Katy Börner

Visual Analytics: Empowering Teachers, Students, Researchers, and Leadership

COLLABORATORS

Michael Ginda, Robert Light, Scott Emmons, David Wild & Ying Ding, SOIC, Raymond Burke, KSB, Robert Goldstone, PBS@COAS, Dennis Groth, VPUE, Daniel Hickey, SoE, Michael Kaganovich, Economics@COAS, George Rehrey, Director of SOTL, Anastasia Morrone, Assoc. VP for Learning Technologies, OVPIT; Dean of IT at IUPUI, Jennifer Robinson, Anthropology@COAS, Linda Shepard, Director of Bloomington Assessment & Research, Timothy F. Slaper, Indiana Business Research Center, Ali Jafari, Course Networking, LLC

INDIANA UNIVERSITY
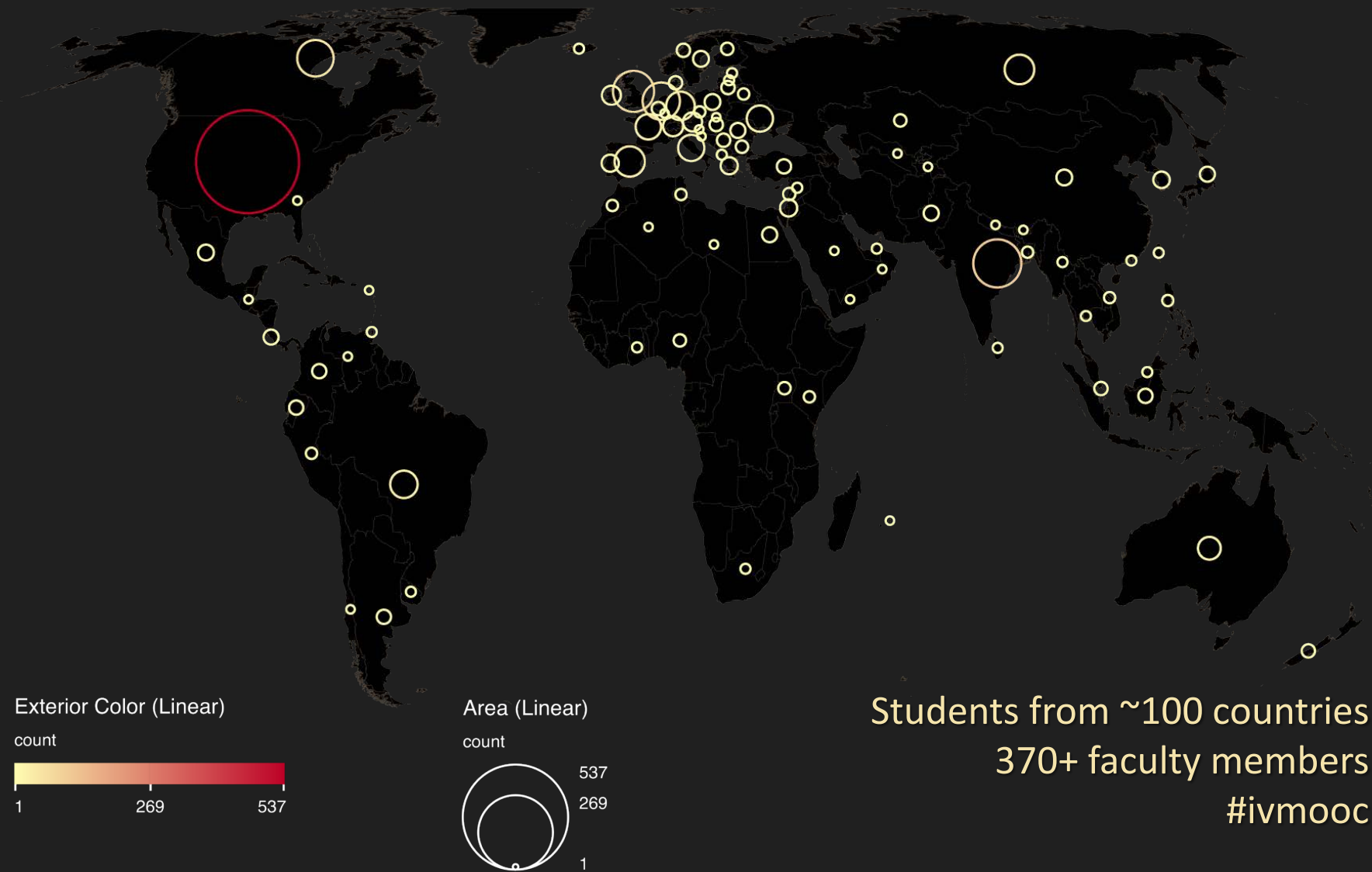**SCHOOL OF INFORMATICS AND COMPUTING**

Information Visualization MOOC

ivmooc.cns.iu.edu

Register for free: http://ivmooc.cns.iu.edu. Class restarts Jan 10, 2017.

The Information Visualization MOOC
ivmooc.cns.iu.edu

Exterior Color (Linear)

count

1   269   537

Area (Linear)

count

537

269

1

Students from ~100 countries
370+ faculty members
#ivmooc

Learning Analytics

Empowering Teachers: How to make sense of the activities of thousands of students? How to guide them?

Empowering Students: How to navigate learning materials and develop successful learning collaborations across disciplines and time zones?

Empowering Researchers: How do people learn? What pedagogy works (in a MOOC) and when?

Empowering MOOC Platform Designers: What technology helps and what hurts?

Visualizing IVMOOC Data

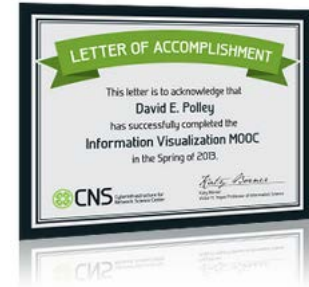Data was collected from different sources:

- 1,901 students registered via GCB (1215 male/557 female)

