empower higher education

FREE webinar, 26 September 2017 11.00 – 12.00 (CEST)

EADTU

Assessing Students and Tutors with Learning Analytics Dashboards

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20 YEARS HELLENIC OPEN UNIVERSITY

Outline

- Big Data, Data Mining & Learning Analytics
- The HOU Data Ecosystem
- Learning Analytics Approaches and Tasks
- Experiments and Results
- Conclusions

The PYTHIA Recommender System

- A framework and a software system
- Provides solutions in terms of scientific inquiries
- Selection of HW/SW artifacts in PSEs
- Quickest and most efficient solution

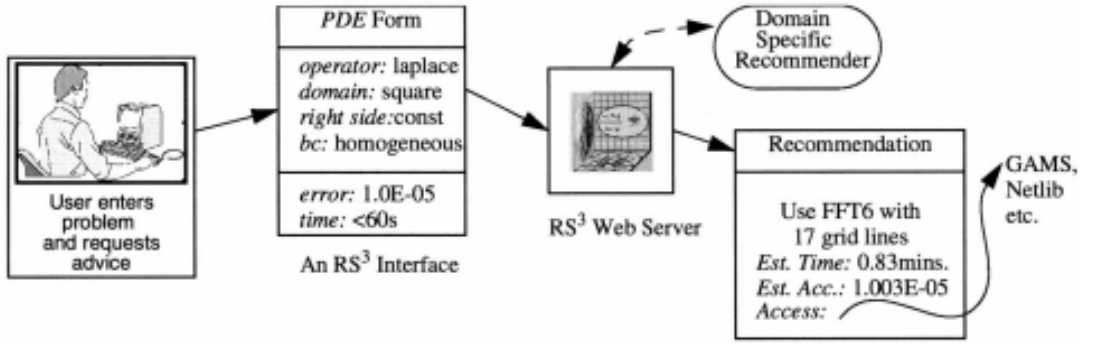
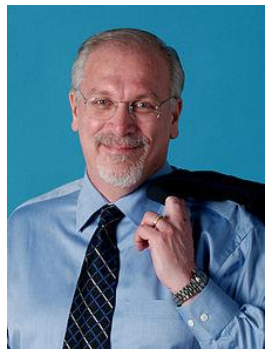


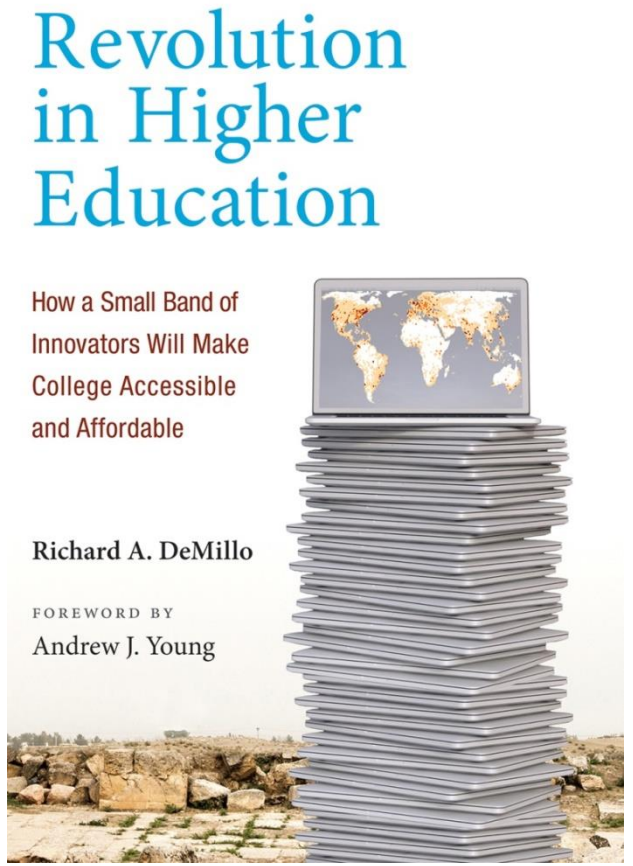
Fig. 1. The recommender component of PYTHIA-II implemented as a web server providing advice to users.

Revolution in Higher Education

- Outlines the problems HEIs are facing today
- Colleges and universities are becoming insufferably costly
- Incapable of sustaining their existence
- Many graduates lack necessary skills

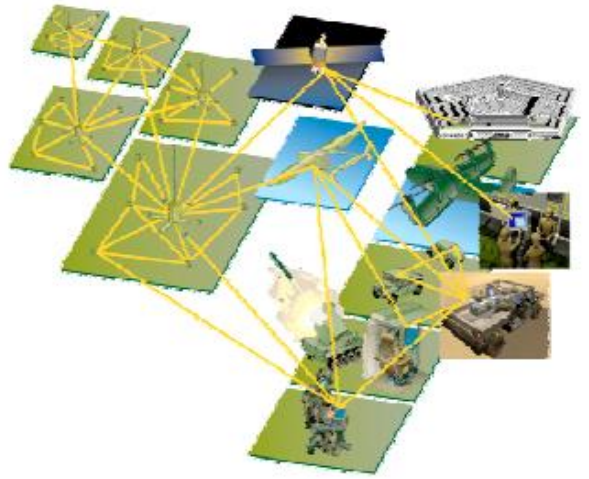


Richard Allan DeMillo



The Petabyte Age

- An era of rapidly developing technology
- Information is gathered at an ever increasing rate
- Capture, store analyze this wealth of data
- Determine how successful we are in the future



The Big Data Era

- A field of immense interest
- Store and index data
- Analyze and utilize in an efficient way
- Answers to most problems

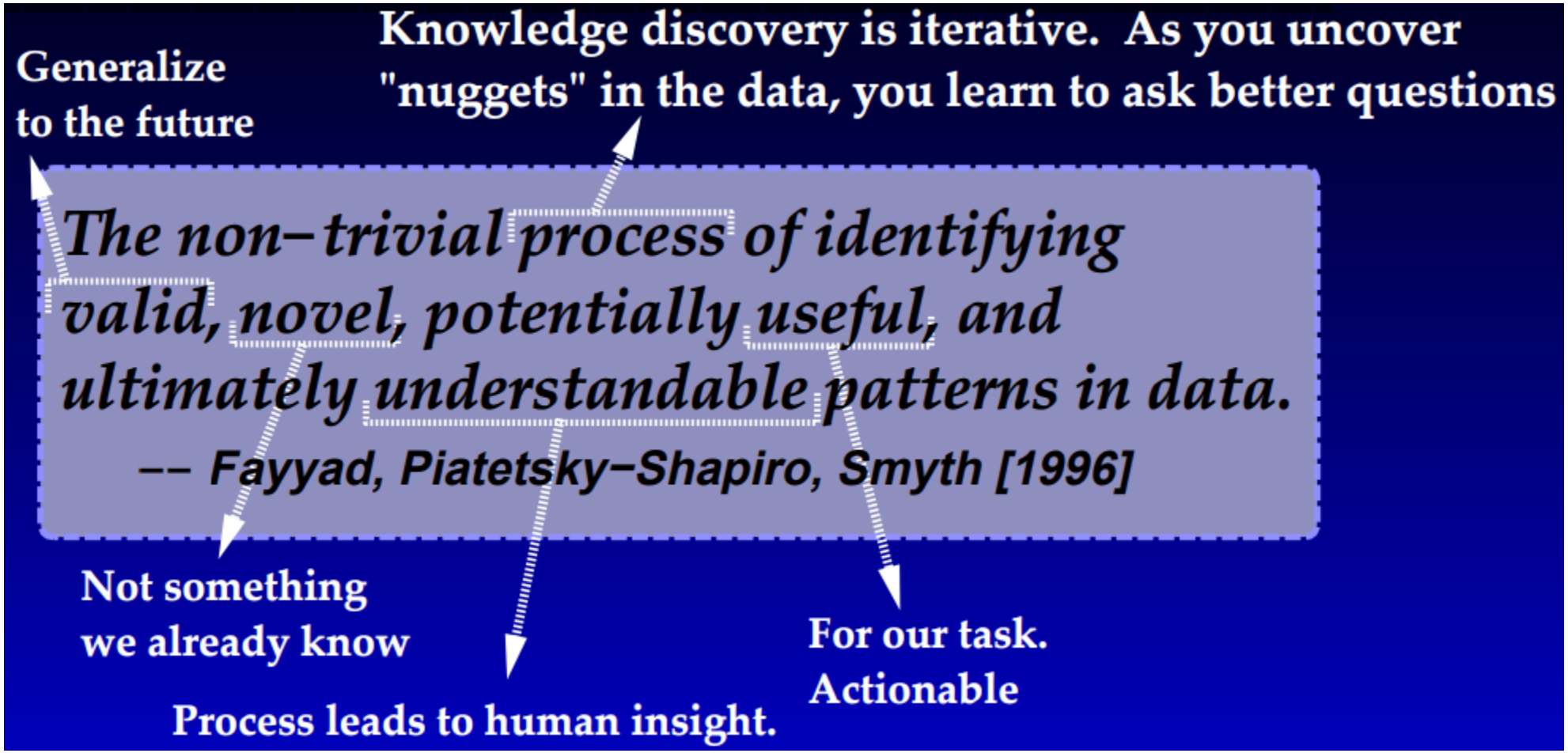
Big data is everywhere – but does it have the solution?

The End of Theory

- An author and an entrepreneur, former editor of Wired Magazine
- Shift in the way we look at data
- Rather than developing a theory
- Look for patterns, outliers, …

Chris Anderson

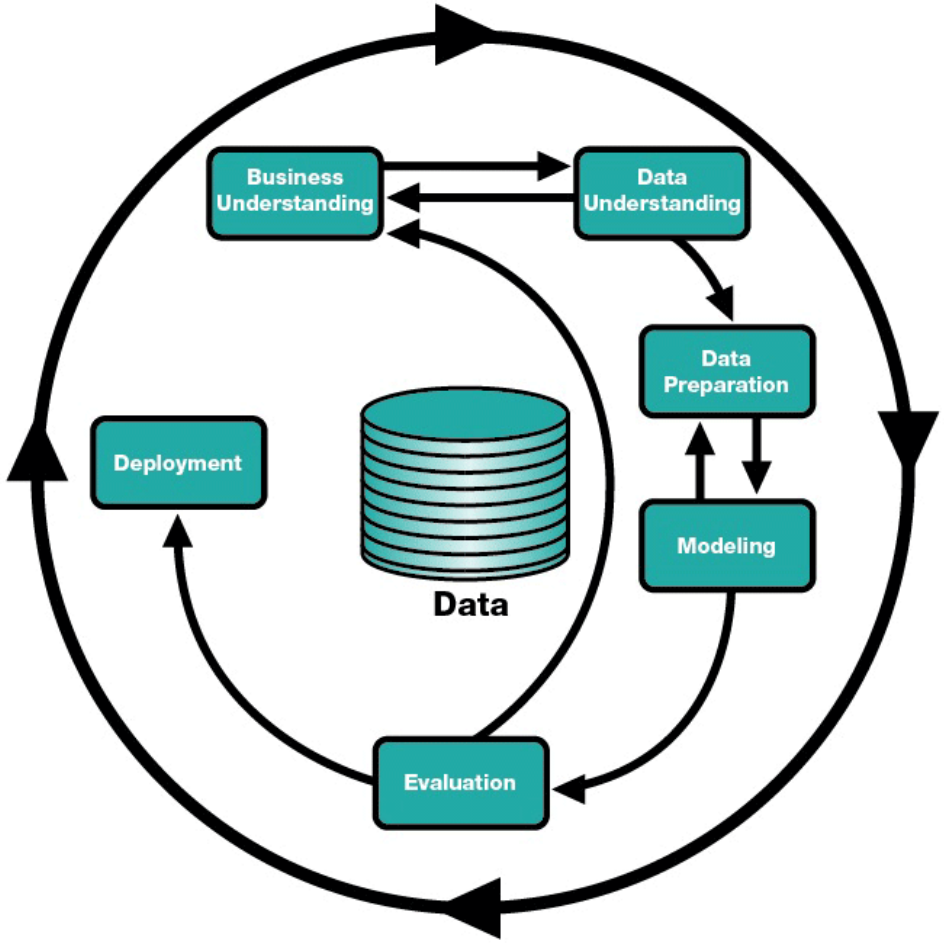
Data Mining



Ronny Kovahi, *Crossing the Chasm: From Academic Machine Learning to Commercial Data Mining*, ICML 1998

