慧科教育研究院
Utide Research Institute

大学习 — 发现学习中的大数据

Big Learning - Unleashing the Data Value in Online Learning

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慧科教育集团高级副总裁
慧科教育研究院院长

一起来找茬 *千年来教育的变化*

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When education meets Internet.

MOOC – The Game Changer

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Washington MONTHLY

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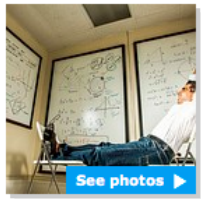
Features

September/October 2012

The Siege of Academe

MAGAZINE

One Man, One Computer, 10 Million Students: How Khan Academy Is Reinventing Education



One man. One computer. Ten million stud
Our $1.3 trillion school system is ripe for revolution. read »

coursera

edX

OPEN EDUCATION

free education for all

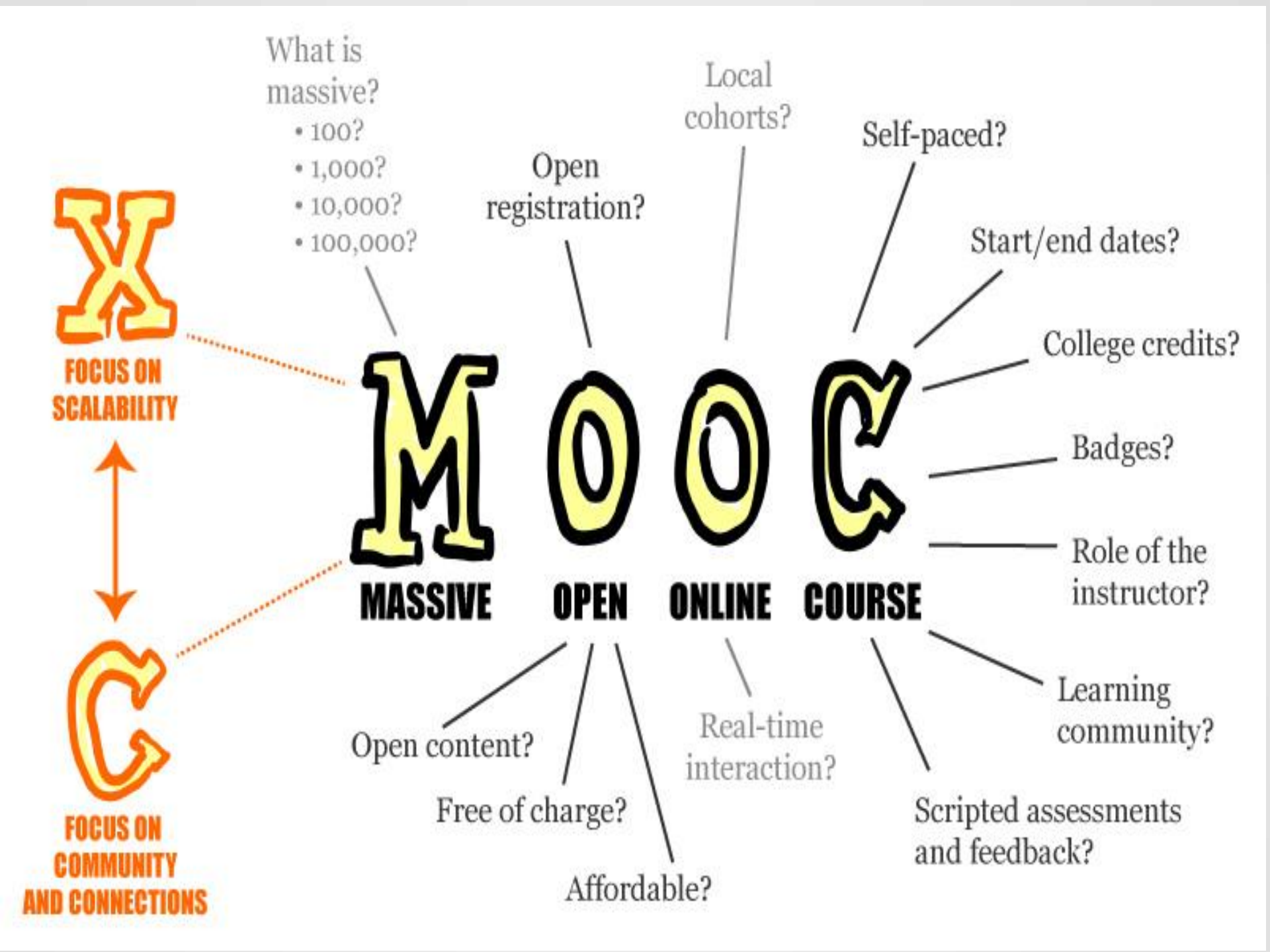
UDACITY

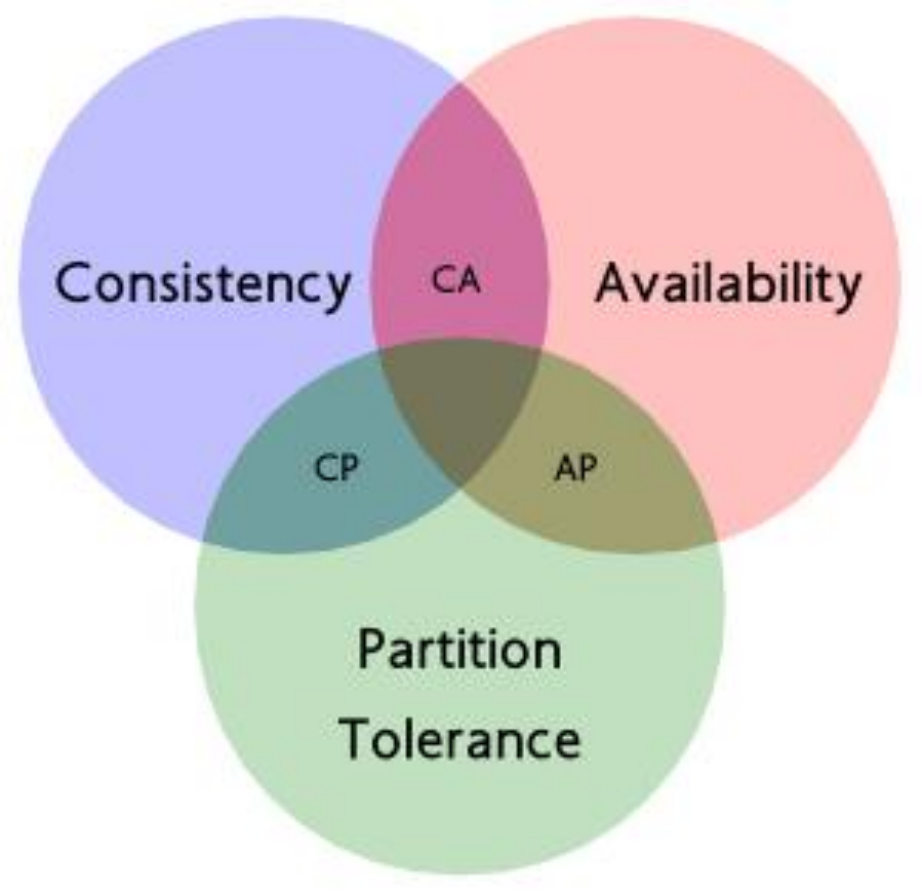
Massive Open Online Course

網易公开课

开课吧
kaikeba.com

xuetangX.com
学堂在线


What is massive?
• 100?
• 1,000?
• 10,000?
• 100,000?
Open registration?
Local cohorts?
Self-paced?
Start/end dates?
College credits?
Badges?
Role of the instructor?
Learning community?
Scripted assessments and feedback?
Real-time interaction?
Affordable?
Free of charge?
Open content?
X
FOCUS ON SCALABILITY
C
FOCUS ON COMMUNITY AND CONNECTIONS
MOOC
MASSIVE OPEN ONLINE COURSE