- 52,557 slide downloads from our server

- 18,893 video views via YouTube

- 193 accounts made 730 tweets

- 134 students took 183 exams in GCB

- 674 remarks on 215 different forum threads in Drupal
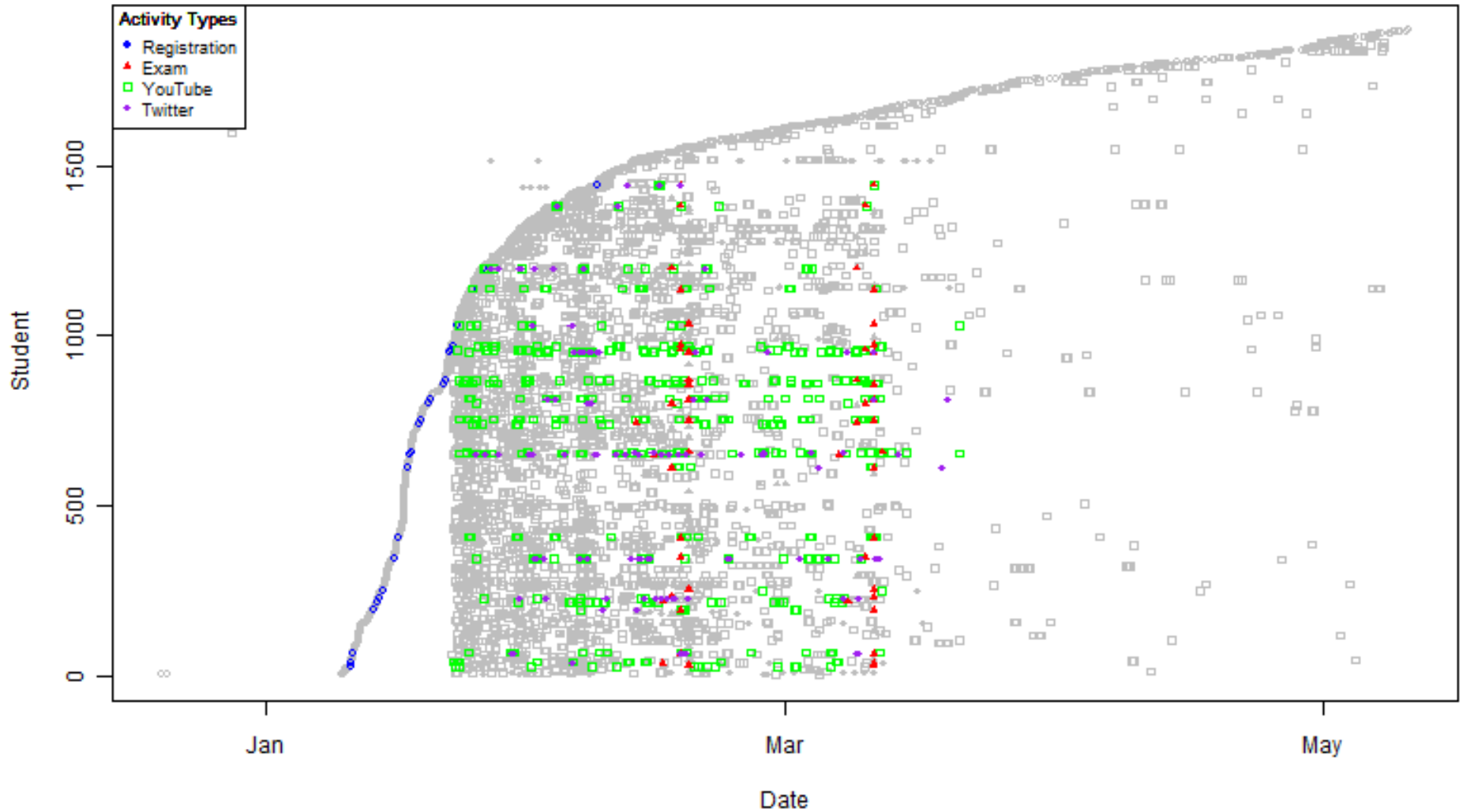
- 64 students submitted projects via Drupal

Student Registration and Activity

Jan. 22: Course Starts

March 11: Final Exam Deadline
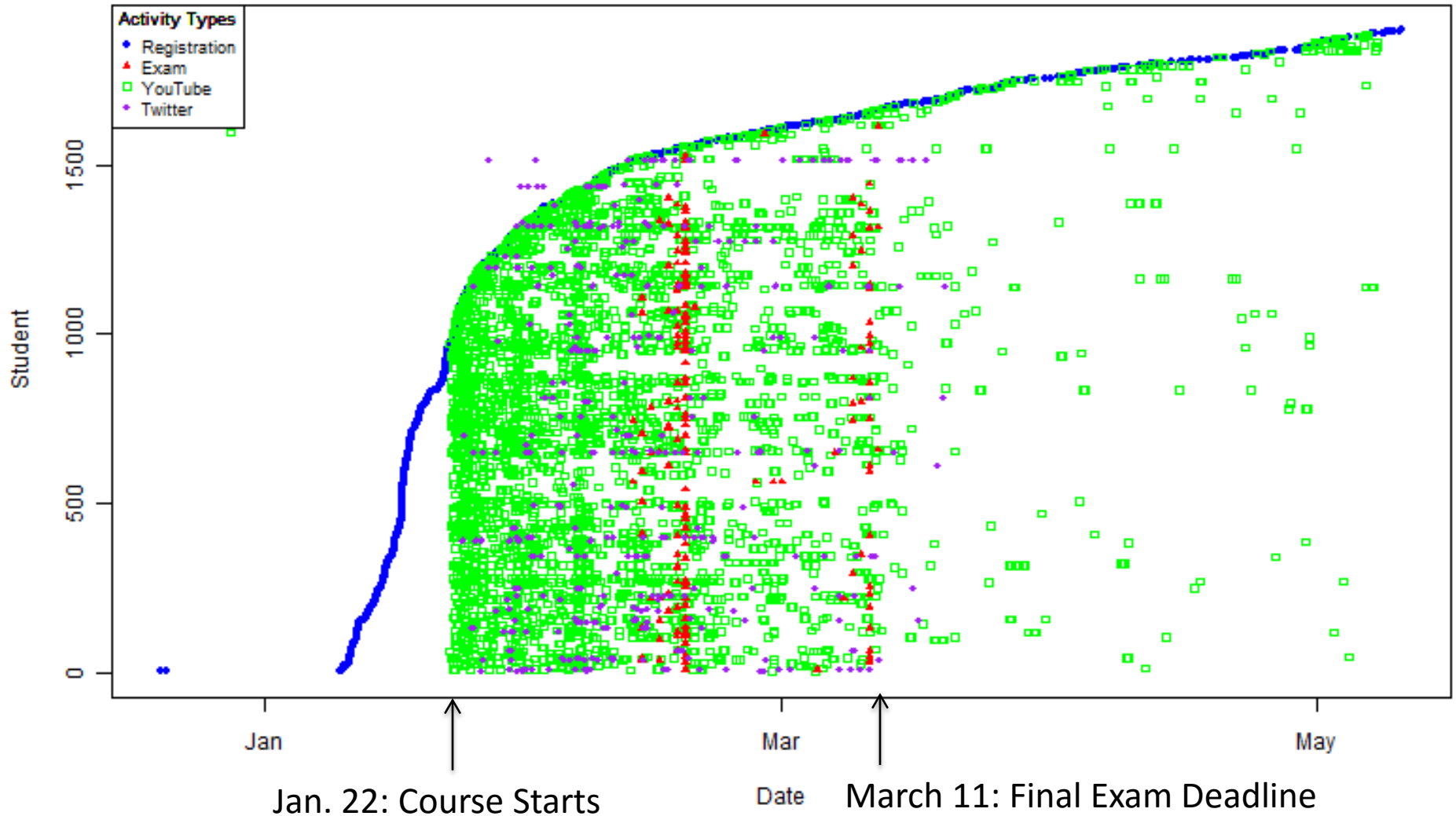
Student Registration and Activity

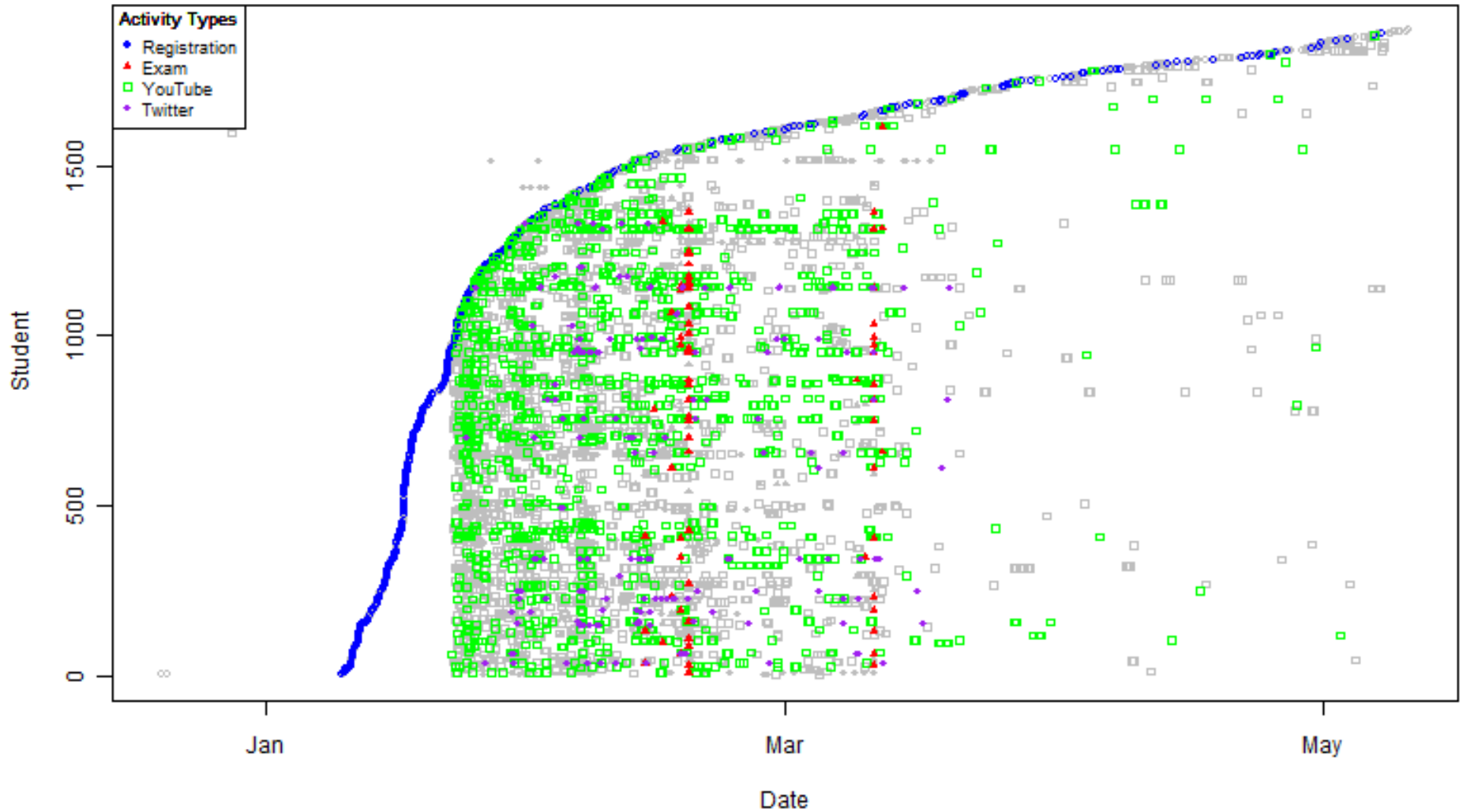IVMOOC Student Activity (Achievement Badge)