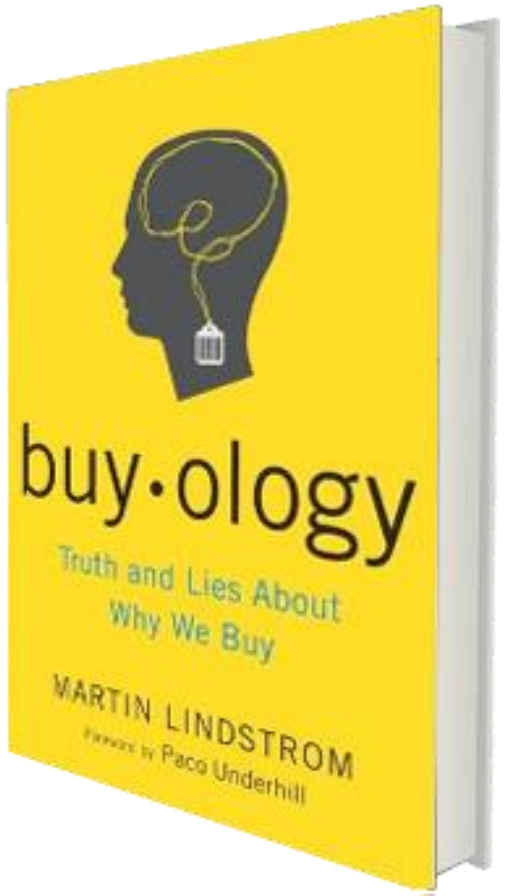
CRoss Industry Standard Process

- Describes the commonly used approaches by data mining experts
- Breaks the process of data mining onto six major phases
- Determining the problem, preparing the data, etc.



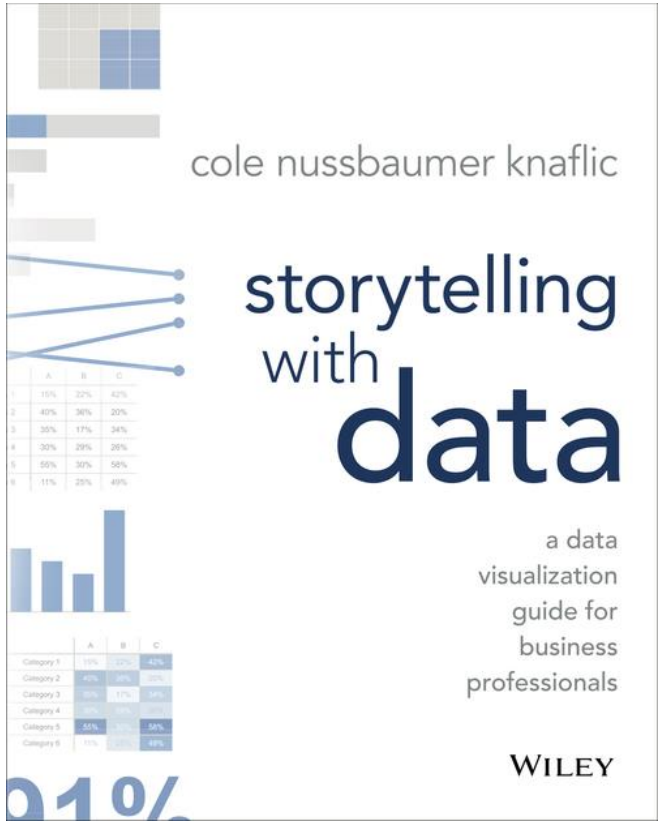
Truth and Lies about how Students Study

- Simple statistics, questionnaires and surveys
- People's answers are not always consistent with the reality
- People lying/cheating, being embarrassed
- Brain scanning test



Data Storytelling

- The Essential Data Science Skill Everyone Needs
- Not simply data visualization or analytics reporting
- A blending of "*hard data*" and "*human communication*"
- Help marketers achieve their goals

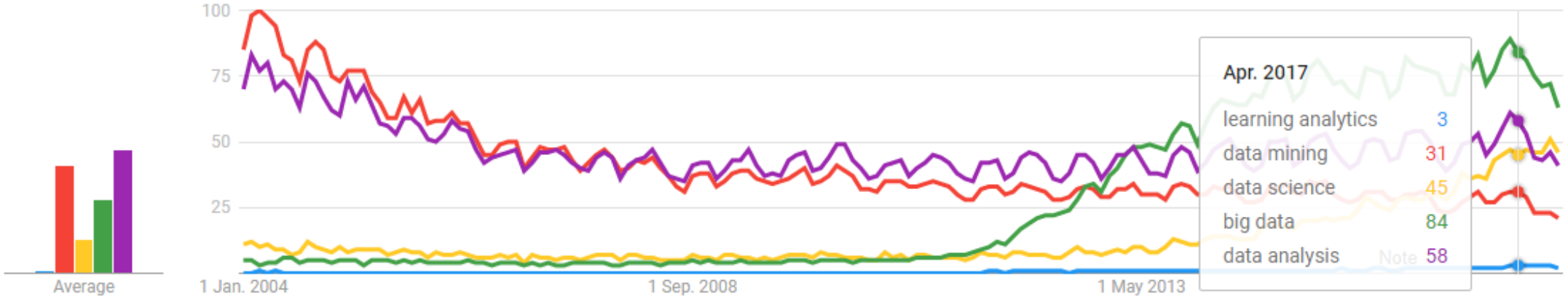


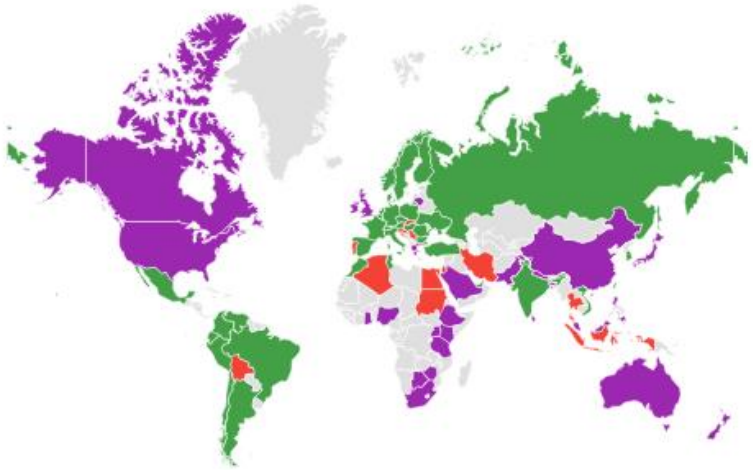
Definition(s) of Learning Analytics

- *"the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environment (s) in which it occurs"* - Siemens, G., 2011
- *"is about collecting traces that learners leave behind and using those traces to improve learning"* - Erik Duval E., 2012
- *"the use of data, which may include 'big data', to provide actionable intelligence for learners and teachers"* – Ferguson R., 2014

Type of Analytics		Level or Object of Analysis	Who Benefits?
Learning Analytics	**Educational data mining**	**Course-level:** social networks, conceptual development, discourse analysis, "intelligent curriculum"	Learners, faculty
		Departmental: predictive modeling, patterns of success/failure	Learners, faculty
Academic Analytics		**Institutional:** learner profiles, performance of academics, knowledge flow	Administrators, funders, marketing
		Regional (state/provincial): comparisons between systems	Funders, administrators
		National and International	National governments, education authorities

Evolution of Trends

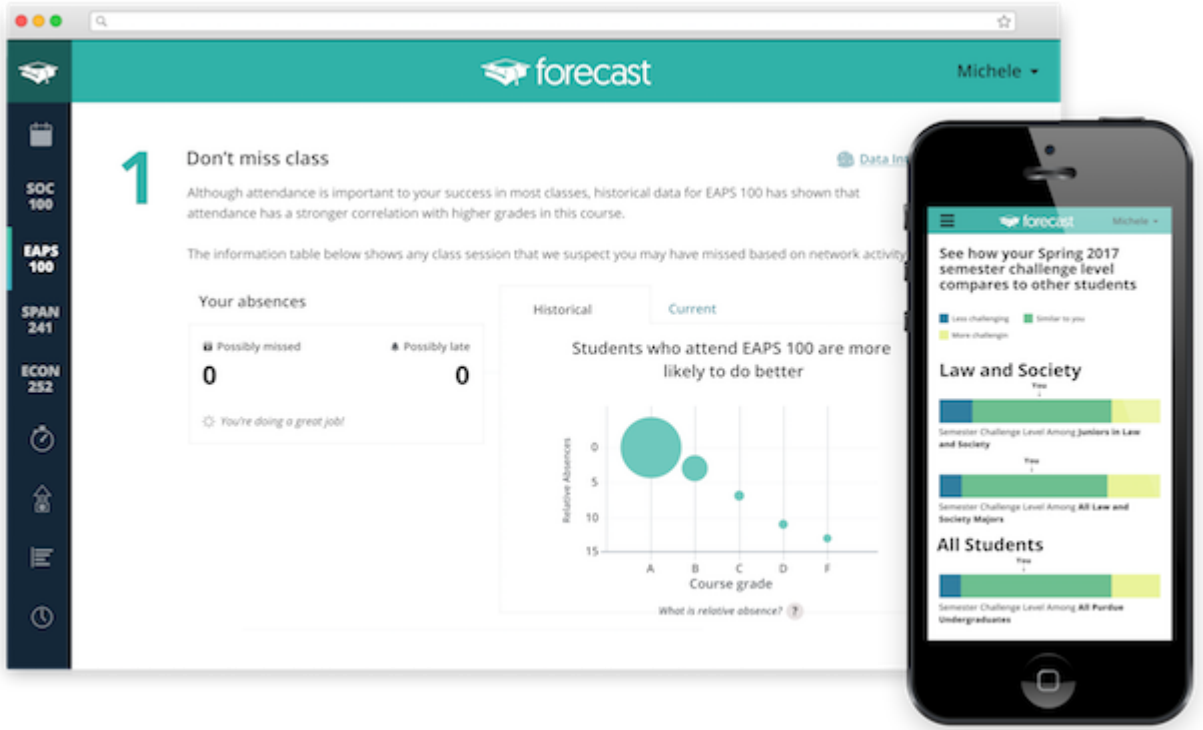




- “Data Mining” and “Data Analysis” give place to “Data Science” and “Big Data”
- “Learning Analytics” are still premature