Consistency
CA
Availability
CP
AP
Partition
Tolerance

CAP in Education

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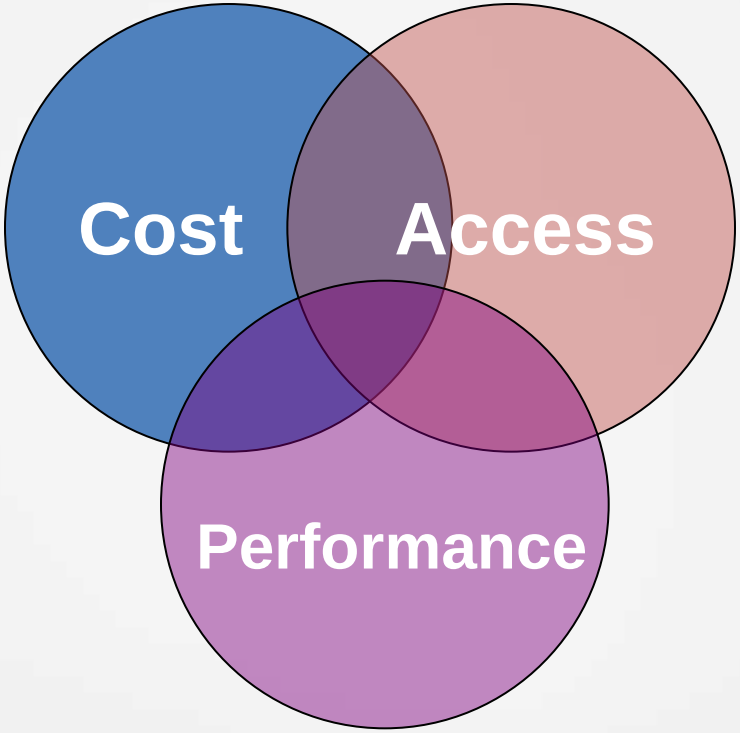

“The Iron Triangle: College Presidents Talk about Costs, Access, and Quality.” By John Immerwahr, Jean Johnson, Paul Gasbarra. October 2008. The National Center for Public Policy and Higher Education and Public Agenda.

http://www.highereducation.org/reports/iron_triangle/index.shtml

Internet + Education

Utide Vision 2014

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O2O	线上下融合
Outside-in Drive	市场力量推动体制转型
Big Learning	大学习
Education Intelligence	教育智能
Crowd-lecturing	众传知识

Big Learning

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LOYD (Learning On Your Device)
Any time
Any where
Any course
Cyberspace

Massive collaboration
Student-centric
Peer review
UGC

Data-driven
Adaptive Learning
Individualized Learning

Competency-based evaluation

The Big Data in Learning.

Data Pyramid

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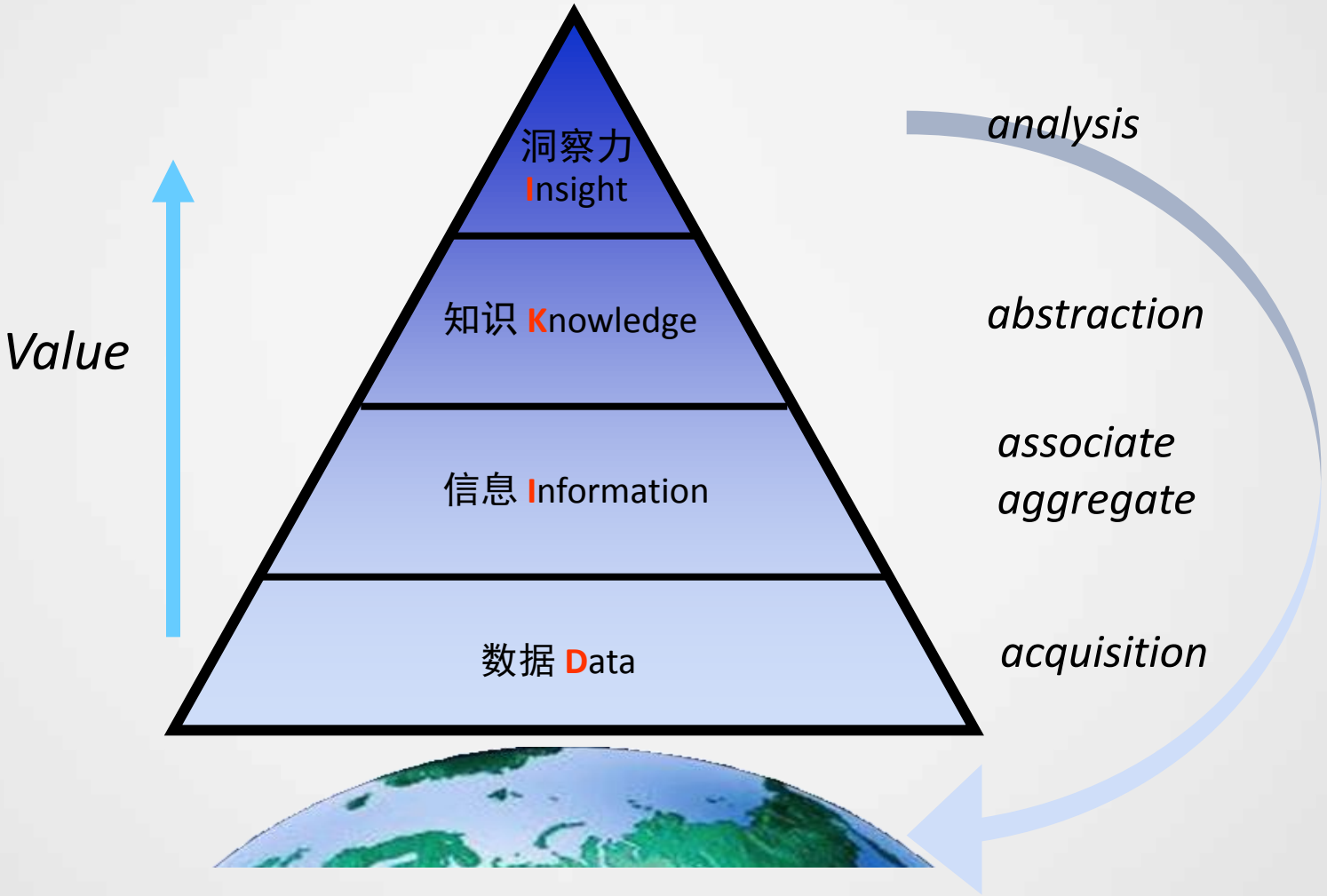
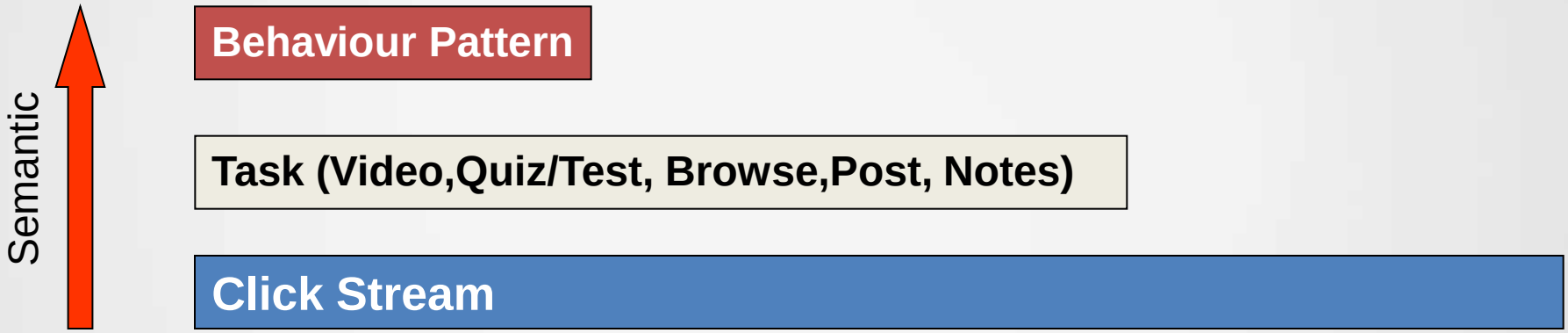