Student Registration and Activity

1215 male students
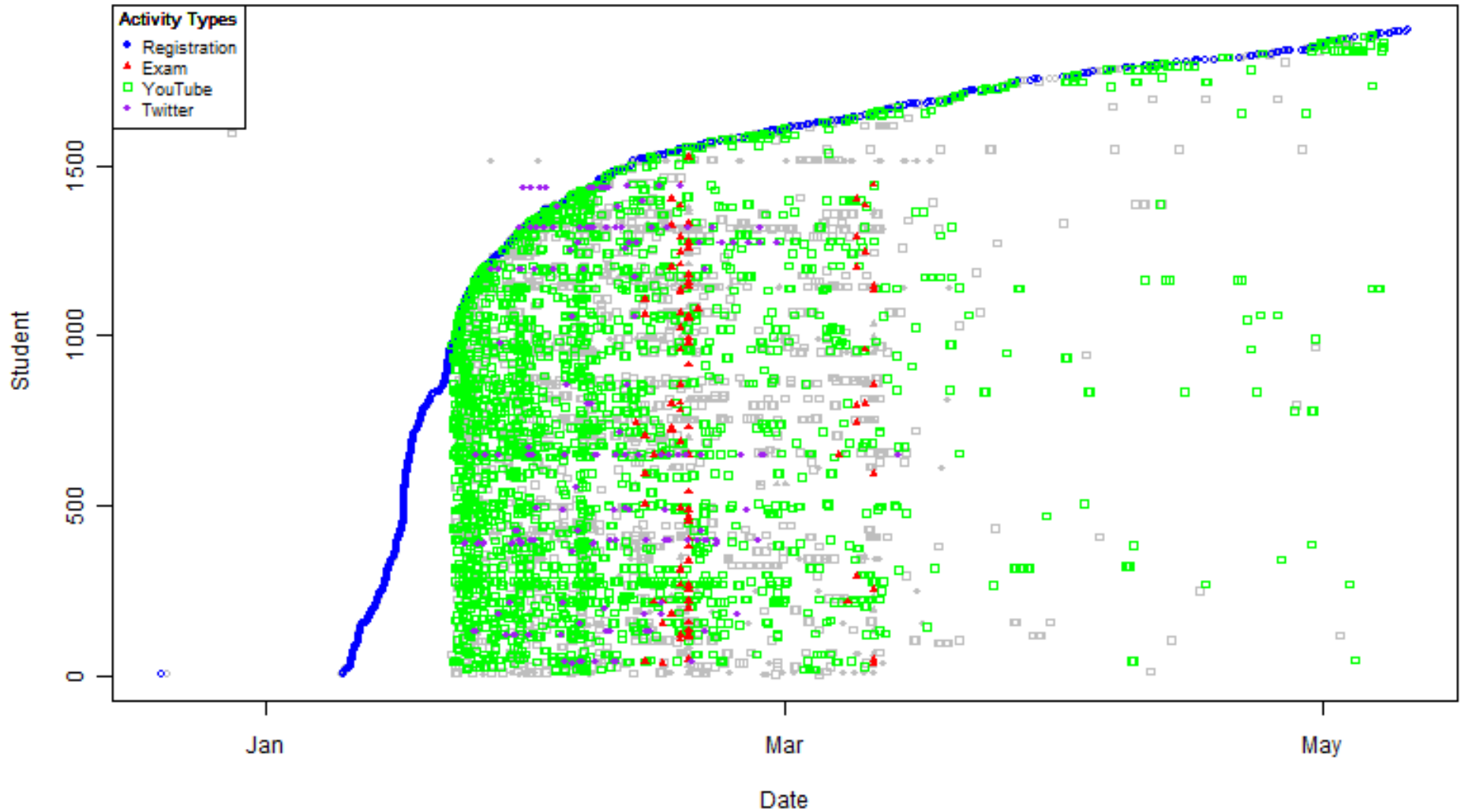557 female students

Female IVMOOC Student Activity

Student Registration and Activity
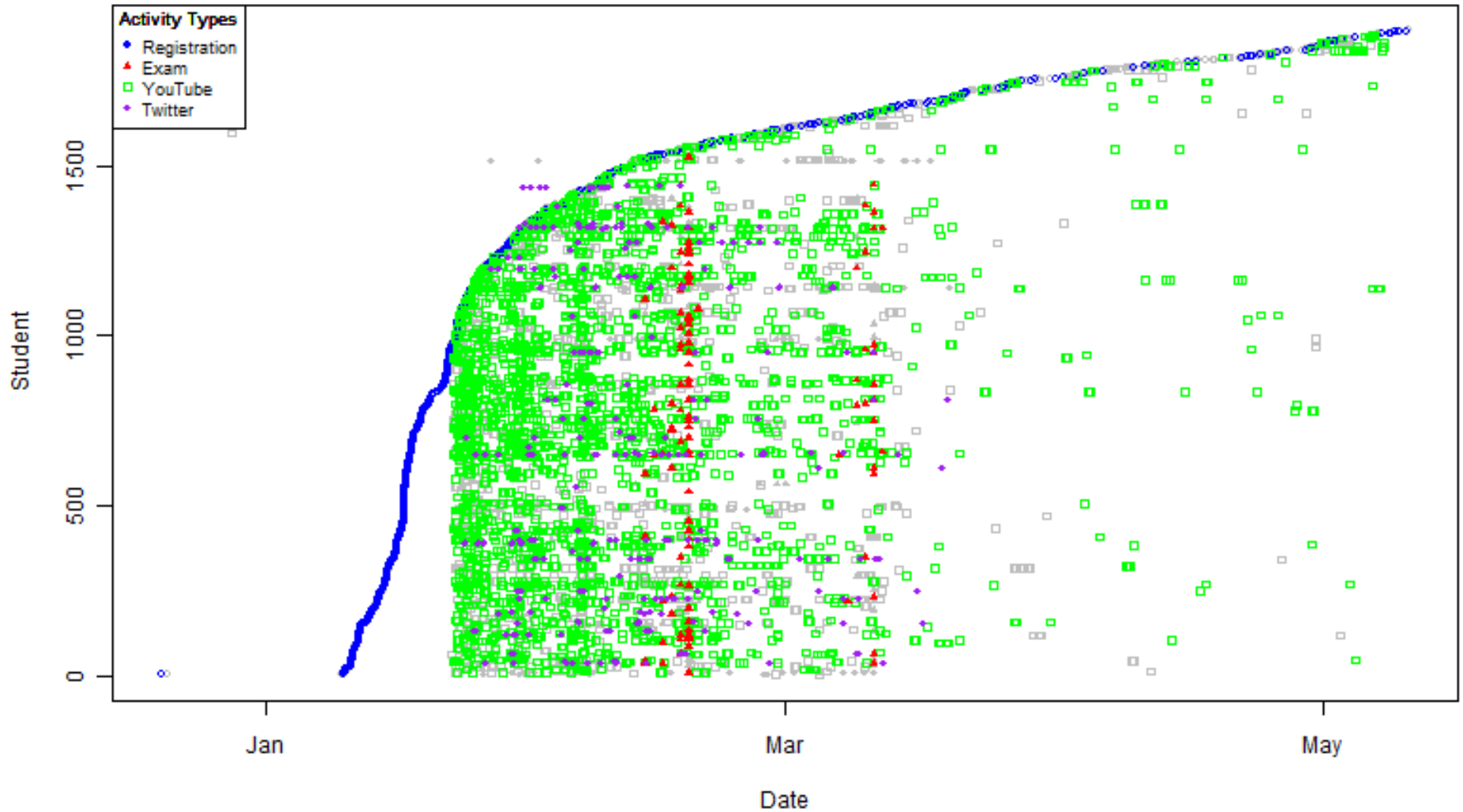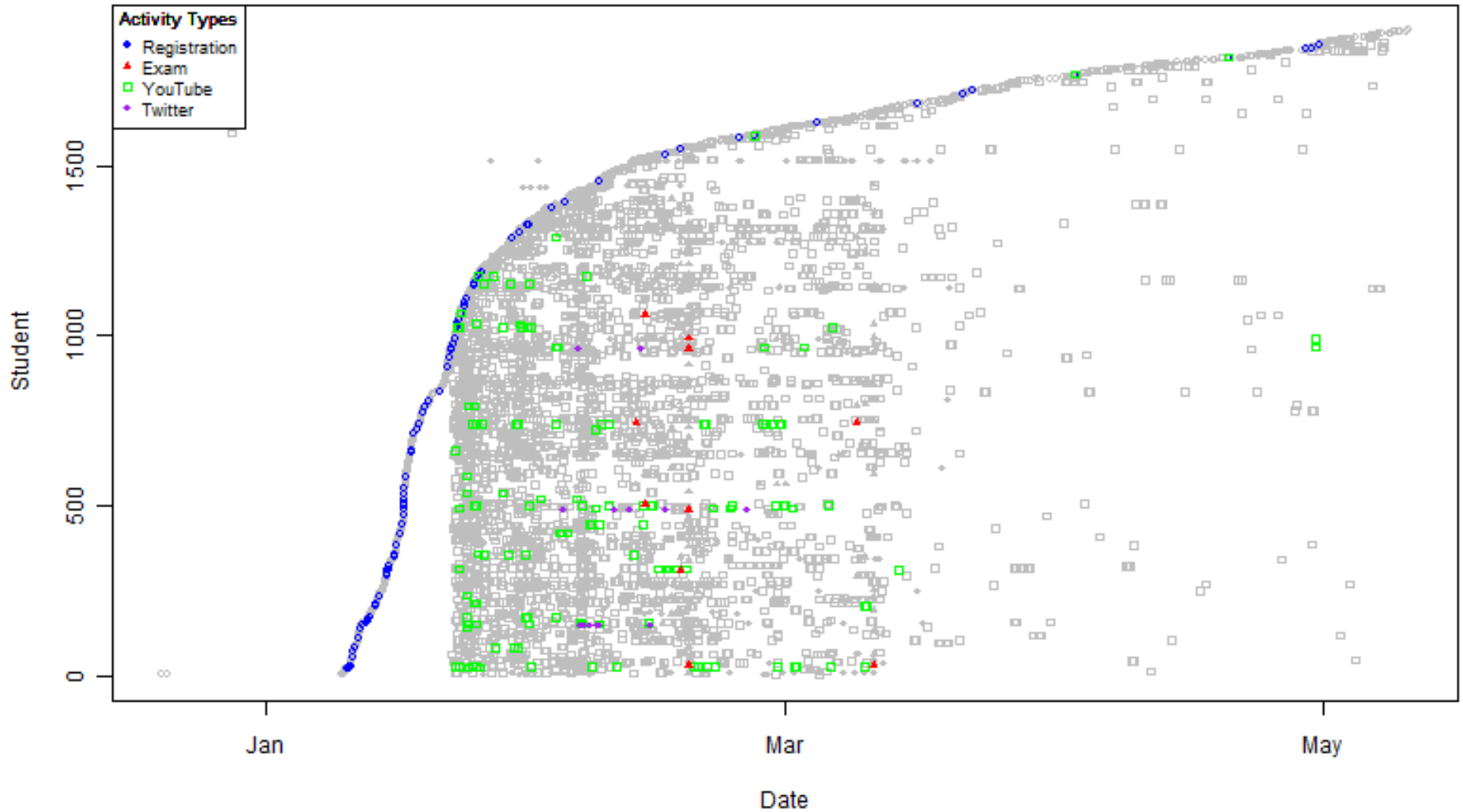
1215 male students
557 female students

Male IVMOOC Student Activity

Activity Types
- Registration
- Exam
- YouTube
- Twitter

Student

Jan   Mar   May

Date

Student Registration and Activity

Novice IVMOOC Student Activity
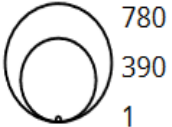
Student Registration and Activity

Students' Countries

Legend

Year
- 2013
- 2014

Students
- 780
- 390
- 1

Top 5 Countries

2013	2014
U.S. (33.4%)	U.S. (39.5%)
India (6.8%)	India (8.7%)
U.K. (4.6%)	U.K. (5.1%)
Canada (3.7%)	Canada (3.3%)
Netherlands (3.5%)	Spain (2.7%)

