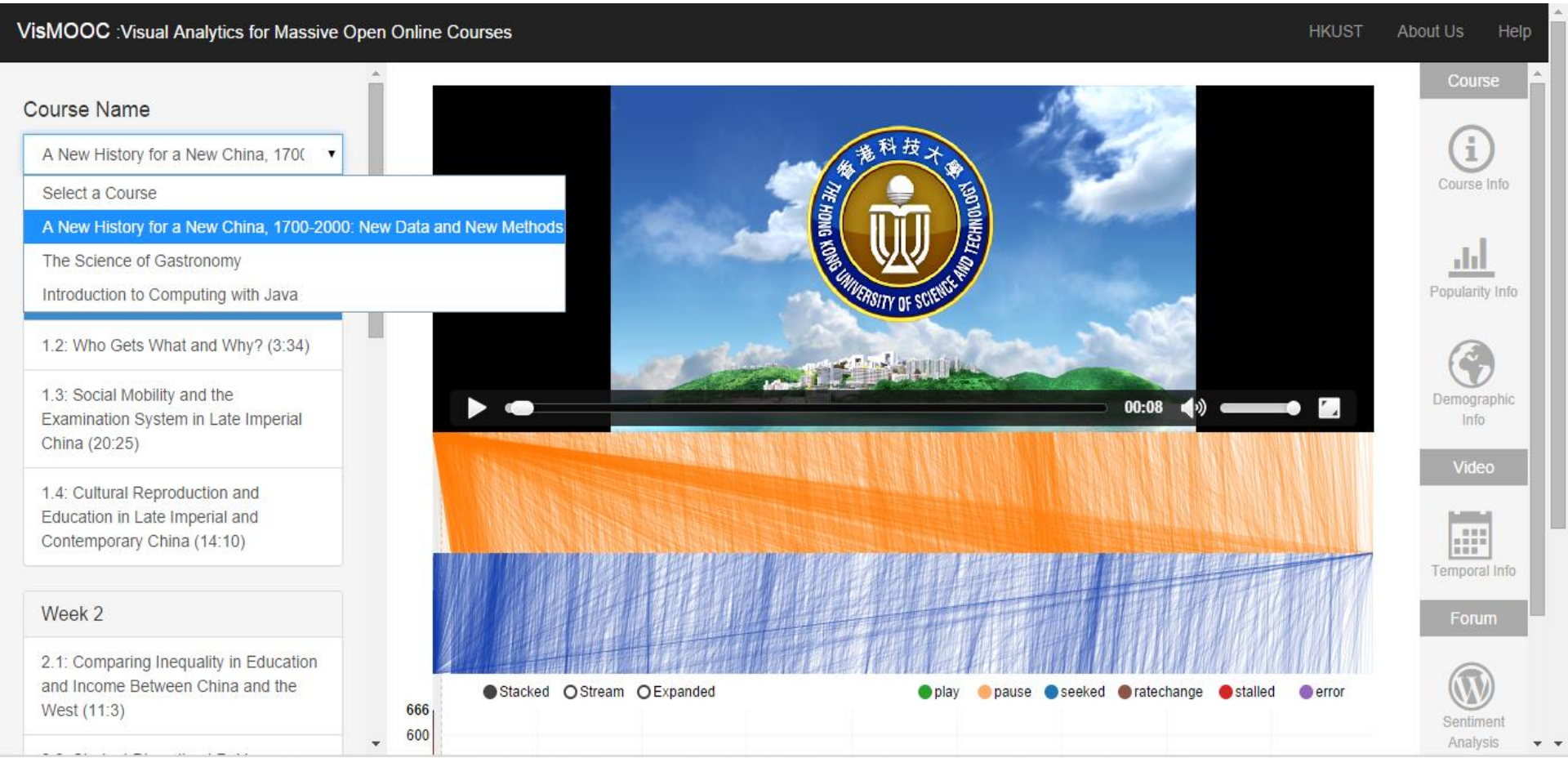
VisMOOC: A visual analytics tool for MOOC developed by Prof. Huamin Qu's research group