A Quiz

73,939,133


Semantic
Behaviour Pattern
Task (Video,Quiz/Test, Browse,Post, Notes)
Click Stream

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eCommerce vs. eLearning

User POV

	eCommerce	eLearning	Implication for eLearning
Transaction Period	Short(minutes)	Long (Days, Months)	Trajectory analysis
Motivation	ACTIVE	ACTIVE or PASSIVE	Retention Stimulate
Contents	TEXT, IMAGE	Multimedia, Forum, Quiz/Test	Learning behaviour, evaluation
Collaboration	NO or FEW	MORE or INTENSE	Sentiment detection, peer review
Comments	on quality of the "product"		Quality,Dropout
Engagement	SHALLOW	DEEP	AWE

Big Learning in Action.

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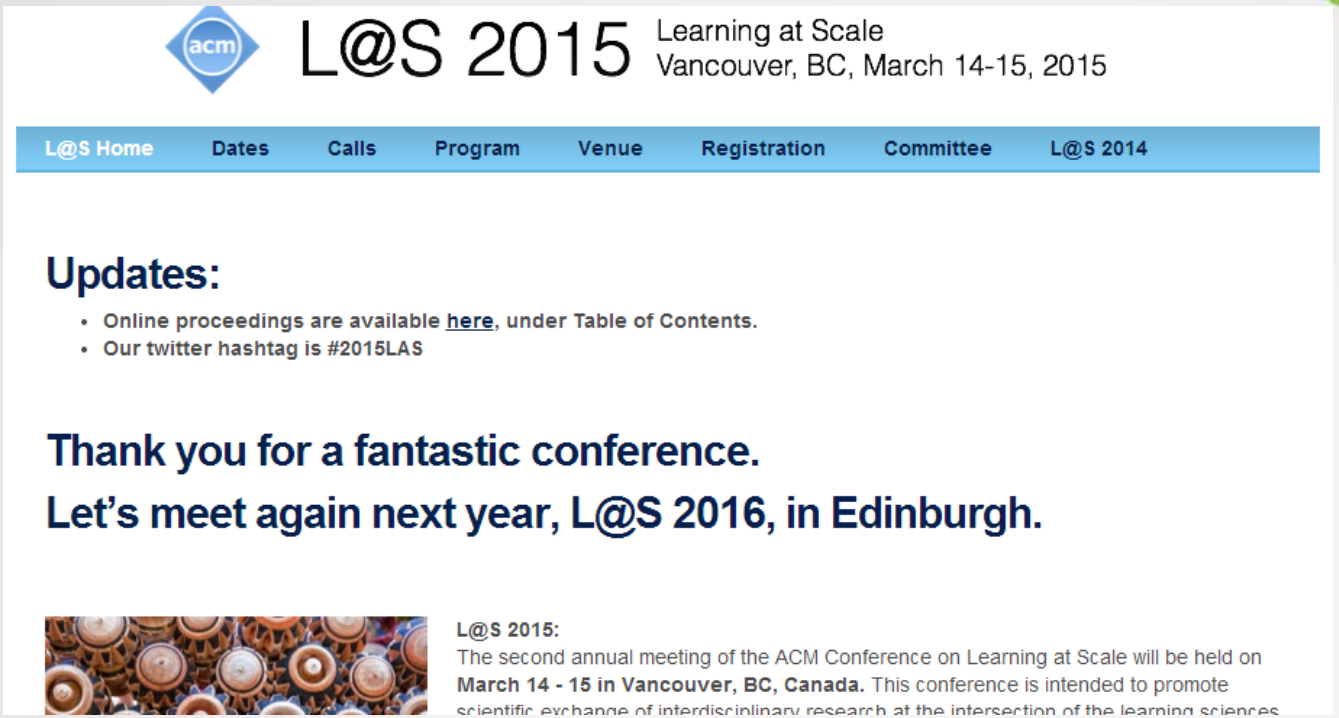

- Usability Studies
- Tools for Automated Feedback and Grading
- Learning Analytics, Analysis of Log Data
- Studies of Application of Existing Learning Theory
- Investigation of Student Behaviour and Correlation with Learning Outcomes New Learning and Teaching Techniques at Scale

http://learningatscale.acm.org/

Bayesian Ordinal Peer Grading. Karthik Raman and Thorsten Joachims (Cornell University)

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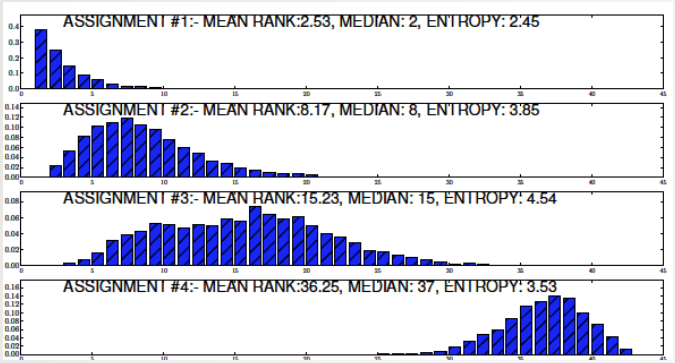
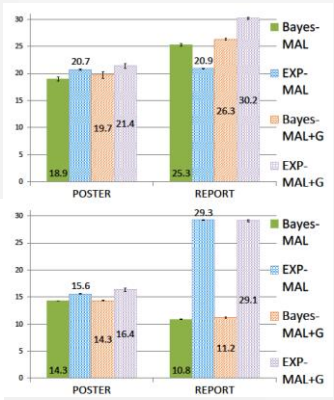
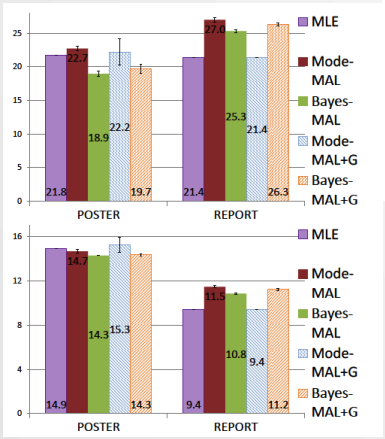


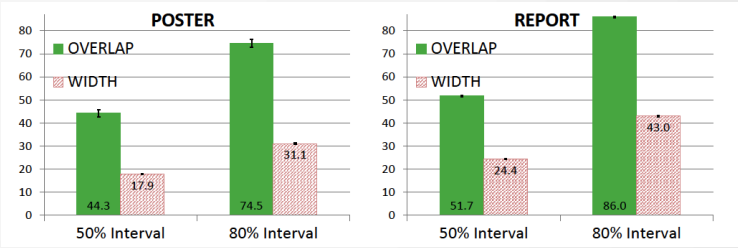
Algorithm 1 Sampling from Mallows Posterior using Metropolis-Hastings