253 students did not identify a country in 2013
110 students did not identify a country in 2014
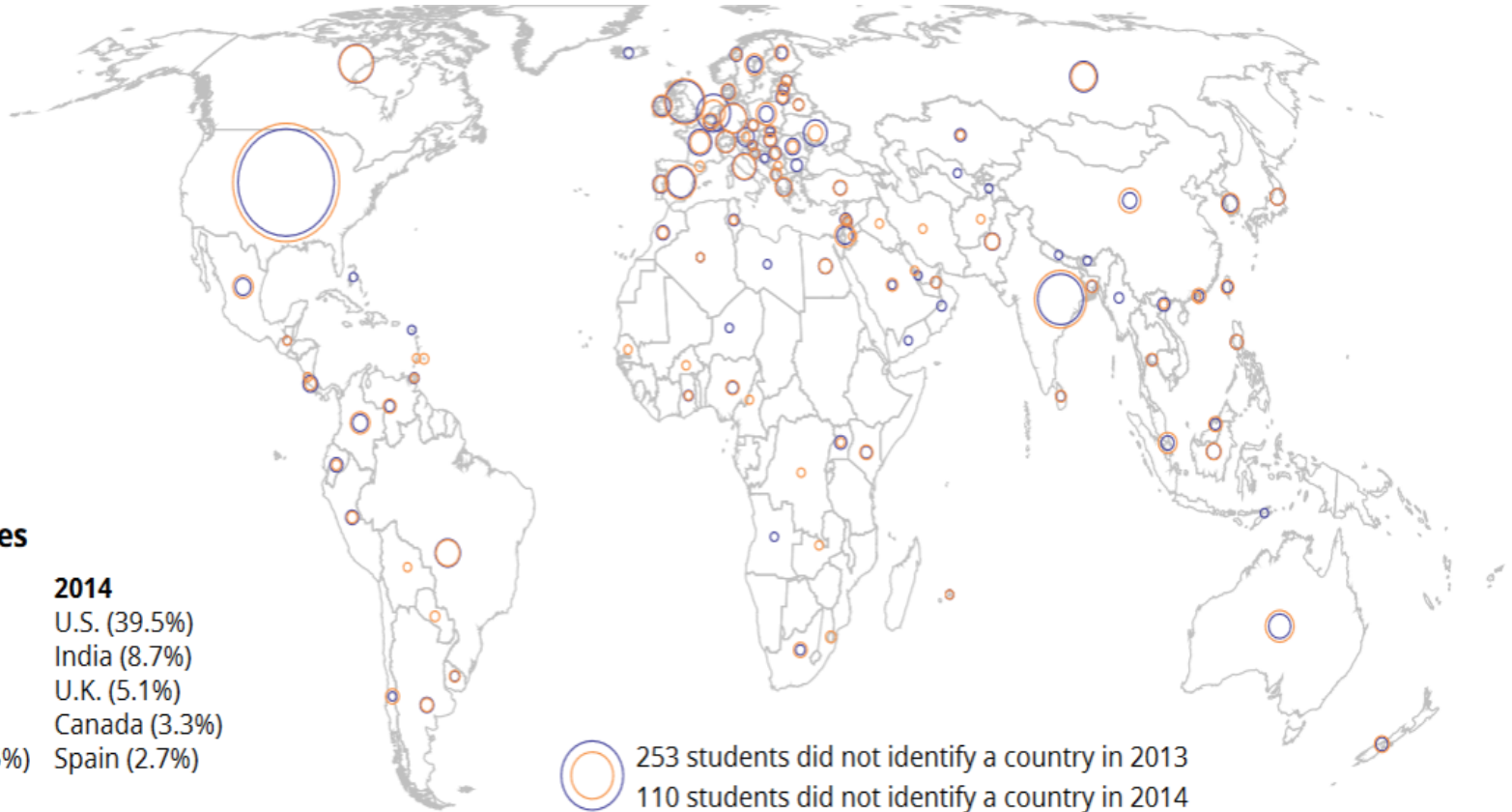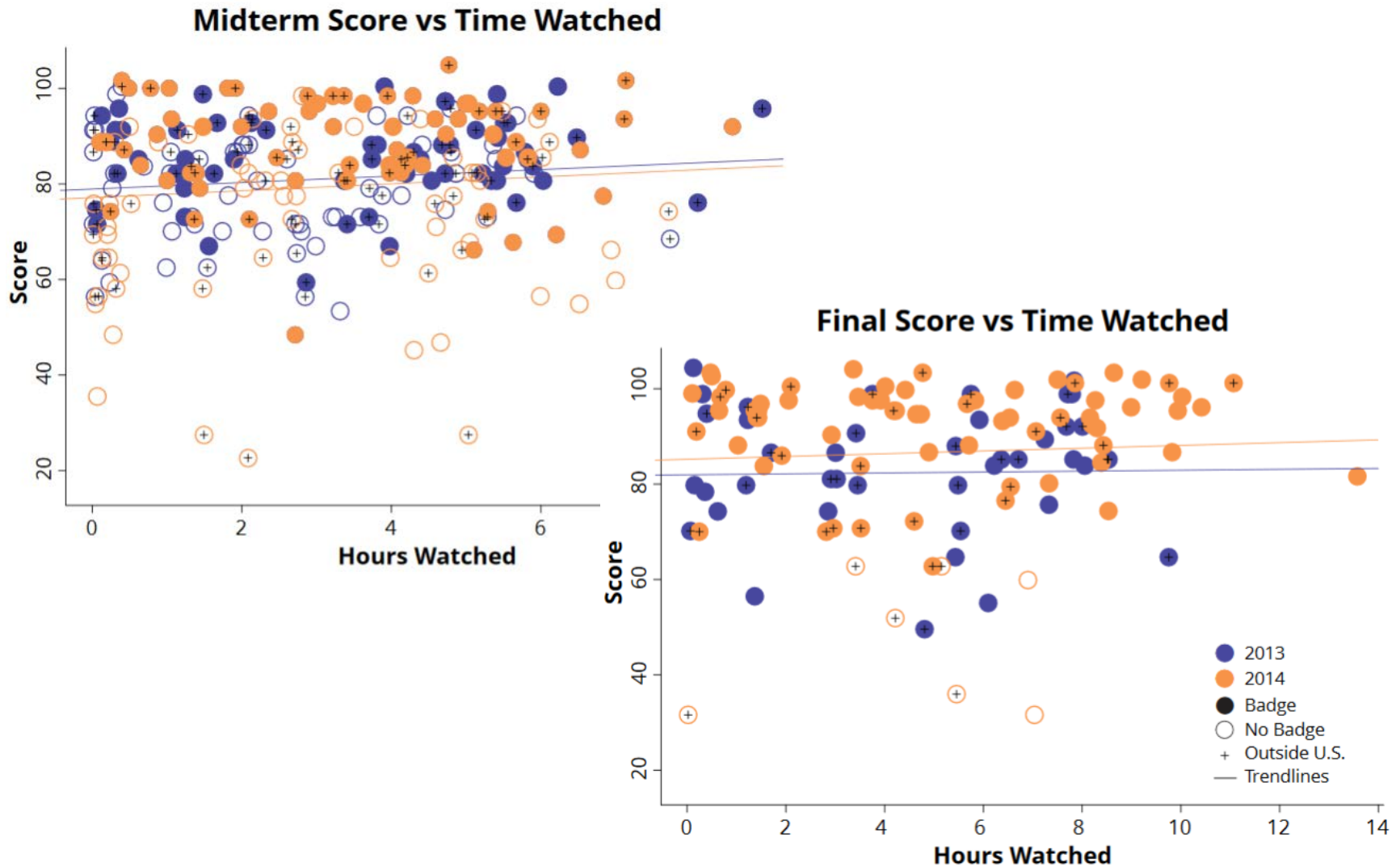
Proportional symbol map of the world showing the location of IVMOOC students from 2013 (blue) and 2014 (orange). Circles are area size coded by the number of students per country.
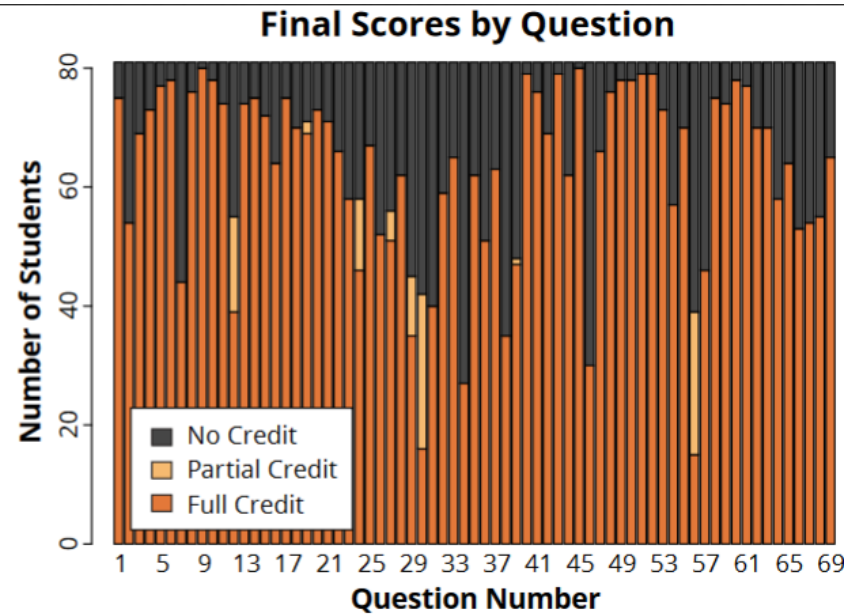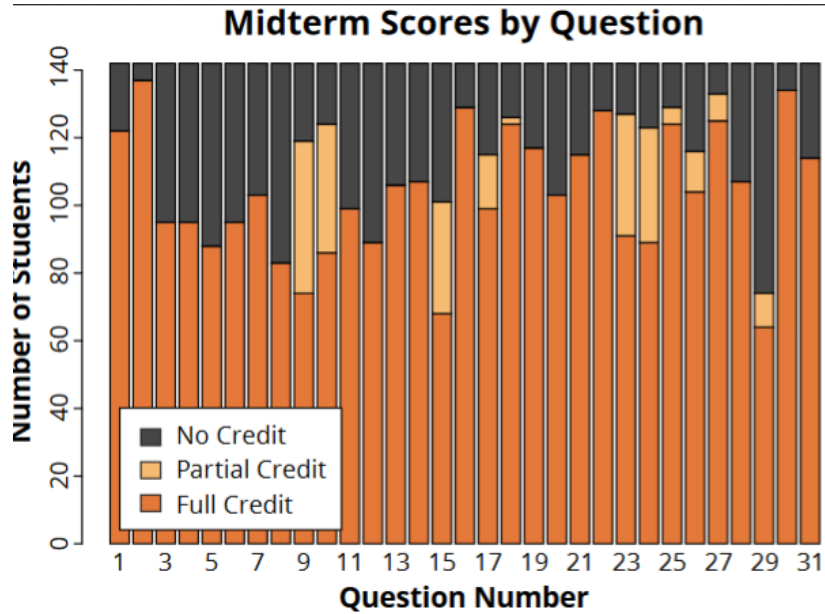
Student Final Score vs. Hours Watched