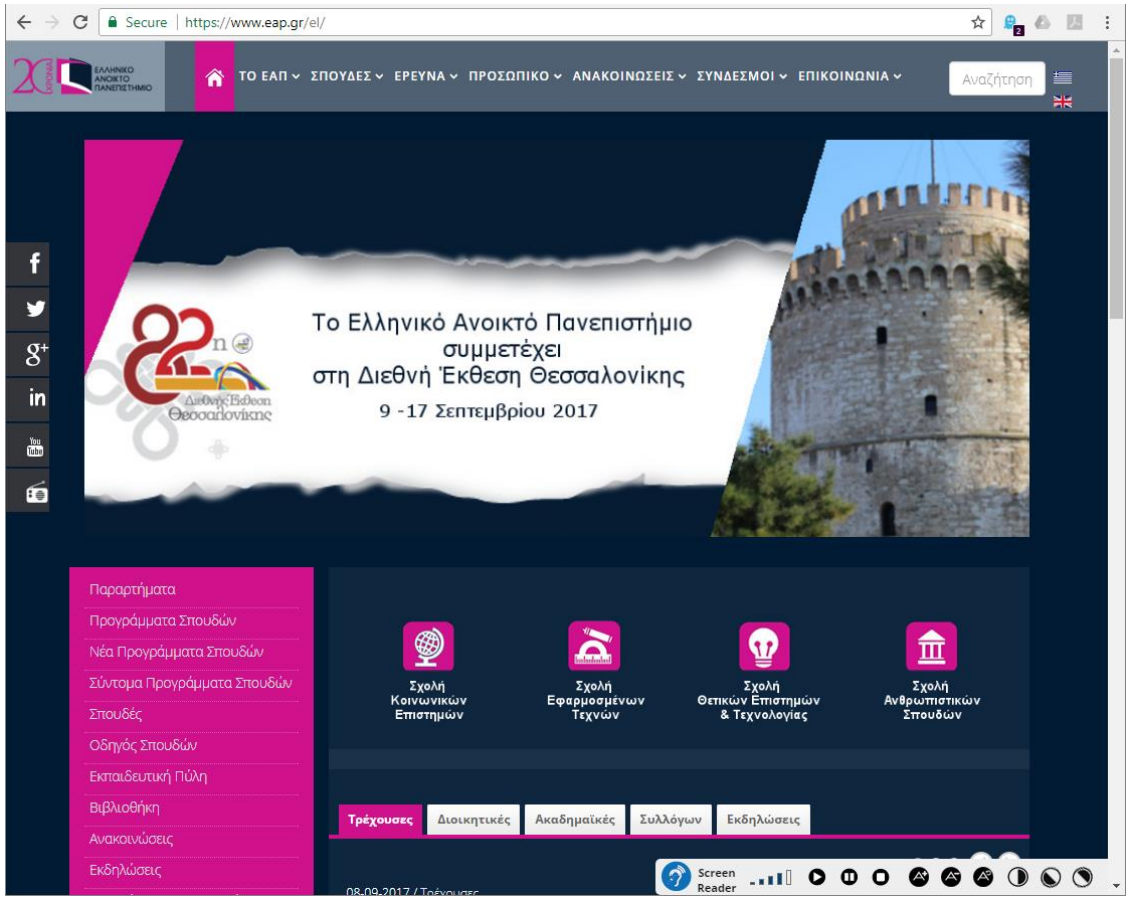
State of the Art in Learning Analytics

- Create software, services and applications
- Forecast – a Purdue-developed student success app
- Develop habits and behaviors

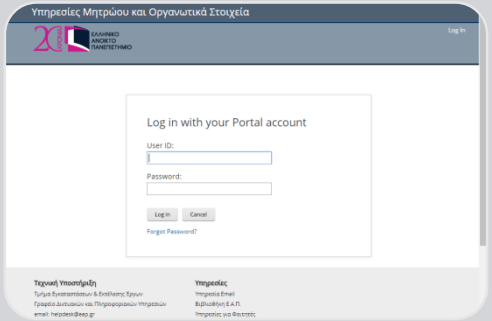


The Hellenic Open University (HOU) story

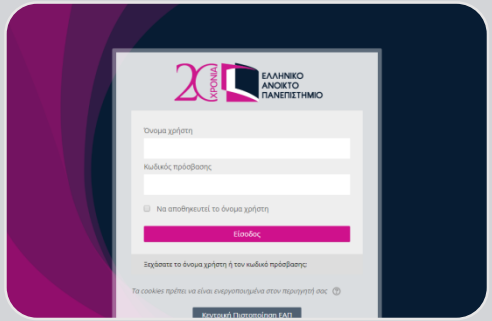
- Officially established in 1997
- The only University in Greece that exclusively offers “distance” education programs
- Four Schools (Humanities, Social Sciences, Science and Technology, and Applied Arts)
- > 40 programs
- ≈ 50 faculty members, 2000 Adjunct lecturers/instructors, 40K students, 220 employees, 12 km^2 building facilities



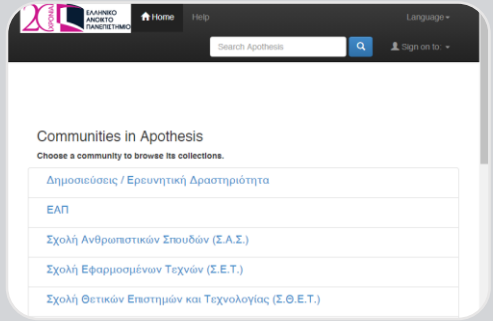
The HOU Core System Infrastructure



Students Information System (open.eap.gr)



The Learning Management System (study.eap.gr)

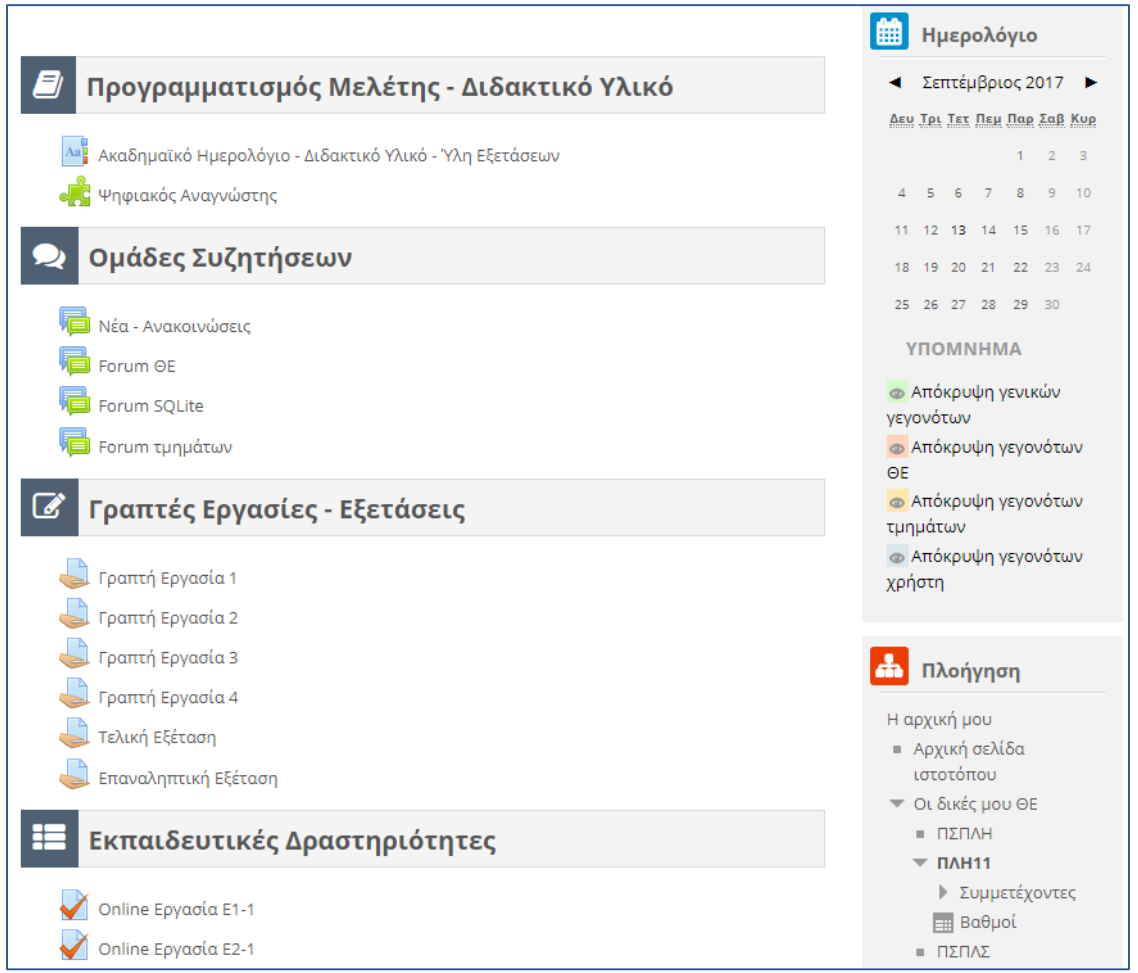


The Educational Material Repository (apothesis.eap.gr)

The web teleconference system (centra.eap.gr)

Studying in HOU

- Each program consists of modules which comprise of up to three regular university courses
- Each module includes five optional face-to-face group sessions that take place in approx. 9 cities in Greece
- Students have to submit 4-6 written assignments throughout the academic year period at the end of which they participate in a compulsory written exam