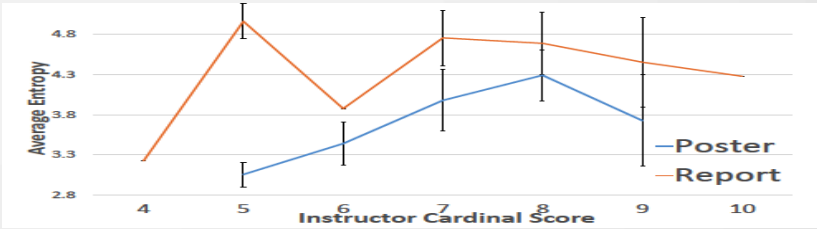
Input: Grader orderings $\sigma^{(g)}$, Grader reliabilities η_g and MLE ordering $\hat{\sigma}$.
Pre-compute $x_{ij} \leftarrow \sum_{g \in G} \eta_g \mathbb{I}[d_i \succ_{\sigma^{(g)}} d_j] - \sum_{g \in G} \eta_g \mathbb{I}[d_j \succ_{\sigma^{(g)}} d_i]$
$\sigma_0 \leftarrow \hat{\sigma}$ ▷ Initialize Markov Chain using MLE estimate
for $t = 1 \ldots T$ **do**
  Sample σ' from (**MALLOWS**) jumping distribution: $J_{MAL}(\sigma' | \sigma_{t-1})$
  Compute ratio $r_t = \frac{P(\sigma' | \{\sigma^{(g)}; \forall g\})}{P(\sigma_{t-1} | \{\sigma^{(g)}; \forall g\})}$ using Equation 5
  With probability $\min(r_t, 1)$, $\sigma_t \leftarrow \sigma'$ else $\sigma_t \leftarrow \sigma_{t-1}$
  Add σ_t to samples (if burn-in and thinning conditions met)

$$P(\sigma | \{\sigma^{(g)}; \forall g\}) = \frac{P(\{\sigma^{(g)}; \forall g\} | \sigma) P(\sigma)}{\sum_{\sigma' \in \pi(D)} P(\{\sigma^{(g)}; \forall g\} | \sigma') P(\sigma')} = \frac{P(\{\sigma^{(g)}; \forall g\} | \sigma)}{\sum_{\sigma' \in \pi(D)} P(\{\sigma^{(g)}; \forall g\} | \sigma')}. \quad (4)$$



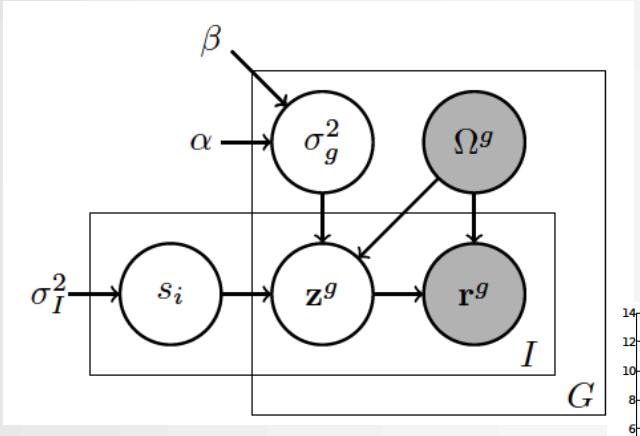


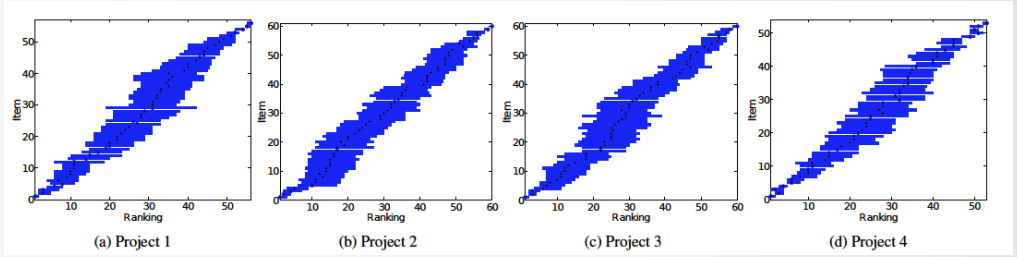


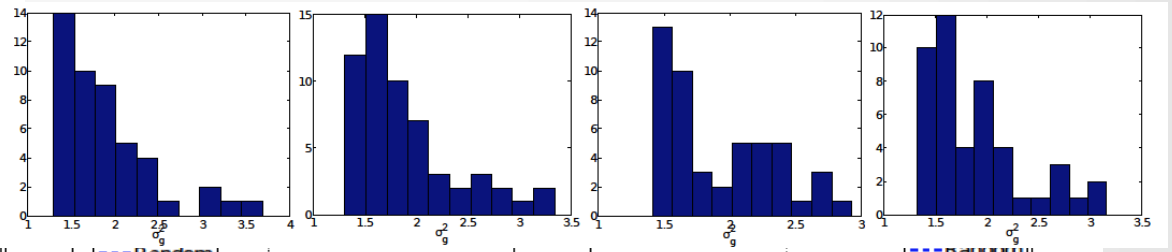


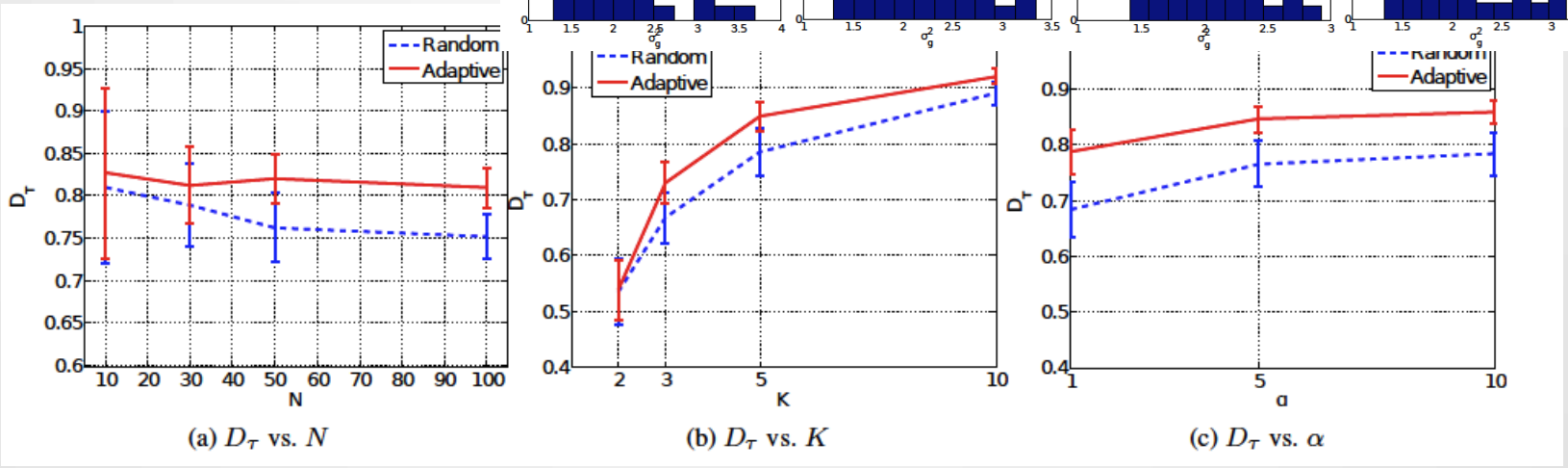
Source: Learning@Scale 2015 Proceedings

BayesRank: A Bayesian Approach to Ranked Peer Grading. Andrew Waters (Rice University), David Tinapple (Arizona State University), and Richard Baraniuk (Rice University)









Source: Learning@Scale 2015 Proceedings

Effective Sampling for Large-Scale Automated Writing Evaluation Systems. Nicholas Dronen (University of Colorado at Boulder & Pearson), Peter Foltz (Pearson & University of Colorado at Boulder), and Kyle Habermehl (Pearson)