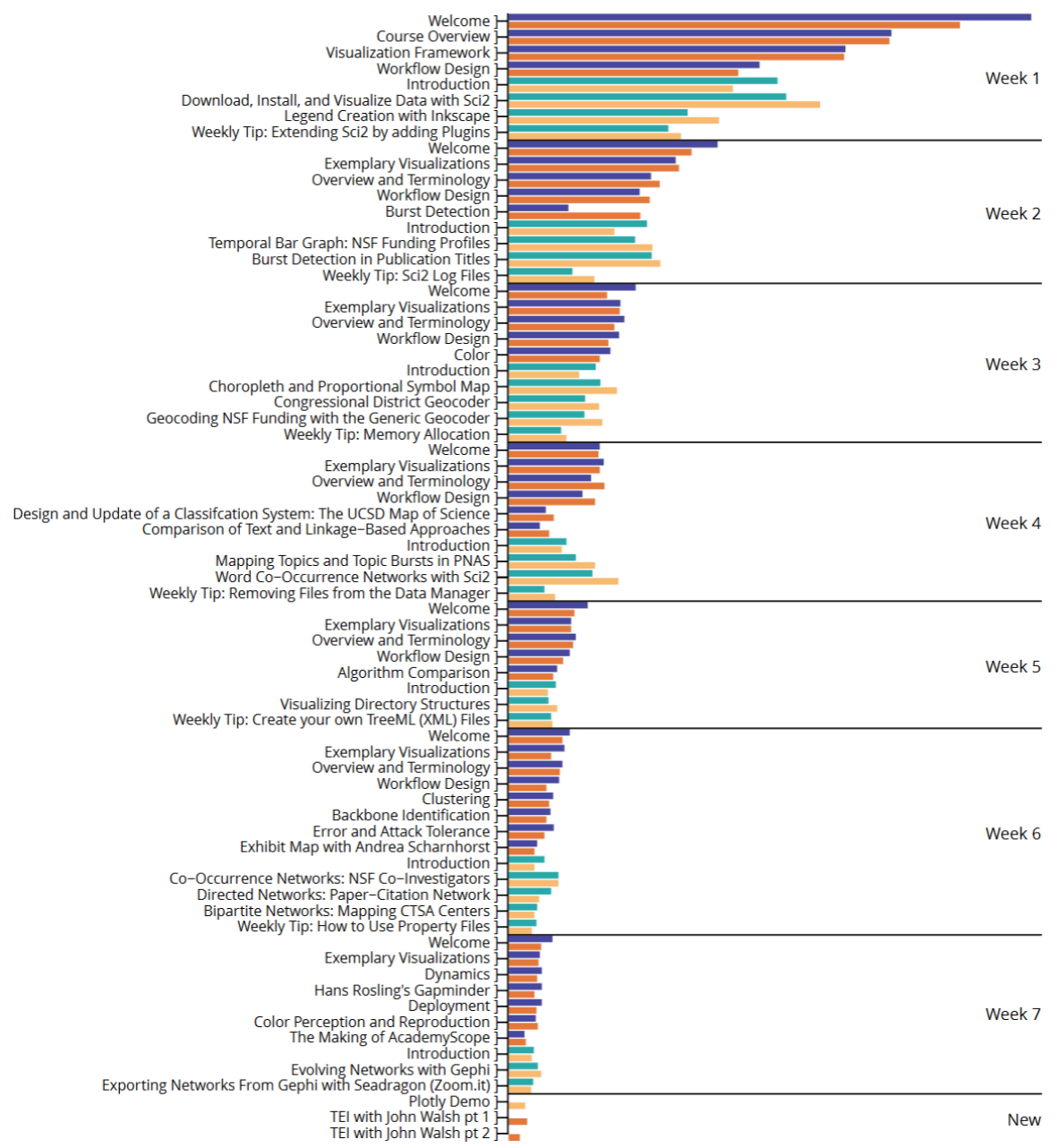Scores vs. time invested watching course videos for students who took the 2013 (blue) and 2014 (orange) IVMOOC midterm (left) and final exam (right) and got at least 50% correct.
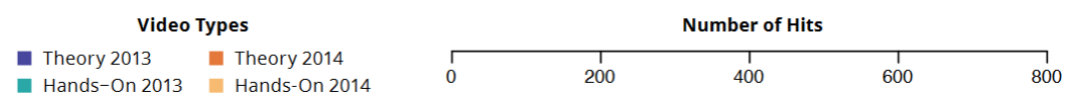
Exam Scores by Question

Student scores per question for midterm (left) and final exam (right) for IVMOOC 2014.

IVMOOC Video Views

IVMOOC video views in 2013 (blue) and 2014 (orange)

Student Client Projects: All Interactions
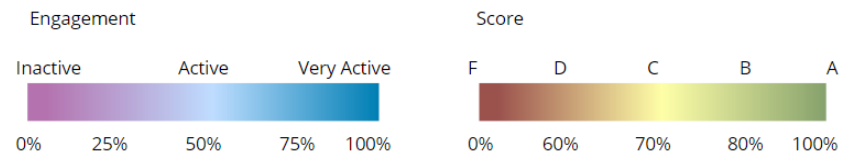
Student Engagement and Performance

Learning Analytics

IVMOOC 2015 Student Group Engagement and Scores

	Pre-Course	Week 1	Week 2	Week 3	Week 4	Midterm	Week 5	Week 6	Week 7	Week 8	Week 9	Final	Curr. Score
IVMOOC	26.05%	38.32%	31.32%	29.96%	27.1%	28.34%	31.07%	24.28%	16.86%	18.23%	13.08%	13.41%	20.87%
Z637-29374	33.01%	52.91%	49.89%	59.22%	50.89%	82.56%	65.04%	49.99%	39.59%	61.63%	54.91%	82.25%	82.4%
Z637-32593	25.08%	54.54%	43.58%	50.67%	53.63%	77.67%	65.7%	59.48%	52.19%	65.71%	47.27%	72.59%	75.13%
Z637-33781	29.33%	55.38%	49.26%	62.18%	77.47%	85%	87.4%	69.8%	55.56%	57.6%	45.69%	70.89%	77.94%

IVMOOC 2015 Student Group Engagement for Midterm

	Midterm	Final	Curr. Score	Overall Engagement
Student 198	100%	85.33%	92.67%	30.34%
Student 210	100%	84%	92%	33.91%
Student 242	97.14%	98.67%	97.9%	55.89%
Student 265	95.71%	92%	93.86%	82.64%
Student 216	95.71%	24%	59.86%	34.92%
Student 257	94.29%	98.67%	96.48%	68.25%
Student 264	94.29%	89.33%	91.81%	80.47%
Student 262	94.29%	85.33%	89.81%	79.65%

Legends

Engagement

Inactive — Active — Very Active

0%   25%   50%   75%   100%

Score

F — D — C — B — A

0%   60%   70%   80%   100%

Description

The heat map visualization is a representation of student engagement (magenta to blue color scale) and performance (red to green color scale) throughout a course. The visualization has two levels. The top level provides an overview of engagement and performance for groups of students, while the bottom level provides a detailed break out of student engagement statistics for individuals with an identified group.