Our case study

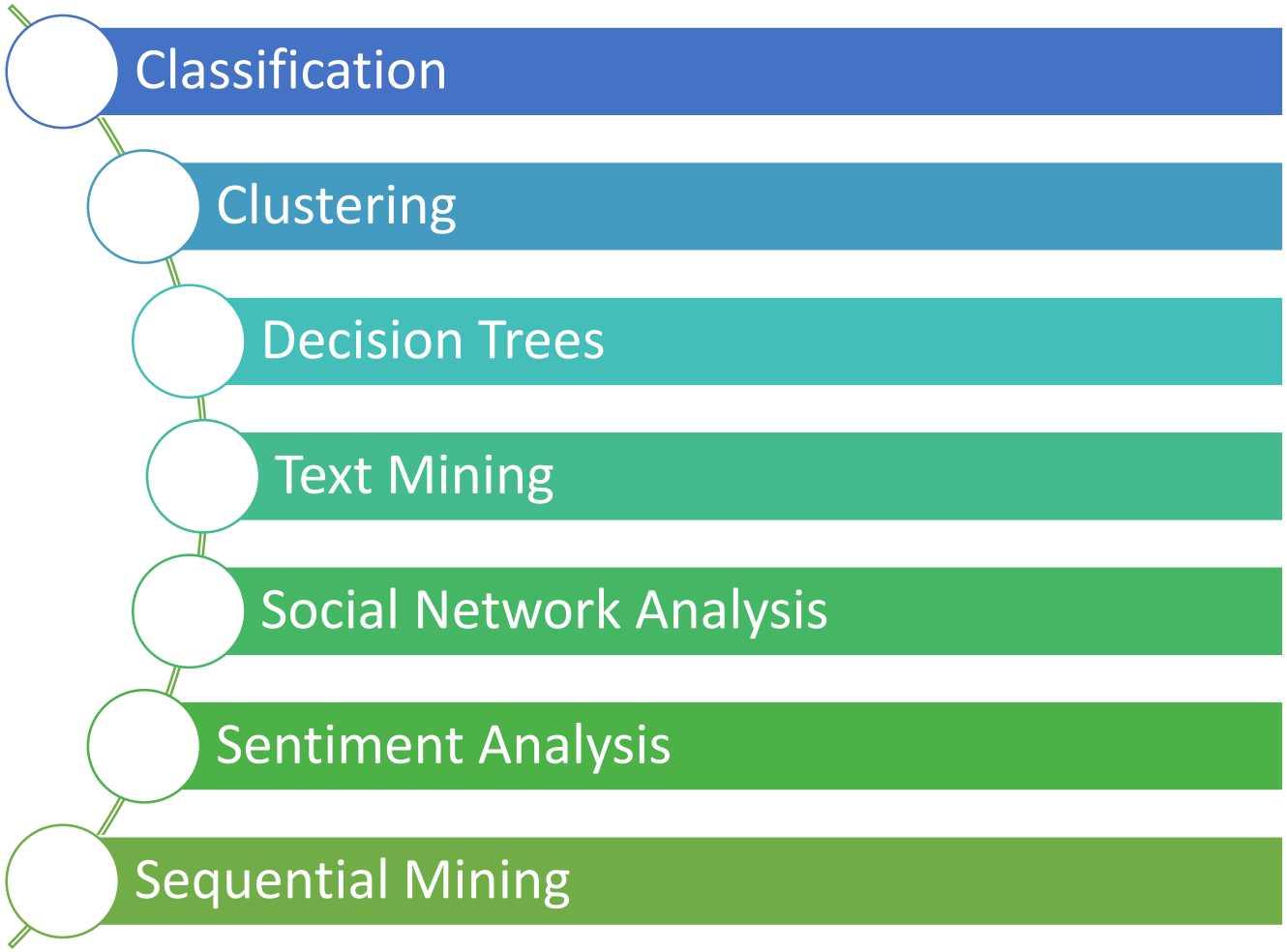
- Student Admission data (1M records) during 2003 - 2013
- Bachelor in Computer Sciences
  - Principles of Software Engineering (PLI11) module
- Master's in Information Systems
  - Specialization in Theory & Software (PLS50) module
  - Specialization in Software Engineering (PLS60) module
- Code - Create - Learn with Scratch (Scratch Coding)

Learning Analytics Approaches

- Non-native approaches
- Data migration
- More options available
- Entails dangers
- Scalability of the process

- Native approaches
- Process data in the origin
- Easier and requires no specialist knowledge
- Can run on real time
- Limited options

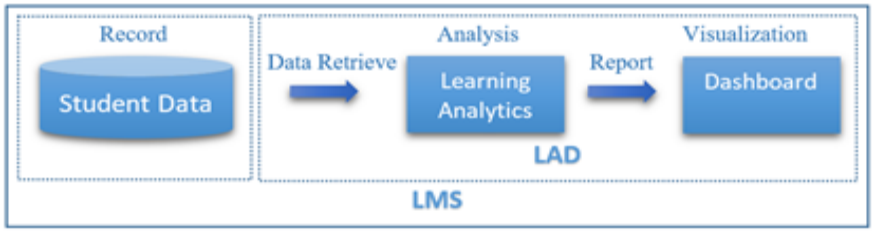
Learning Analytics Tasks

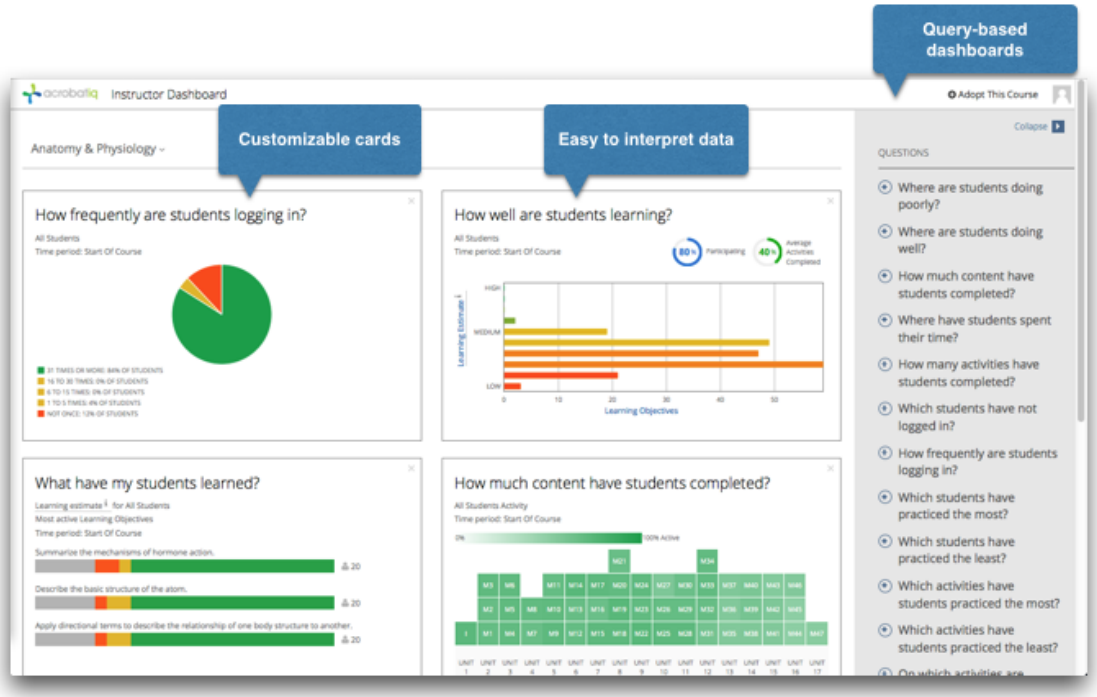


Learning Analytics Tools

Learning Analytics Dashboards

- Device Analytics
- Completion Progress
- Course Dedication
- Forum Graph Report
- Graph Analytics Block
- Configurable Report

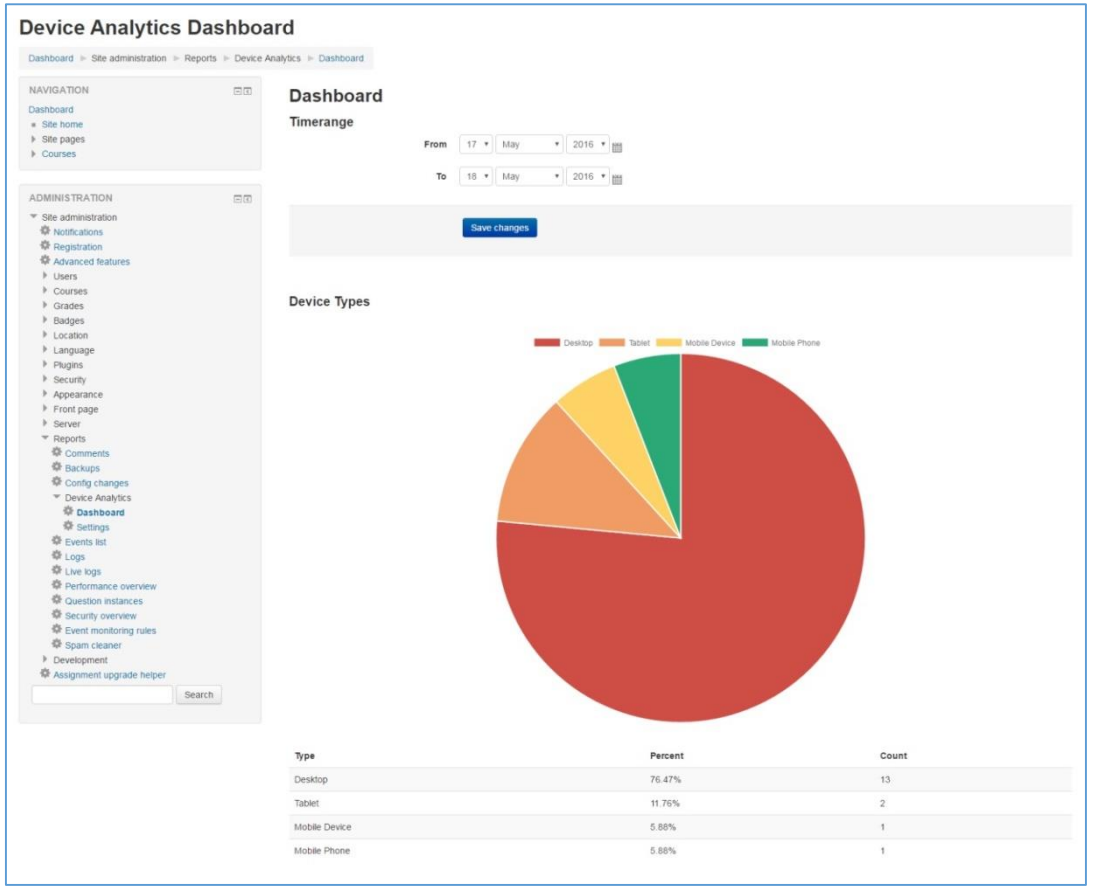




Device Analytics

Provides a quick overview of users' used devices.