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Set	m									
	10	20	30	40	50	60	70	80	90	100
1	42	18	10	7	5	4	3	2	2	2
2a	86	69	47	37	26	26	22	18	18	15
2b	94	68	48	39	32	27	26	23	18	17
3	26	18	16	10	8	8	5	5	4	4
4	25	7	**4**	**3**	5	4	**3**	**3**	**4**	**2**
5	25	12	7	4	3	2	1	1	1	1
6	59	30	17	12	8	7	5	4	3	3
7	54	29	16	10	6	5	4	2	2	2
8	106	84	62	93	80	65	74	84	50	63

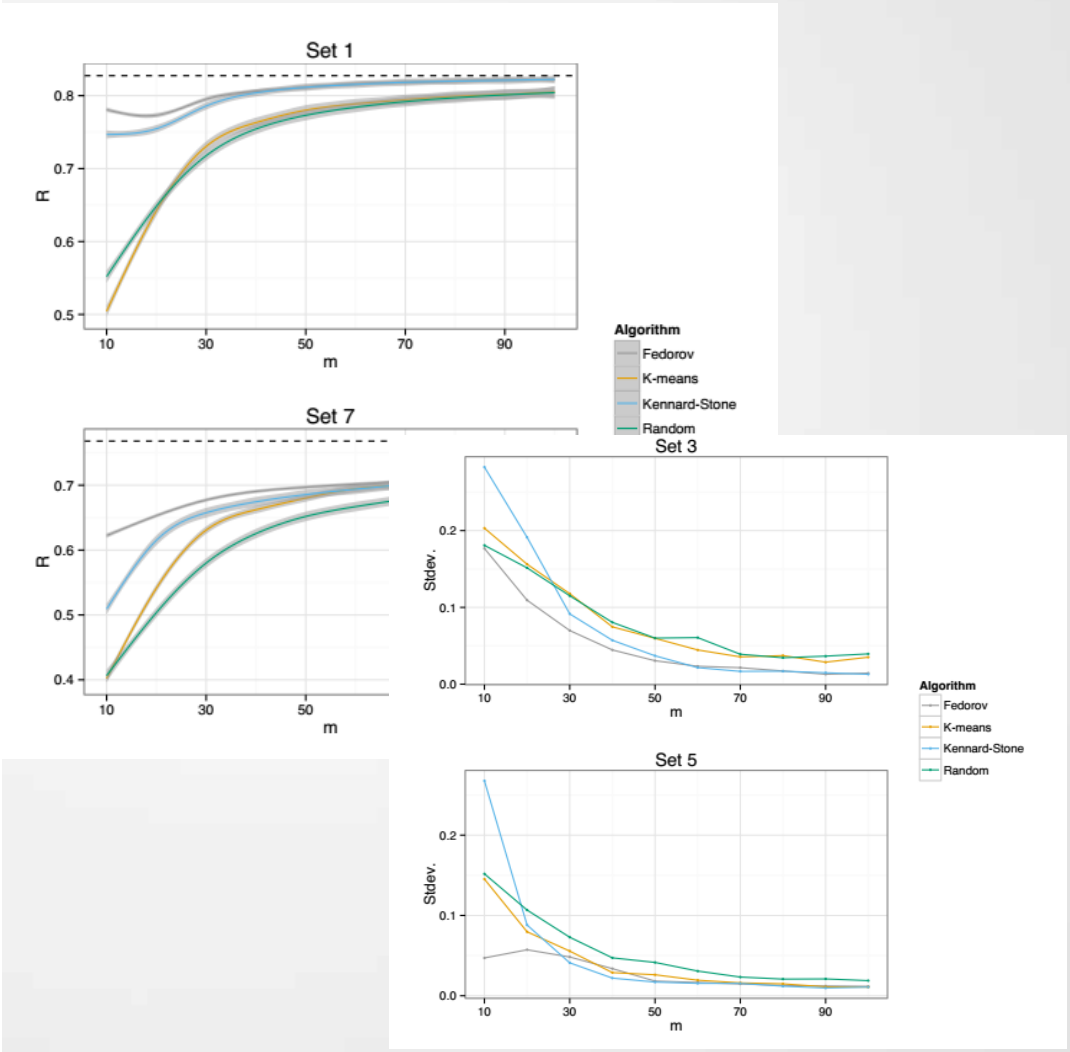
(a) Fedorov

Set	m									
	10	20	30	40	50	60	70	80	90	100
1	36	15	9	6	5	4	3	2	2	2
2a	62	70	48	36	26	26	21	18	18	15
2b	70	67	45	36	30	25	25	22	17	17
3	25	13	13	9	7	9	6	5	5	4
4	-33	**-2**	**-1**	**0**	**1**	**2**	**1**	**2**	**2**	**1**
5	**-5**	11	7	5	4	3	2	1	1	1
6	52	28	17	11	8	6	4	4	2	3
7	25	22	11	8	5	4	3	2	3	2
8	52	66	45	54	73	53	69	85	53	62

(b) Kennard-Stone

Set	m									
	10	20	30	40	50	60	70	80	90	100
1	-8	**-1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
2a	30	42	32	23	17	19	16	13	14	12
2b	53	40	32	28	23	19	20	18	14	14
3	**-4**	**0**	5	**3**	**1**	3	1	1	1	1
4	13	14	13	7	8	6	4	4	**3**	**0**
5	**4**	9	5	4	3	2	1	1	1	1
6	15	8	10	9	7	6	5	4	3	3
7	**0**	7	8	6	4	4	3	2	2	2
8	46	52	45	41	40	33	40	43	**22**	25

(c) K-means



Source: Learning@Scale 2015 Proceedings

Probabilistic Use Cases: Discovering Behavioral Patterns for Predicting Certification. Cody A. Coleman, Daniel T. Seaton, and Isaac Chuang (MIT)

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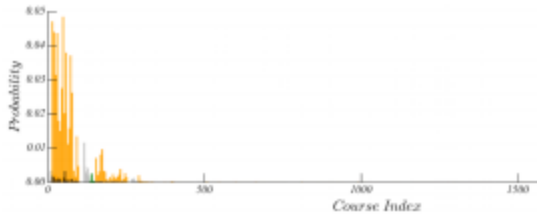
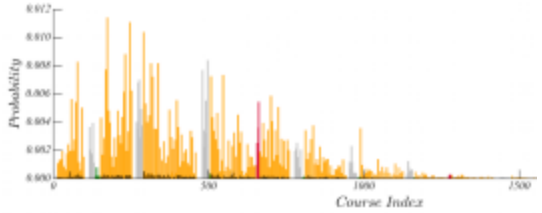
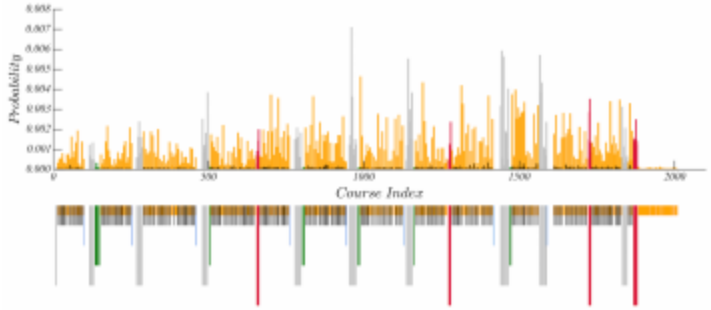