Custom interactive visualizations of IVMOOC student engagement and performance data, explore functionality online at http://goo.gl/TYixCn

Student Flows – STEM Academic Career Pathways
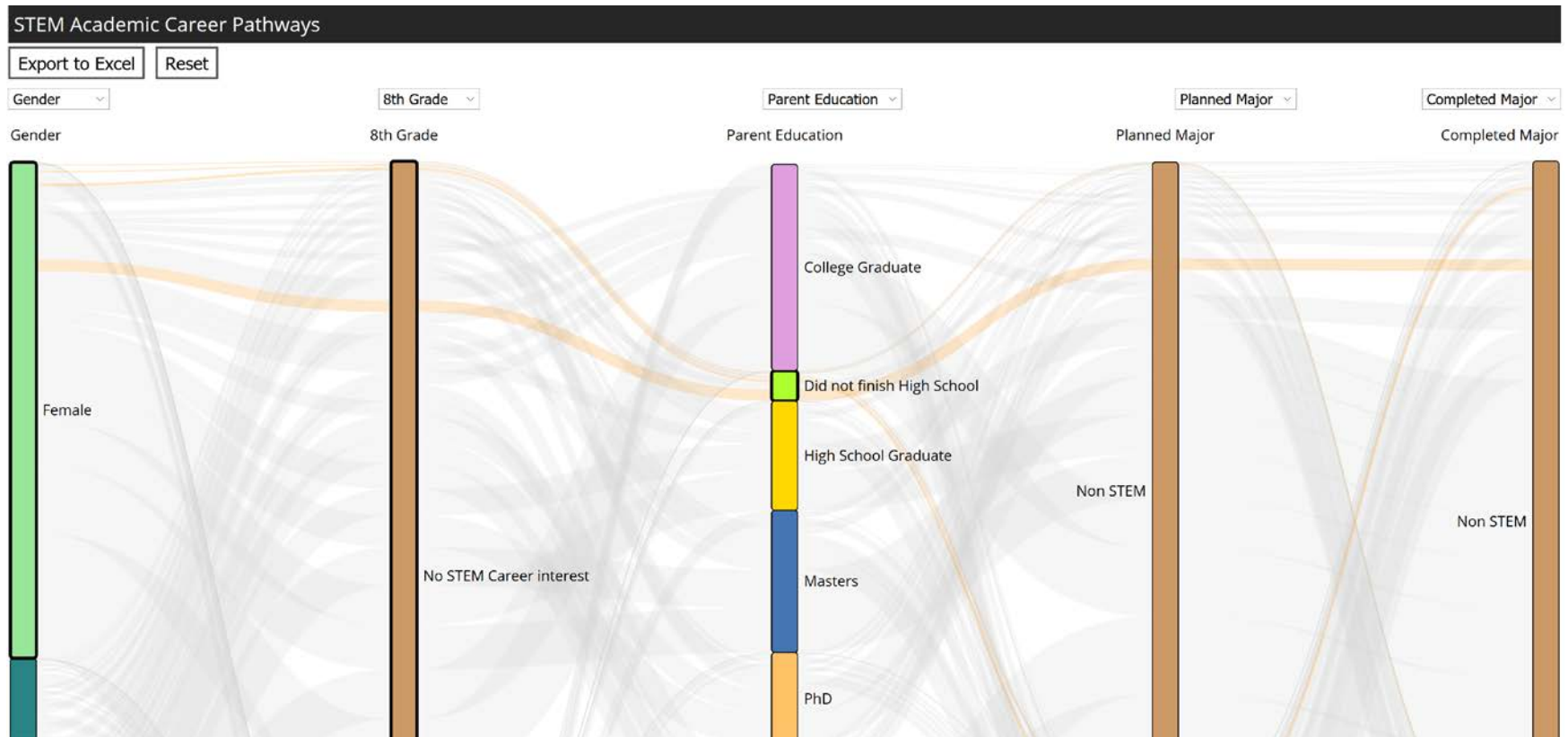
Measuring and Visualizing STEM Pathways. NSF NCSE-1538763 Award (Adam Maltese, Katy Börner) Aug. 15, 2015 - Jan. 2017.
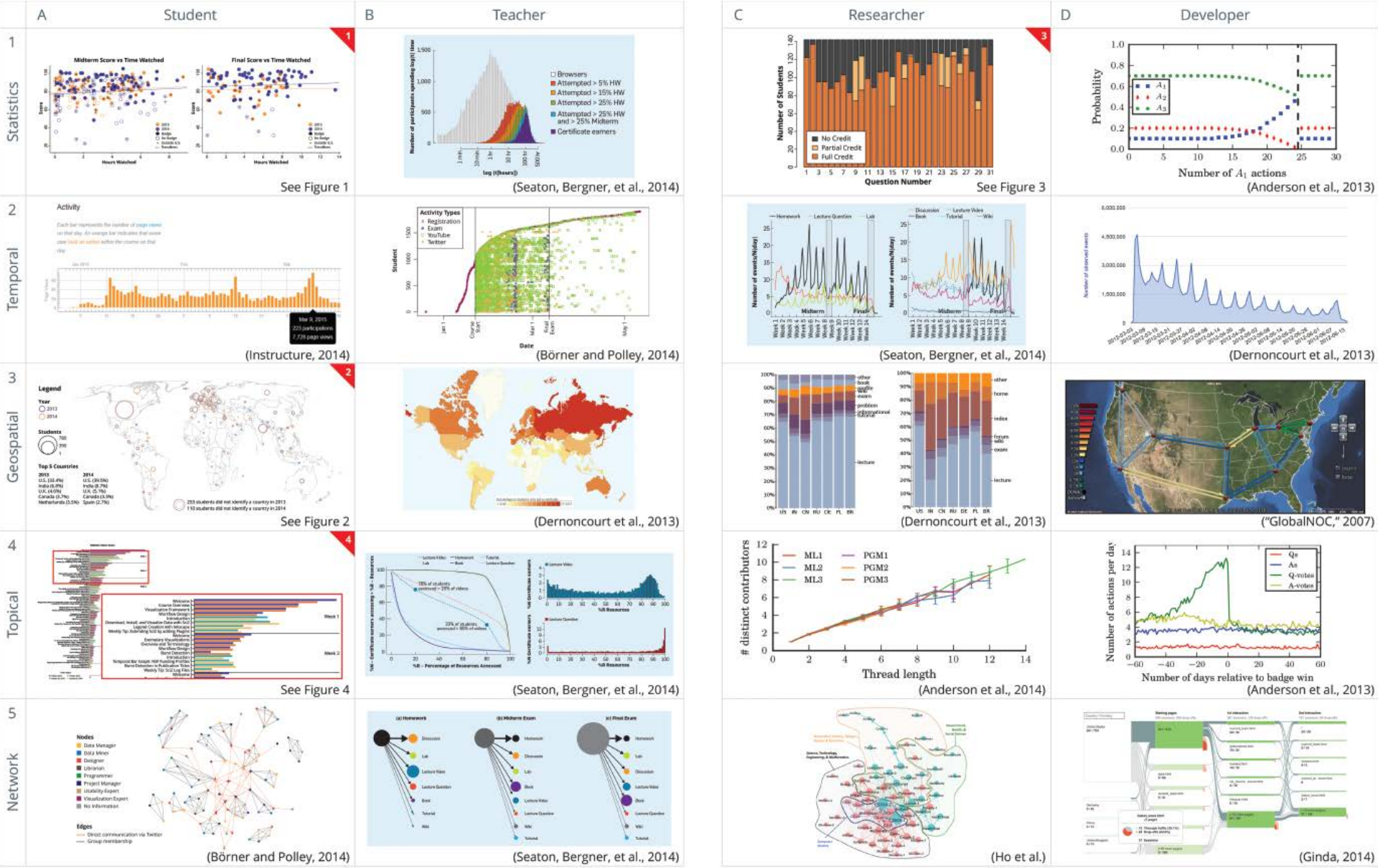
Interactive web site: http://demo.cns.iu.edu/client/stem

Student Flows – IU Data Science Program

Figure 1: Analysis types vs. user needs.