- Device type
- Operating System
- Browser (version logging)
- Display and Window size
- Input type (mouse, touchscreen)

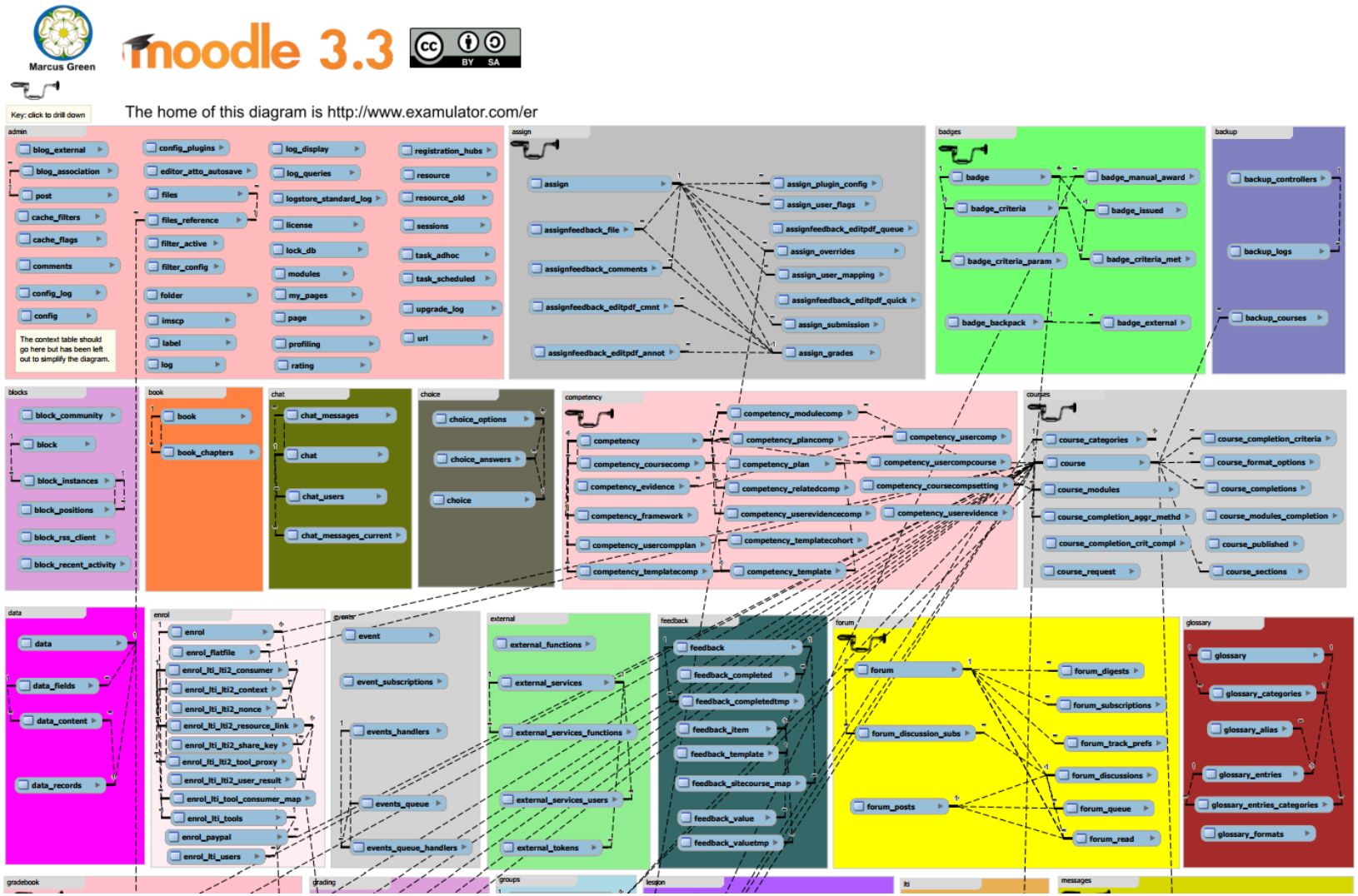


Configurable Report

- A custom reports builder
- Based on SQL queries on Moodle Database Scheme
- No SQL knowledge is required?!
- Suitable for admins or teachers
- Several types of reports:

  Courses, Categories, Users, Timeline reports, Custom SQL reports

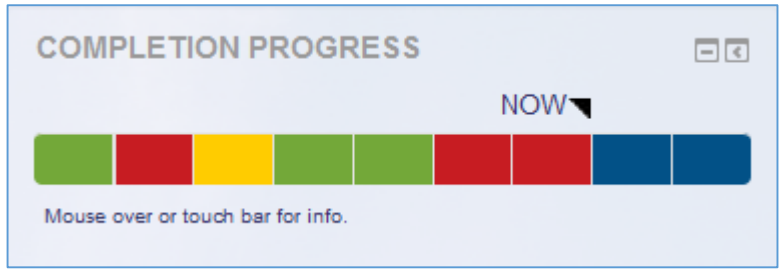
Moodle Database Schema

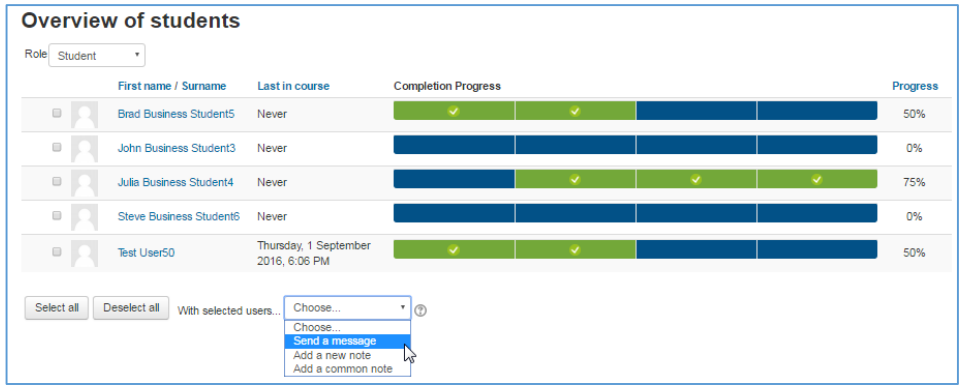


Completion Progress

A time-management tool

- Relies on completion settings of activities/resources in the course
- Visual representation of activities to be completed
- Color-coded for quick reference
- Overview for teachers, identify students at risk

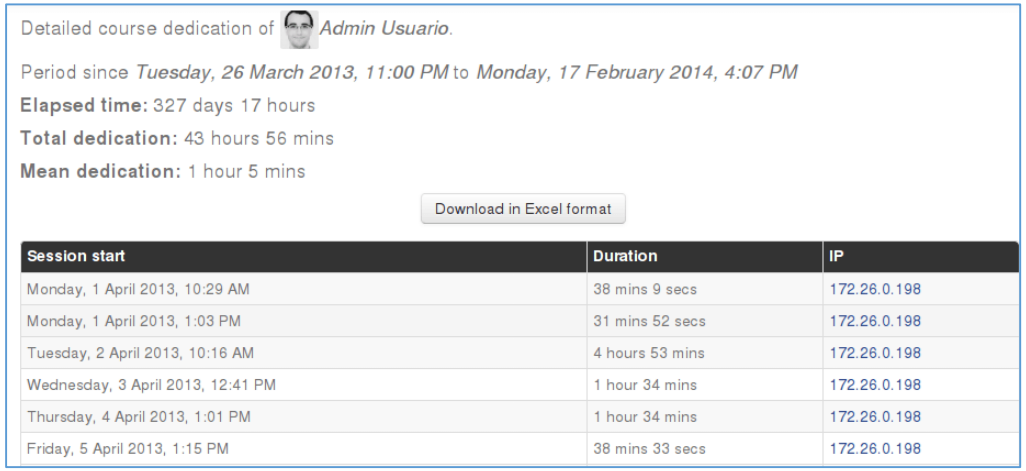




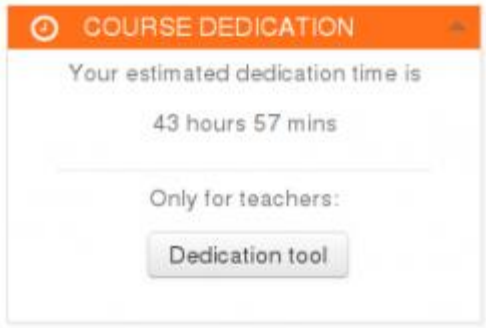
Course Dedication

Allow teachers to keep track of estimated dedication time of students in a course

- Time is estimated based on
  - Clicks, Sessions, and Sessions Duration
- Offers views of dedication time of
  - The course, in total
  - A group of students
  - An individual student



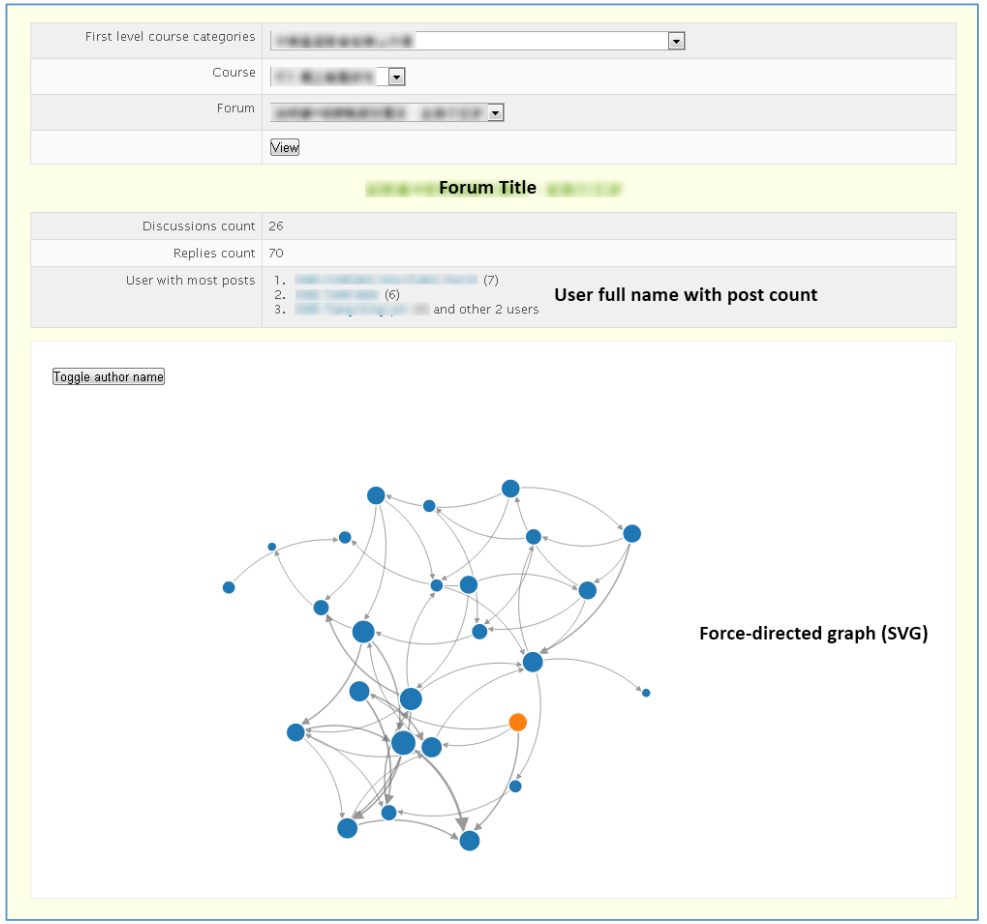
Session start	Duration	IP
Monday, 1 April 2013, 10:29 AM	38 mins 9 secs	172.26.0.198
Monday, 1 April 2013, 1:03 PM	31 mins 52 secs	172.26.0.198
Tuesday, 2 April 2013, 10:16 AM	4 hours 53 mins	172.26.0.198
Wednesday, 3 April 2013, 12:41 PM	1 hour 34 mins	172.26.0.198
Thursday, 4 April 2013, 1:01 PM	1 hour 34 mins	172.26.0.198
Friday, 5 April 2013, 1:15 PM	38 mins 33 secs	172.26.0.198



Forum Graph Report

Analyze the interactions between participants in a forum activity

- Each node is a user
  - the size depends on the no. of posts
- Each edge represents the interaction between 2 users
  - Thickness indicates the no. of replies
  - Arrow indicates who was replying