(a) Shopping use case



(b) Disengaging use case



	3-use case model			5-use case model			10-use case model			50-use case model		
Week	ACC	TNR	TPR	ACC	TNR	TPR	ACC	TNR	TPR	ACC	TNR	TPR
1	0.71±0.01	0.70	0.79	0.77±0.01	0.77	0.76	0.81±0.01	0.81	0.75	0.81±0.01	0.81	0.74
2	0.79±0.01	0.78	0.93	0.83±0.01	0.82	0.90	0.83±0.02	0.82	0.89	0.85±0.02	0.85	0.90
3	0.87±0.02	0.86	0.96	0.84±0.02	0.83	0.96	0.88±0.02	0.87	0.96	0.90±0.02	0.90	0.94
4	0.90±0.01	0.89	0.97	0.91±0.02	0.90	0.97	0.91±0.02	0.90	0.97	0.93±0.02	0.93	0.95
5	0.87±0.02	0.86	0.98	0.91±0.02	0.91	0.98	0.91±0.02	0.91	0.96	0.93±0.02	0.93	0.96
6	0.90±0.02	0.90	0.99	0.91±0.02	0.90	0.99	0.92±0.02	0.91	0.98	0.94±0.02	0.94	0.98
7	0.92±0.02	0.91	0.99	0.91±0.02	0.90	0.99	0.92±0.02	0.92	0.98	0.95±0.02	0.95	0.97
8	0.92±0.02	0.91	0.99	0.94±0.02	0.94	0.99	0.94±0.01	0.93	0.99	0.96±0.02	0.96	0.97
9	0.94±0.01	0.93	0.99	0.95±0.01	0.95	0.98	0.94±0.01	0.94	0.99	0.96±0.01	0.96	0.97
10	0.93±0.02	0.93	0.99	0.94±0.02	0.93	1.00	0.96±0.01	0.96	0.98	0.97±0.01	0.97	0.97
11	0.93±0.02	0.93	1.00	0.95±0.01	0.95	1.00	0.96±0.01	0.96	0.99	0.97±0.01	0.97	0.98
12	0.93±0.02	0.93	1.00	0.93±0.02	0.93	0.99	0.96±0.01	0.96	0.99	0.98±0.01	0.98	0.97
13	0.92±0.02	0.91	0.99	0.95±0.01	0.95	0.99	0.97±0.01	0.97	0.99	0.98±0.01	0.98	0.98
14	0.96±0.01	0.95	0.97	0.97±0.01	0.97	0.99	0.97±0.01	0.97	0.99	0.98±0.01	0.98	0.98
15	0.92±0.02	0.92	0.99	0.95±0.01	0.95	0.99	0.96±0.01	0.96	0.99	0.99±0.01	0.99	0.98
16	0.96±0.01	0.96	1.00	0.95±0.01	0.94	1.00	0.97±0.01	0.97	0.99	0.99±0.01	0.99	0.98
17	0.96±0.01	0.95	1.00	0.97±0.01	0.97	0.98	0.97±0.01	0.97	0.99	0.98±0.01	0.98	0.98
18	0.96±0.01	0.96	1.00	0.96±0.01	0.96	1.00	0.97±0.01	0.97	0.99	0.99±0.00	0.99	0.98

$$\prod_{u=1}^{K} P(\beta_u) \prod_{t=1}^{T} P(\phi^t|\alpha)\{\prod_{i=1}^{n_t} \phi_u^t \beta_{m_i|u}\}$$

Source: Learning@Scale 2015 Proceedings

Uncovering Trajectories of Informal Learning in Large Online Communities Of Creators. Seungwon Yang, Carlotta Domeniconi, Matt Revelle, Mack Sweeney, Ben U. Gelman, Chris Beckley, and Aditya Johri (George Mason University)

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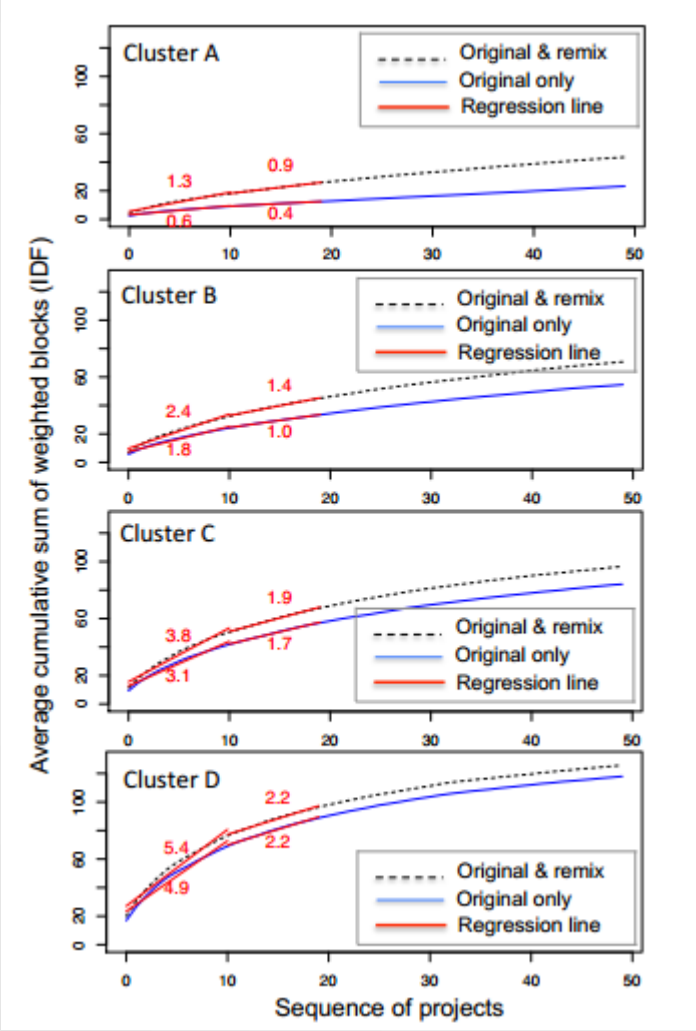