Emmons, Light, and Börner. "MOOC Visual Analytics: Empowering Teachers, Students, Researchers, and Developers of Massively Open Online Courses". *Journal of the Association for Information Science and Technology (in press)*.

Educational Data Science:
Precision Learning, Teaching, and Leadership
IU Emerging Area of Research Proposal

"We will develop, validate, and optimize models that explain and help predict the impact of different interventions on student success at IU and in life."

Big Questions

- What would college students, faculty, and other stakeholders do differently if they had easy, first-hand access to the data already created by college life in the information age?
- What wisdom about learning and life could students actualize from pathways visualized through documents, data, code, expertise, laboratory outcomes, class performance, and grades?
- What leverage points for learning could faculty discern and operationalize?
- What interventions should faculty/units/institutions implement for positive gains?

Research Cores

The team will perform cutting-edge, interdisciplinary research in **Educational Data Science (EDS)** at the intersection of four research areas:

- ***Cognitive Science > Classroom Experiments*** investigates the cognitive and social variables, patterns, and leverage points in learning and teaching.

- ***Learning Science > Student Support*** investigates the impact of curricular interventions on student success at IU and in life.

- ***Decision Science: Economics of Higher Education*** investigates the economic value of education across scales—from micro to macro. ***Management/Student Choice Research*** investigates the impact of incentives and educational product offerings on short-term and long-term decision making.

- ***Data Science > Learning Analytics*** performs research on data mining, modelling, and visualization techniques that increase "data (visualization) literacy" and data-driven decision making.
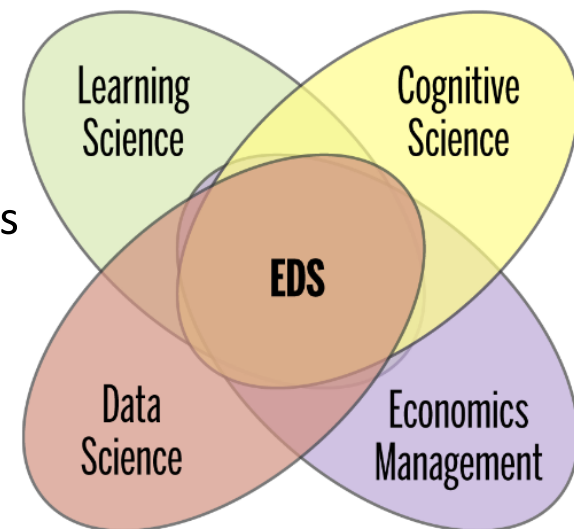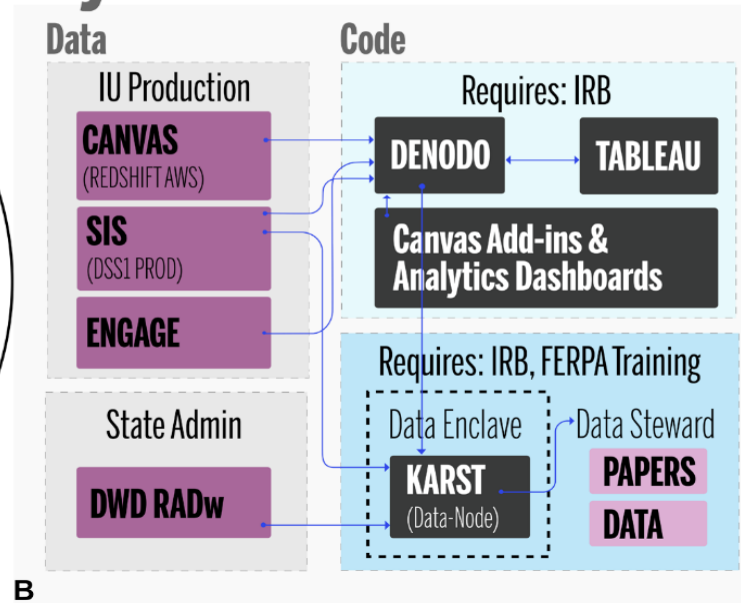
Cyberinfrastructure Core

- Implements novel means to provision sensitive data via secure data enclaves and federated Denodo virtualized databases.

- Develops novel functionality for existing learning management systems (LMS) such as Canvas using LTI and Caliper.

- Uses/extends Tableau to serve actionable dashboards for IU leadership.
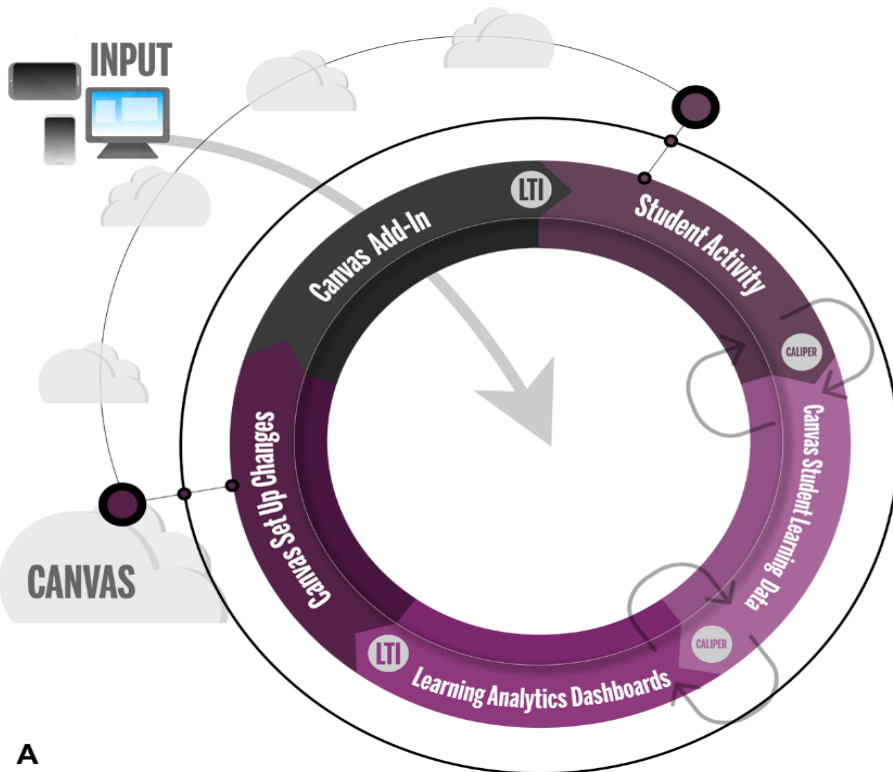
Establishing EDS and Ensuring IU Leadership

Capitalizing on existing IU strengths:

- Student Learning Analytics (SLA) Fellows Program
- Scholarship of Teaching and Learning Program
- Learning Technologies, UITS
- Learning Science Research, PBS, COAS
- Cognitive Science Program, IUB
- Learning Sciences Program, School of Education
- Bloomington Assessment and Research (BAR) office
- Indiana Business Research Center, http://ibrc.indiana.edu
- Decision Support Initiative, http://dsi.iu.edu

Proactive collaborations with other institutions:

- Unizin—11-institution digital learning consortium, http://unizin.org
- Bay View Alliance—8-institution Student Learning Analytics (SLA) initiative