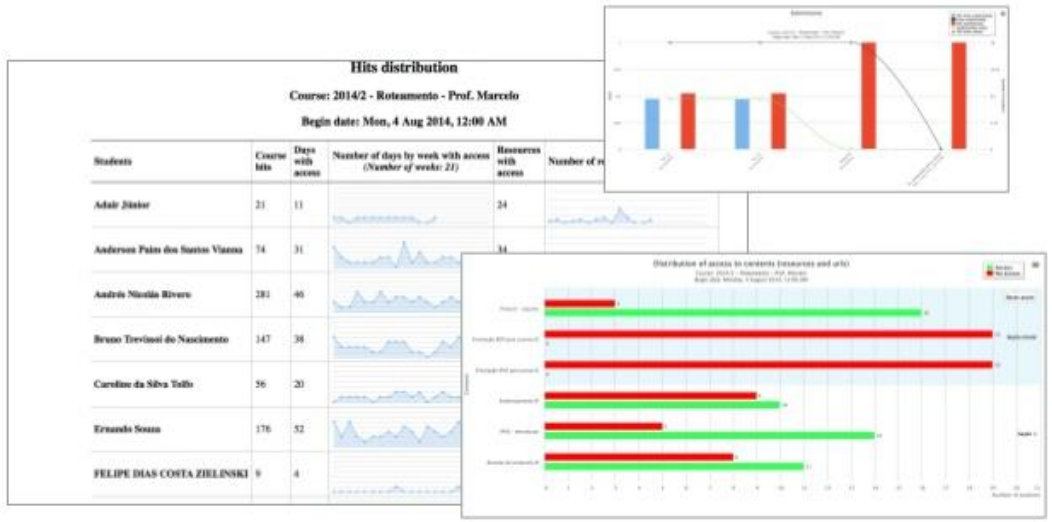


Graph Analytics

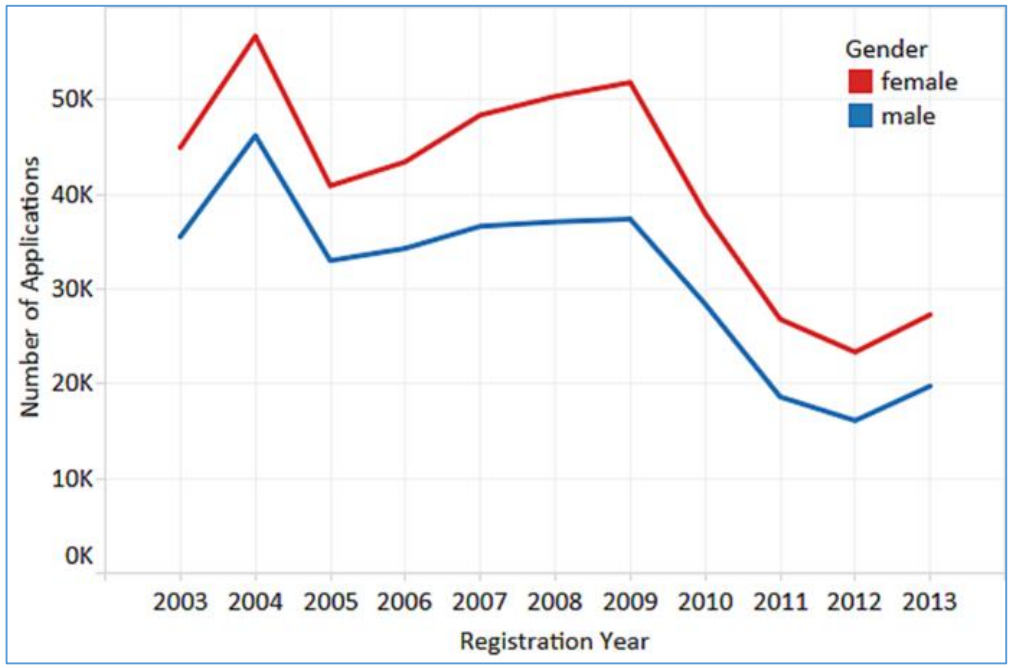
Provides graphs that facilitate the identification of student profiles

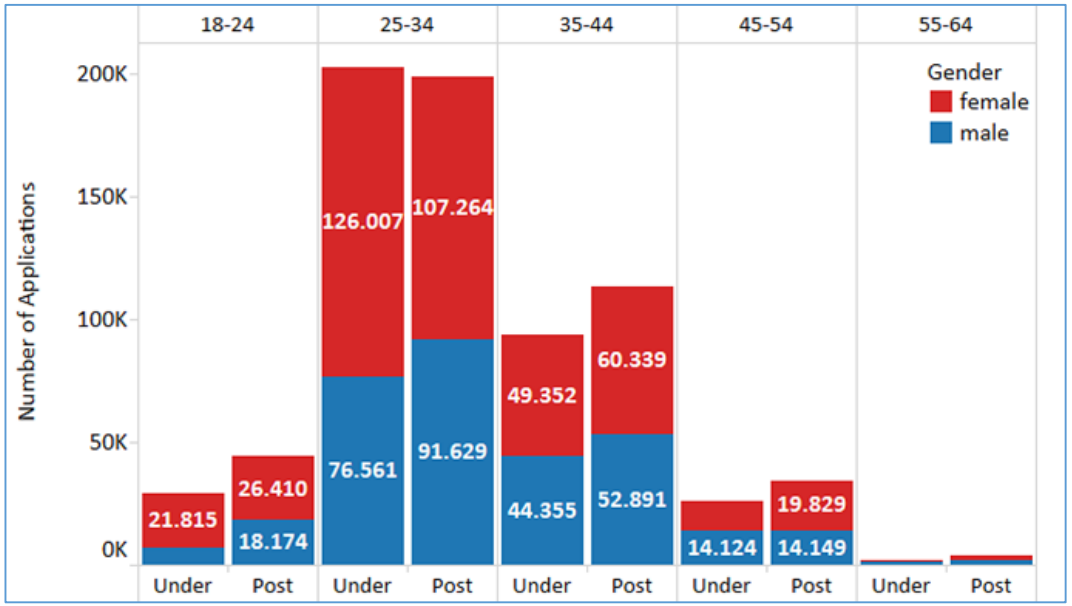
- Grades Chart
- Content Access Chart
- Active Users Chart
- Assignment Submissions Chart
- Hits Distribution Chart

Graphs allow teachers to message students according to their behavior in the course