Learning Analysis on clickstream patterns

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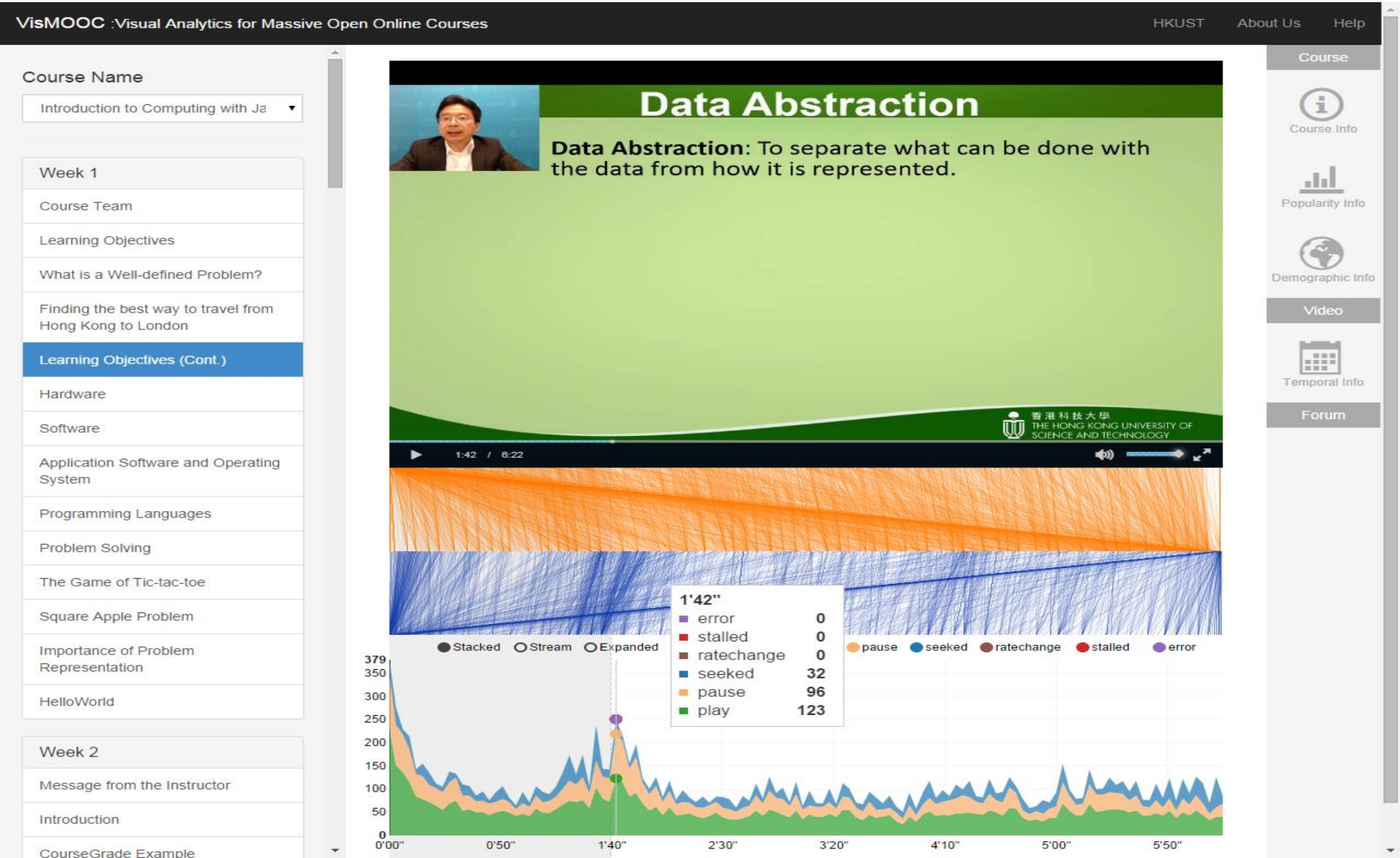

Learning Analysis on clickstream patterns

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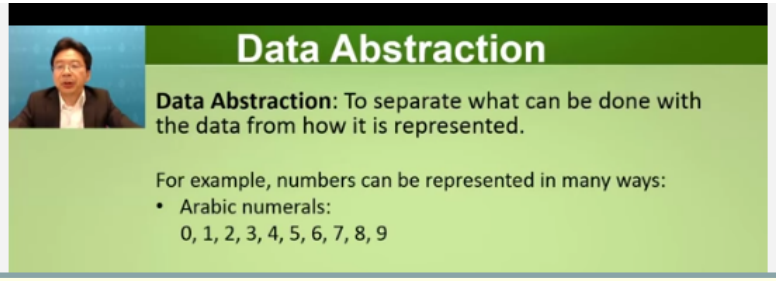
Week01 Graded Problem Set due Apr 13, 2015 at 15:30 UTC

First Java Program

Lab 01 Hello World
Labs due Apr 13, 2015 at 15:30 UTC

Week 2 - Programming Fundamentals



users.