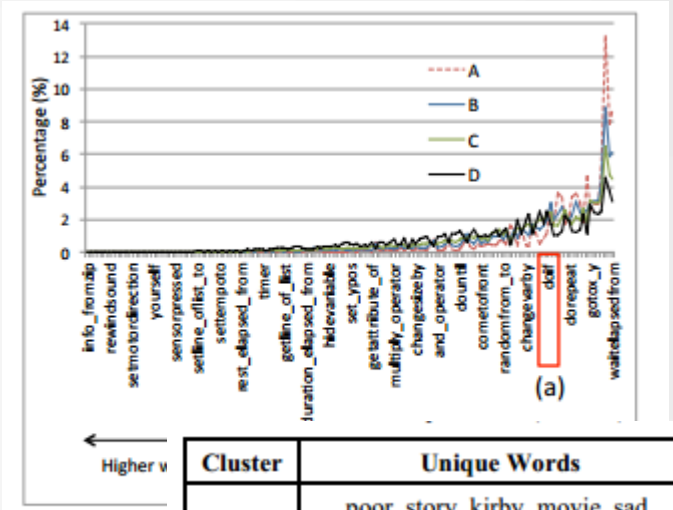


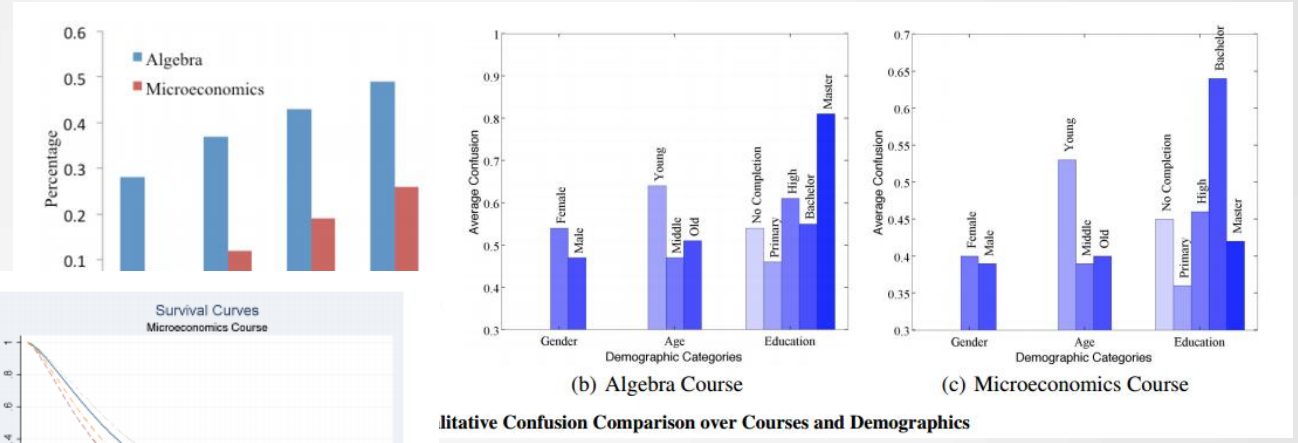
Figure 7. B
graph an

Cluster	Unique Words	Count
A	poor, story, kirby, movie, sad, cookie, anime, car, baby, wolf, shadow, drawing	12
B	king, head, views, meow, dragon, nice	6
C	nyan, spam, watch, astro, darkraiworld, hill, battle, pizza, stick	9
D	color, bros, radas, player, tagger, darkb, mouse, liam, long, version, online, turbo, adventure, survived, scripts, ninja, projects, great, mhm, magic, level, geometry, button, bob, view, erk	26

Table 3. Unique words extracted from the project descriptions and comments in each cluster.

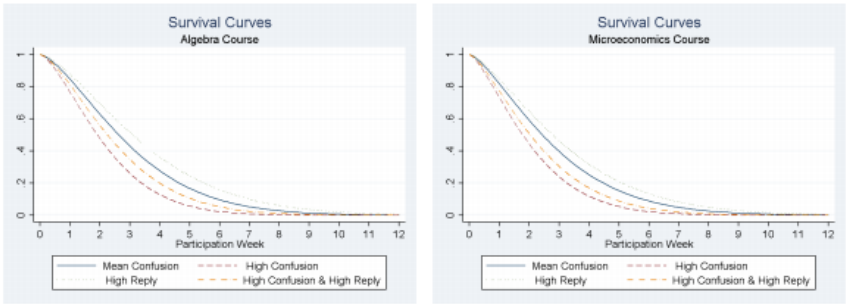
Source: Learning@Scale 2015 Proceedings

Exploring the Effect of Confusion in Discussion Forums of Massive Open Online Courses. Diyi Yang, Miaomiao Wen, Iris Howley, Robert Kraut, and Carolyn Rose (Carnegie Mellon University



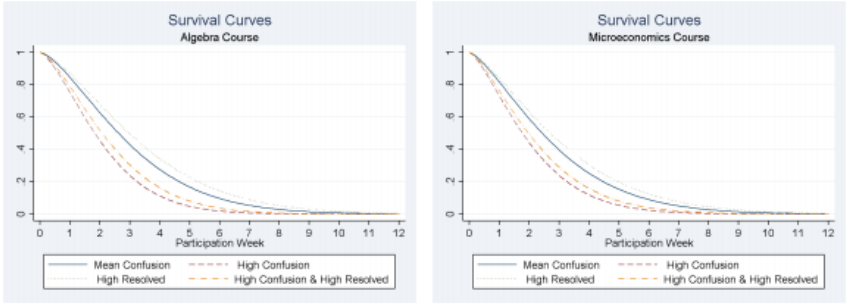
(b) Algebra Course (c) Microeconomics Course

litative Confusion Comparison over Courses and Demographics



(a) Algebra Course (b) Microeconomics Course

Figure 2. Survival Curves for Students Exposed to Different Levels of Confusion Being Replied



(a) Algebra Course (b) Microeconomics Course

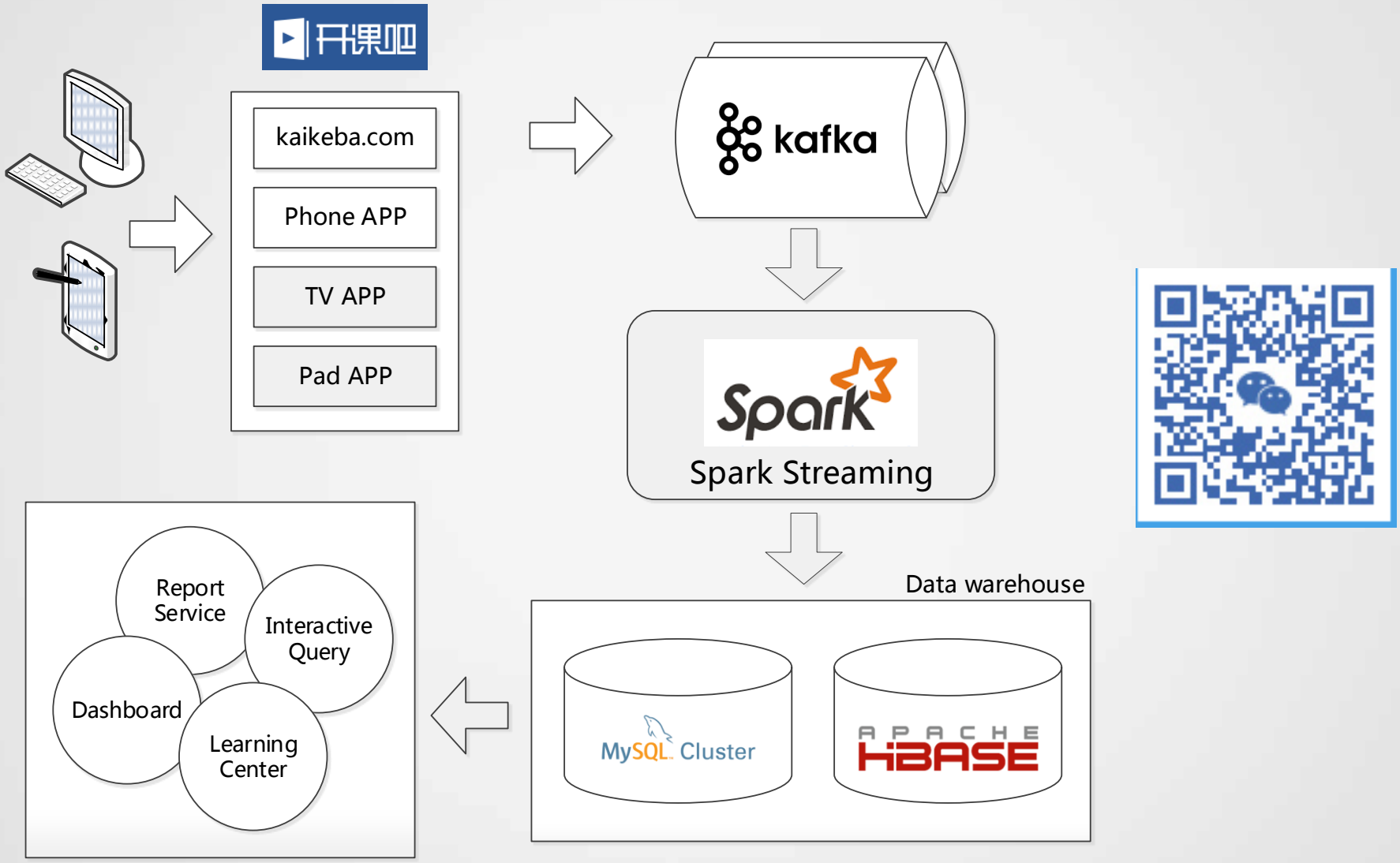
Figure 3. Survival Curves for Students Exposed to Different Levels of Confusion Being Resolved