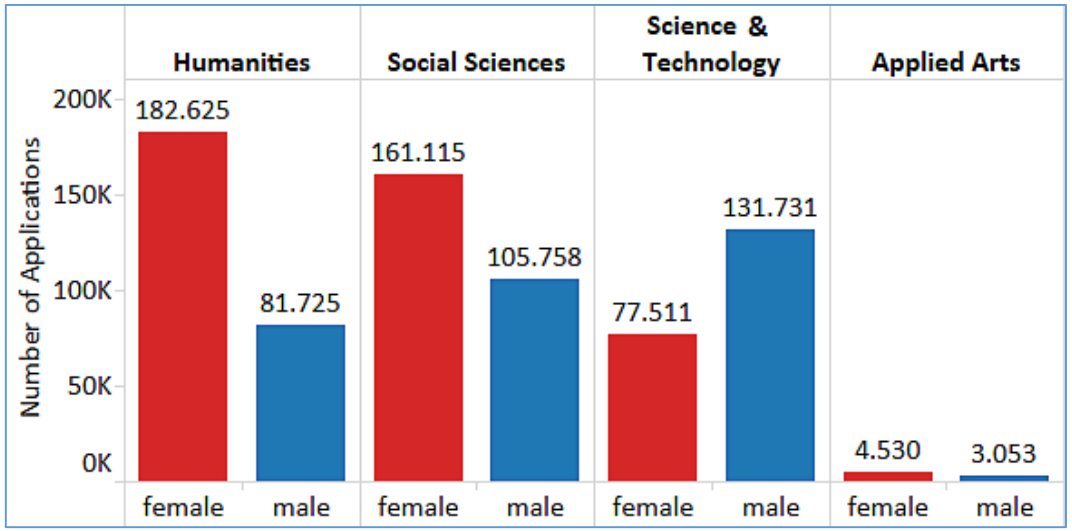
Analyzing Admission Data



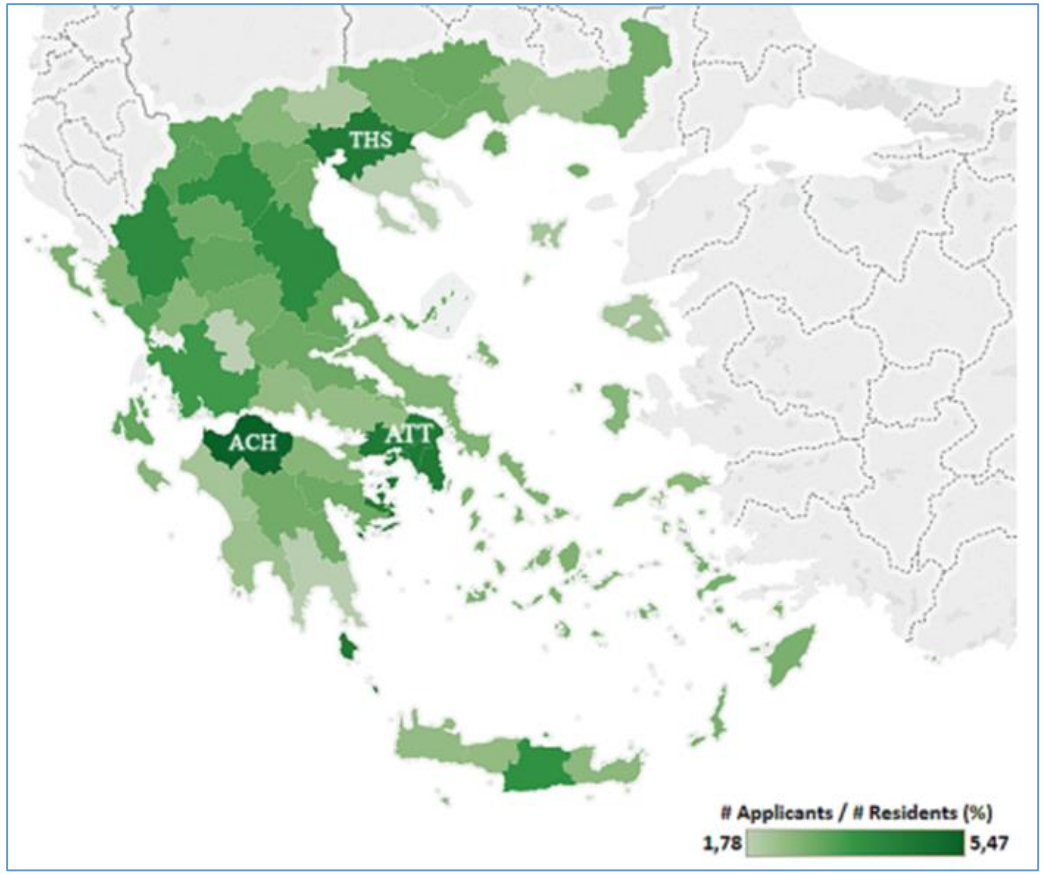


** Created using Python*

Analyzing Admission Data

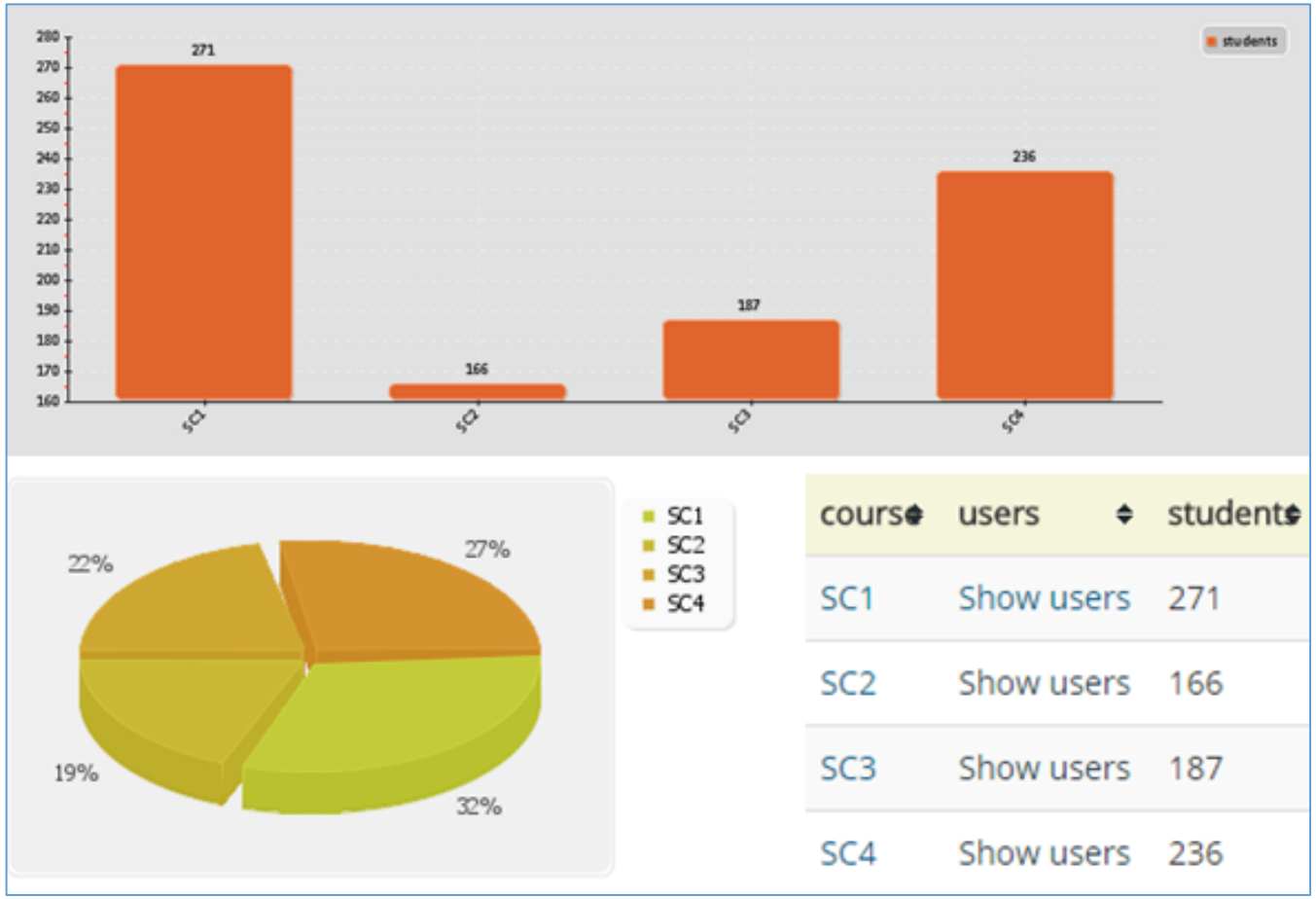


** Created using Python*



** Created using Tableau v. 9.3*

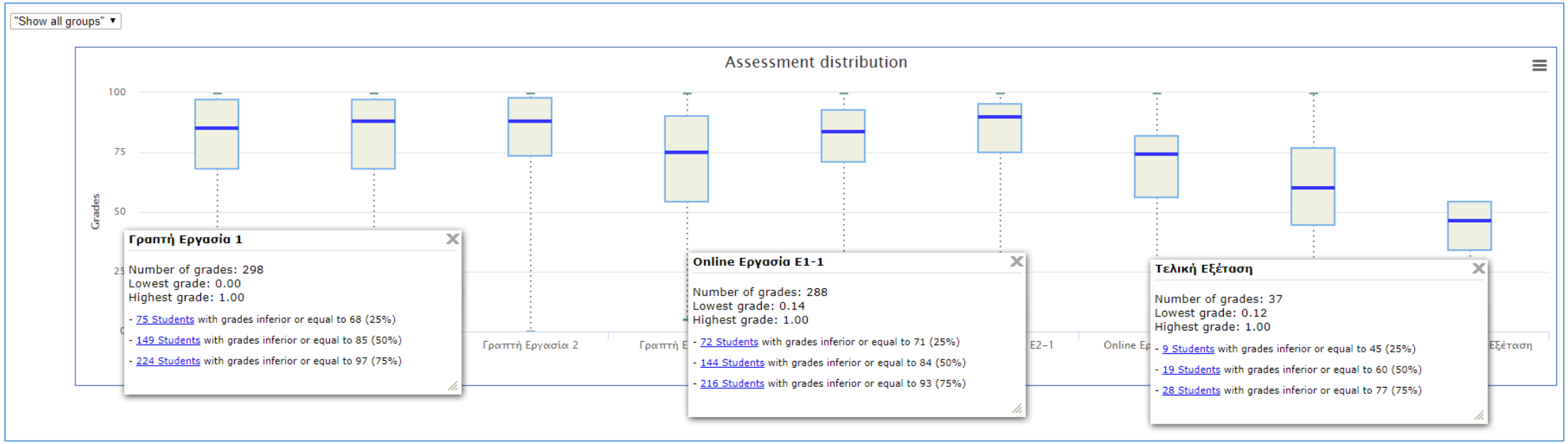
Customized Reports



- Customized reports based on Moodle SQL scheme
- Knowledge of Database Internal Organization is Required

** Created using Moodle Configurable Reports plugin*

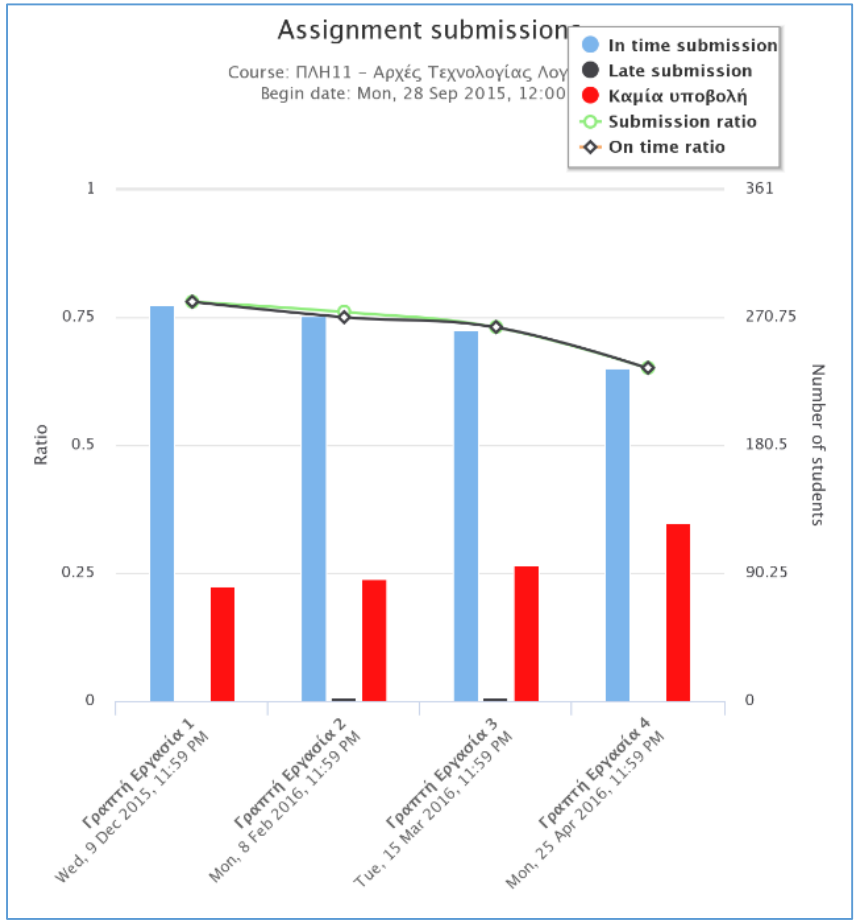
Students Performance Visualization



Analytics graph for grades distribution of written and online assignments

** Created using Moodle Forum Graph plugin*

Visualizing Students' Submissions



Assignments and Quizzes submission graphs

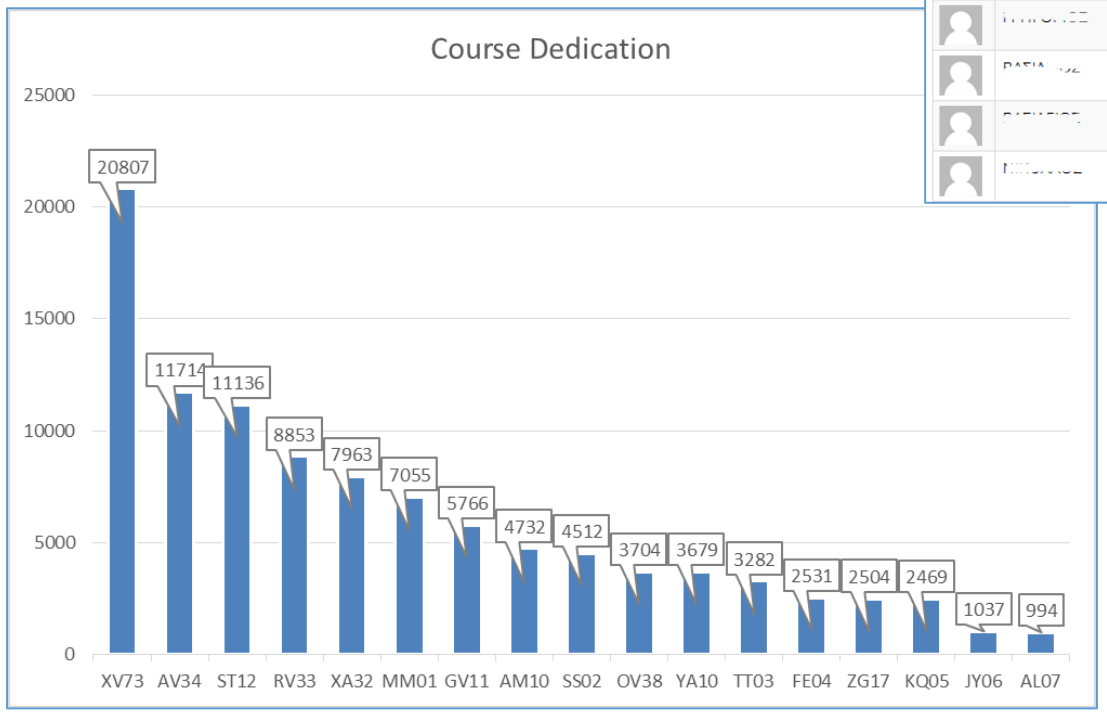
** Created using Moodle Forum Graph plugin*