In most applications, we usually care only about what the data objects can be used for but not how they are represented.

For example, a number can be represented in many ways.

In human language, the most

ABSTRACTION

We have just introduced the concept of data abstraction in the video above. Abstraction helps us to focus on "what" features are provided for an object rather than "how" those features are represented/implemented. Taking an elevator as an example, the control panel provides an abstraction of the functionalities of the elevator. Pressing on the floor buttons will move the elevator to certain floors, but how the mechanical parts work to position the elevator is completely concealed.

Post-course Survey

Unused

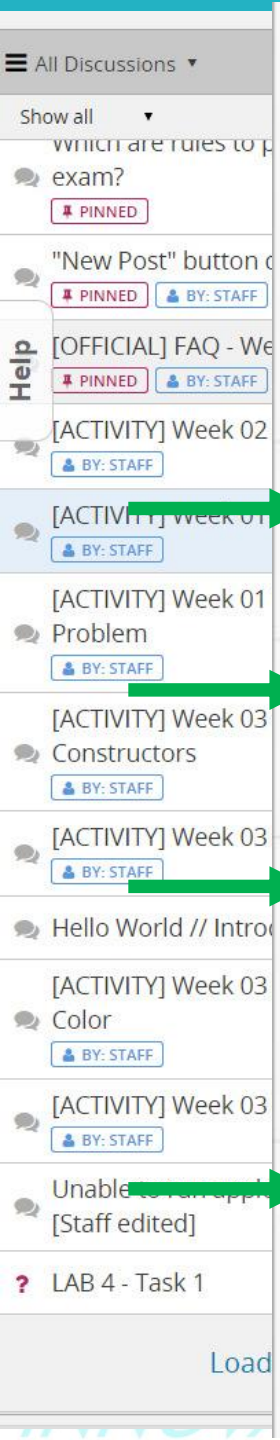
(Part 2 Content) Week 6 - Arrays, Simple Sorting, Multidimensional Arrays

(Part 2 Content) Week 7 - Character String, File I/O

STAFF DEBUG INFO

ABSTRACTION

We have just introduced the concept of data abstraction in the video above. Abstraction helps us to focus on "what" features are provided for an object rather than "how" those features are represented/implemented. Taking an elevator as an example, the control panel provides an abstraction of the functionalities of the elevator. Pressing on the floor buttons will move the elevator to certain floors, but how the mechanical parts work to position the elevator is completely concealed.



Think about Google search engine. You type in something you want to find, press enter or GO, and it brings you back several links, listed out nice and seperate for easy viewing. There is code behind your search that runs all that to display the results a certain way.

Hope that helps you.

posted 2 months ago by **Hanger-Terri**

I got it.. thanks.

posted 2 months ago by **Prateekkk**

Nice explanation. I Got it. Thanks.

posted 2 months ago by **khabbubhilai**

Nicely said! Using Google is a perfect example. How many of us have viewed our browsers and Google as some sort of 'magic box'? Ask it (google) it) anything and it will reveal everything you need to know.

posted 2 months ago by **MFPeg**

Very nice example. We take it for granted, without thinking of the real implementation of how Google implements the search algorithms to give us what we need.

posted 2 months ago by **netdost**

Extending MOOCs for Asynchronous Flipped

A small-scale pilot trial was conducted in Fall / Winter 2015-16 on the Java programming course:

- Students from HKUST:
  - Complete the MOOC in the Fall semester
  - Take an assessment to confirm participation
  - Enroll in a 2-week face-to-face Winter session
  - Take an exam to earn academic credits for the course
- A model to use MOOCs for expanding the international student exchange program and outreach to secondary school students