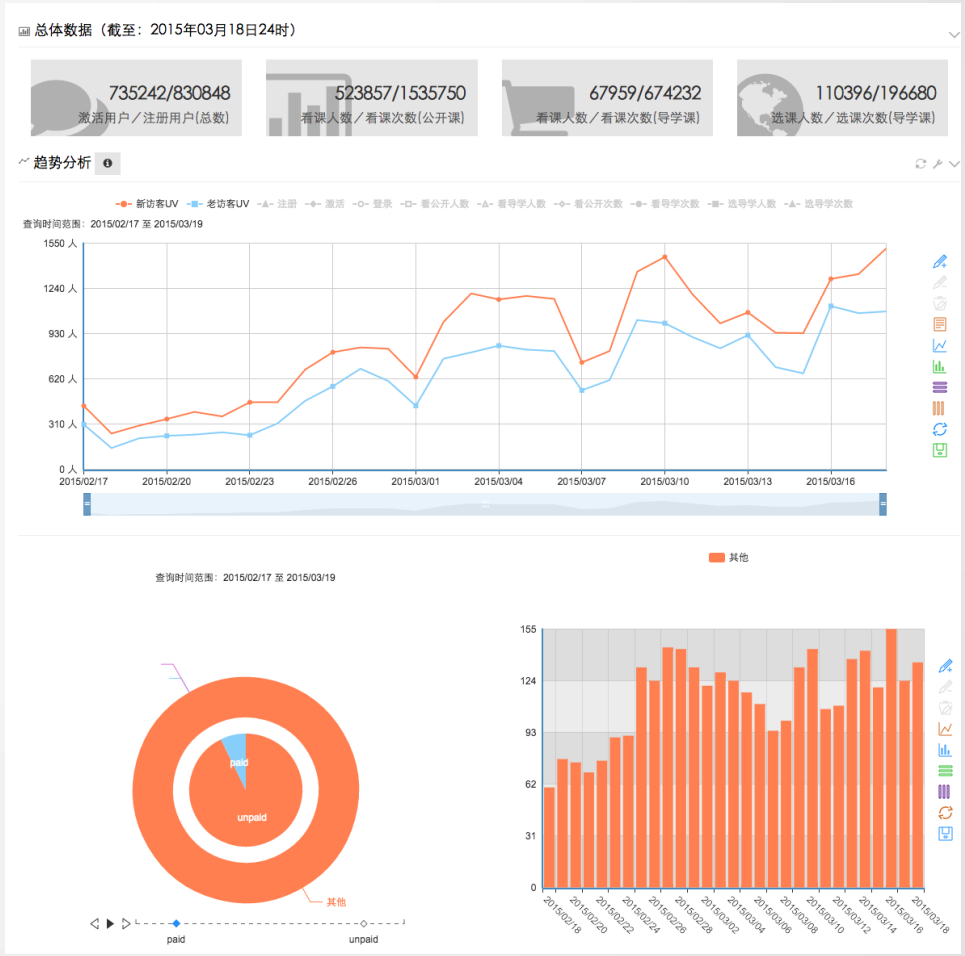
Courses	Algebra	Microeconomics
Most Important Features (Feature Weight)	question marker count(1.16) 1st pers singular (1.31) question word count(0.52) click pattern (0.38) impersonal pronouns (-0.15) certainty (-0.17) negation (-0.19) adverbs (-0.20)	question marker count(1.30) start with modal words (1.09) 1st pers singular(0.73) question word count(0.17) adverbs (-0.17) affect (-0.18) click pattern(-0.19) negation (-0.20) insight (-0.28)

Table 2. Top Ranked Features for Confusion Detection

Source: Learning@Scale 2015 Proceedings

What we are doing

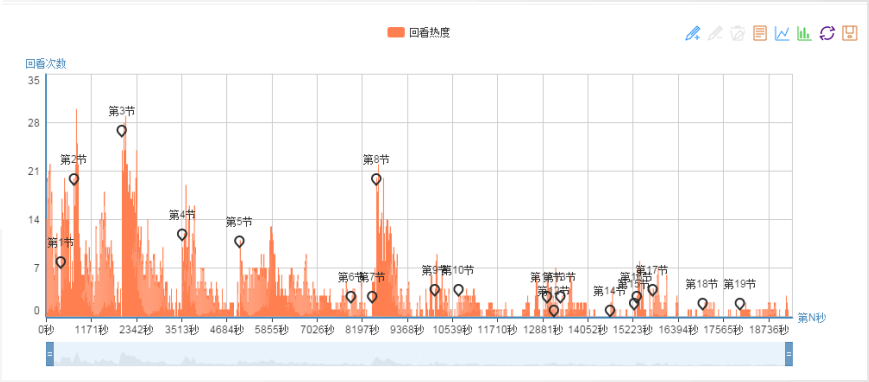


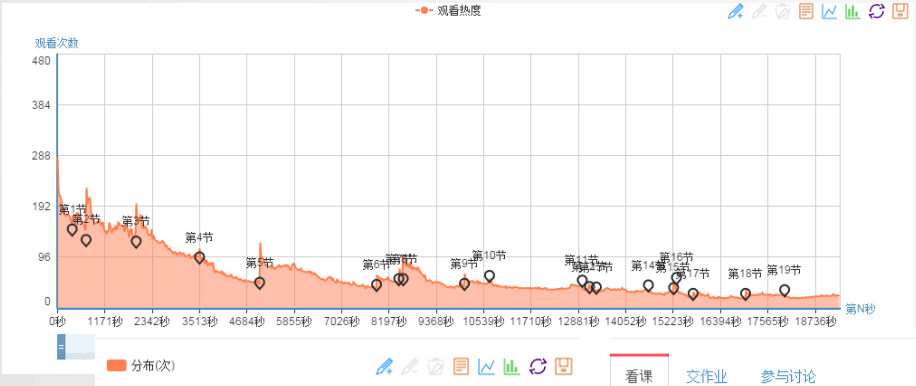


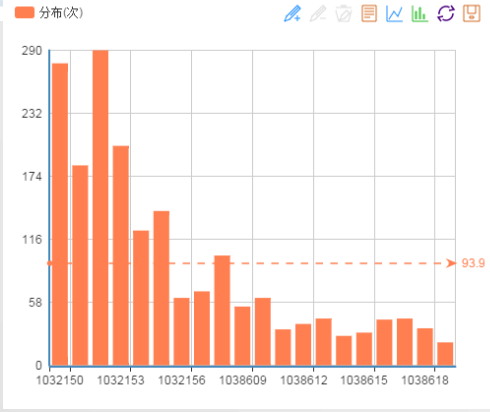
学习时长，完成度
学习专注度
考试成绩
维度：课程分类、教学模式

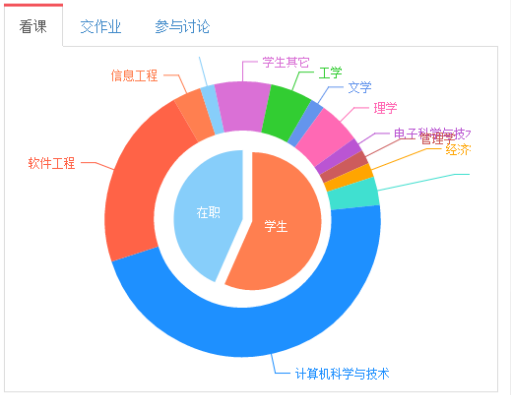
勤奋指数
（在全体学生中的相对排行）

课程推荐、职位推荐、3D简历生成









课程日、周、月排行榜。

根据学生观看行为，计算
视频观看热度、
回放热度、
暂停热度区域

能看到自己负责课程的学生情况，比如，喜欢一天当中什么时段看视频？做作业？学生的职业/年龄分布？

一起来想象 *十年后的教育*

慧科教育研究院
Utide Research Institute

Education changes us for decades,
it is time for us to change education.

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