A Joint E-learning/MOOC Platform for Hong Kong's Tertiary Education Sector

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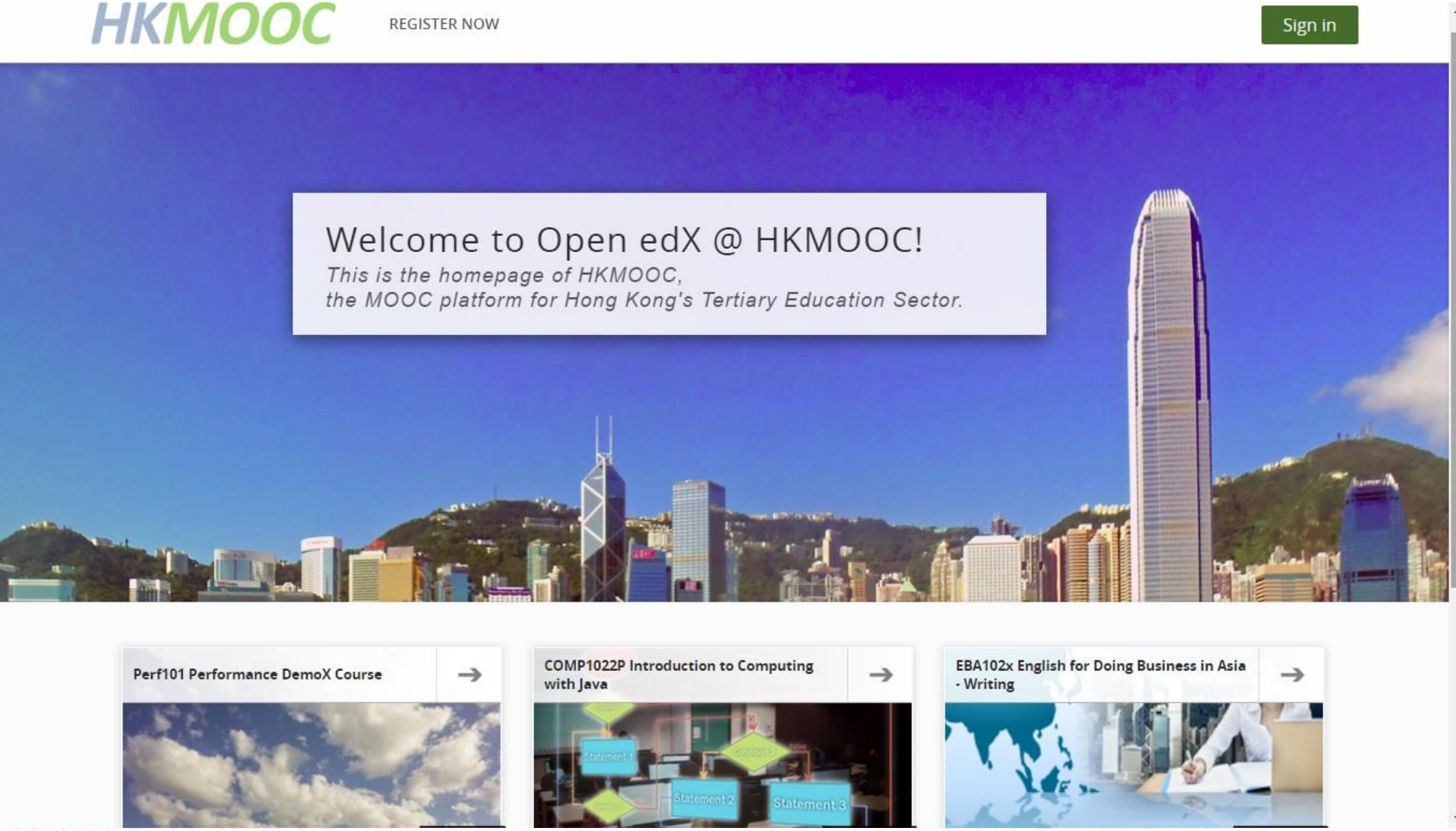
http://hkmooc.hk/



MOOC as a Catalyst for Enhancing Learning Experience

MOOC as a catalyst for improving teaching and learning on campus:

- Using MOOCs as bases for developing blended / flipped courses
- Using the data collected to derive learning analytics for improving the learning experience of students.
- Outreaching to prospective undergraduate/postgraduate students around the world and expanding our student exchange program
- Packaging MOOCs into curriculum programs – Massive Open Online Program/Degree (MOOP/MOOD)
- Using MOOC as a platform for inter-institutional collaboration through student/faculty exchange and joint programs such as MicroMaster.


Thank you!