Measuring Engagement with the Platform

Students' dedication info

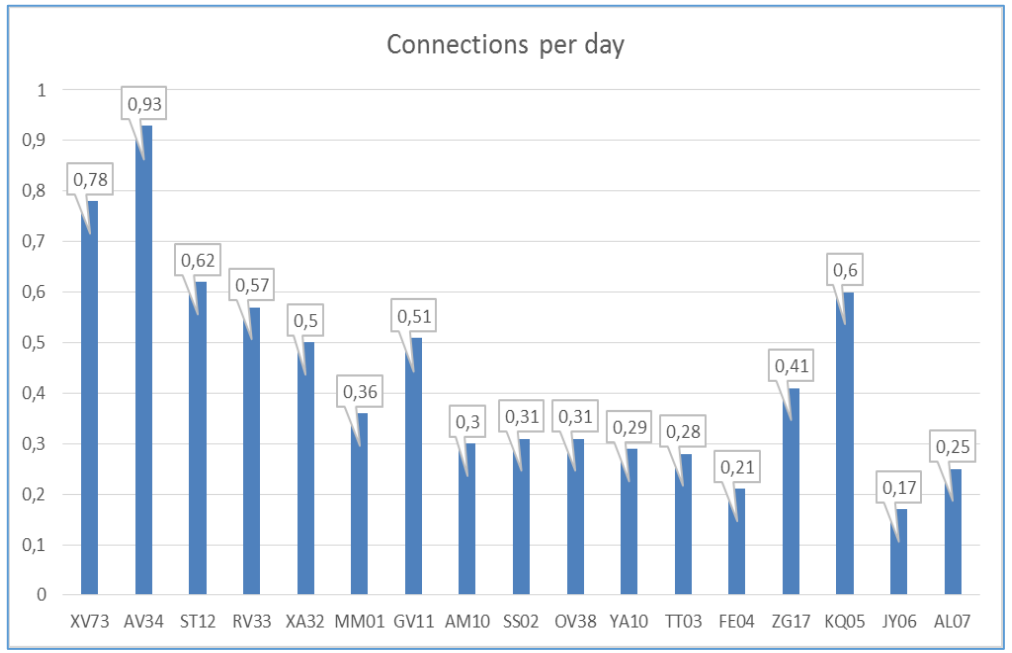
** Created using Moodle Course Dedication plugin*

	Όνομα	Επώνυμο	Ομάδα	Αφοσίωση μαθήματος	Συνδέσεις / ημέρα
	[redacted]	[redacted]	ΠΛΗ11-ΑΘΗ1	25 ώρες 32 λεπτά	0.28
	[redacted]	[redacted]	ΠΛΗ11-ΑΘΗ1	12 ώρες 19 λεπτά	0.24
	[redacted]	[redacted]	ΠΛΗ11-ΑΘΗ1	7 ώρες 28 λεπτά	0.32
	[redacted]	[redacted]	ΠΛΗ11-ΑΘΗ1	34 ώρες 28 λεπτά	0.21
	[redacted]	[redacted]	ΠΛΗ11-ΑΘΗ1	2 ώρες 50 λεπτά	0.1
	[redacted]	[redacted]	ΠΛΗ11-ΑΘΗ1	29 ώρες 12 λεπτά	0.35

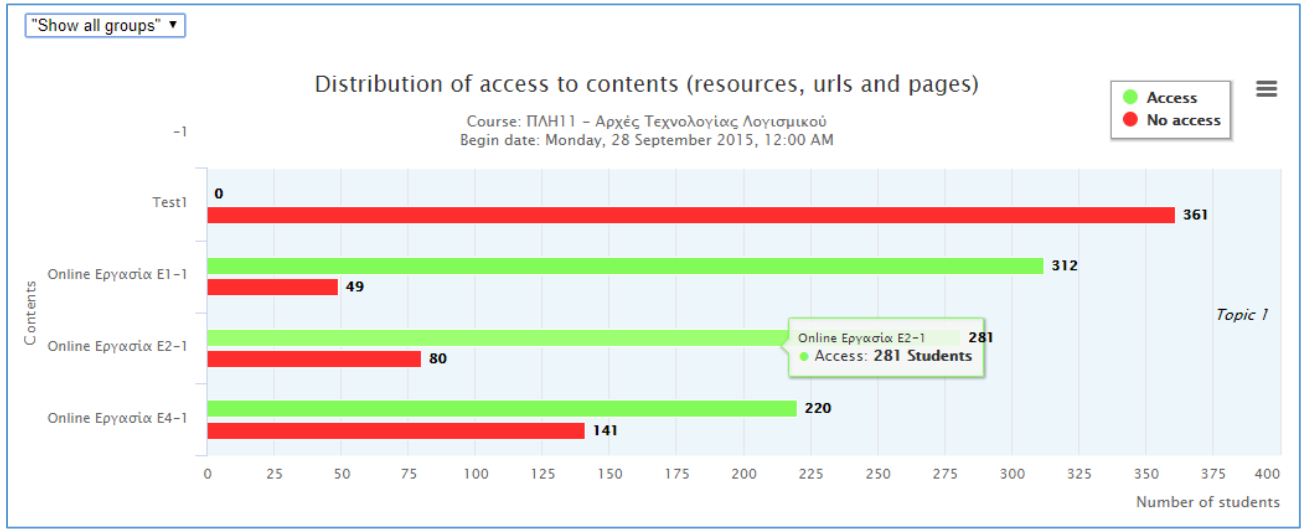


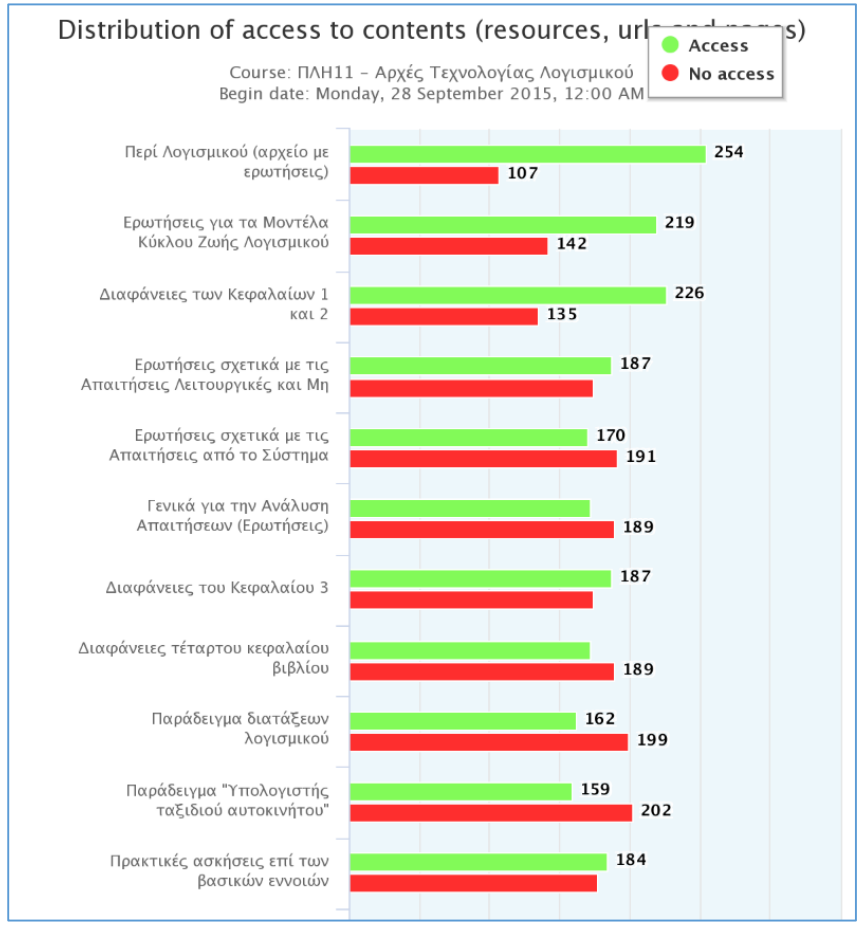
Tutors' course dedication time

Tutors' connections per day



Measuring Engagement with the Content

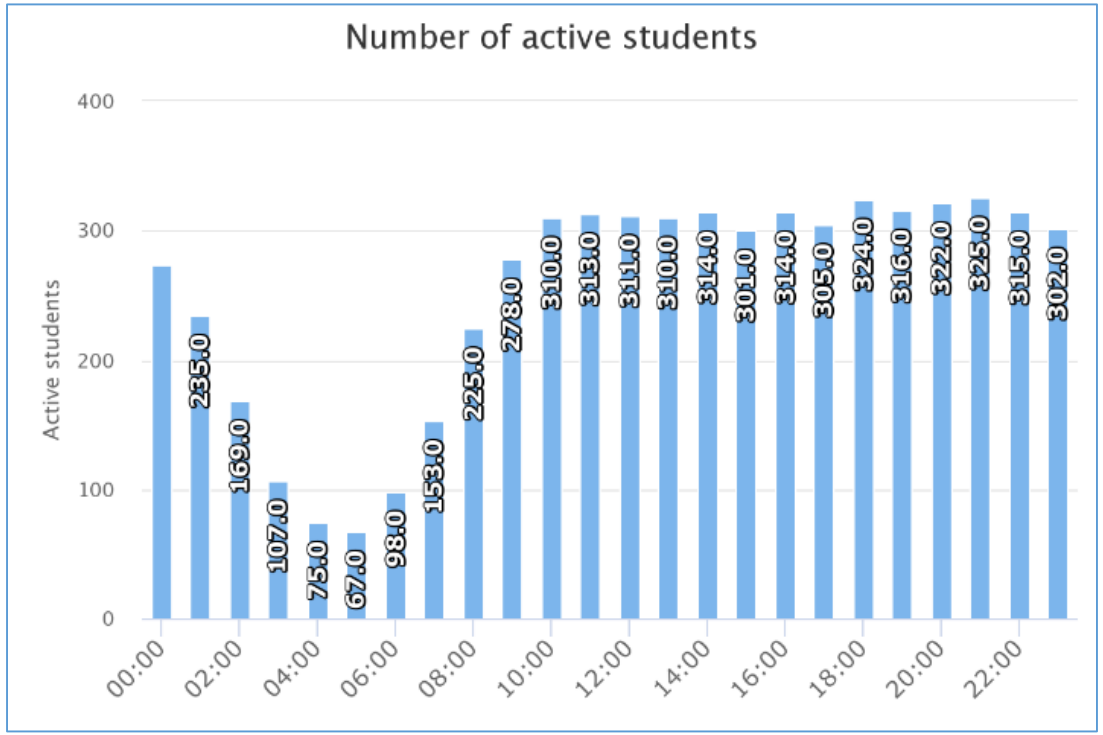


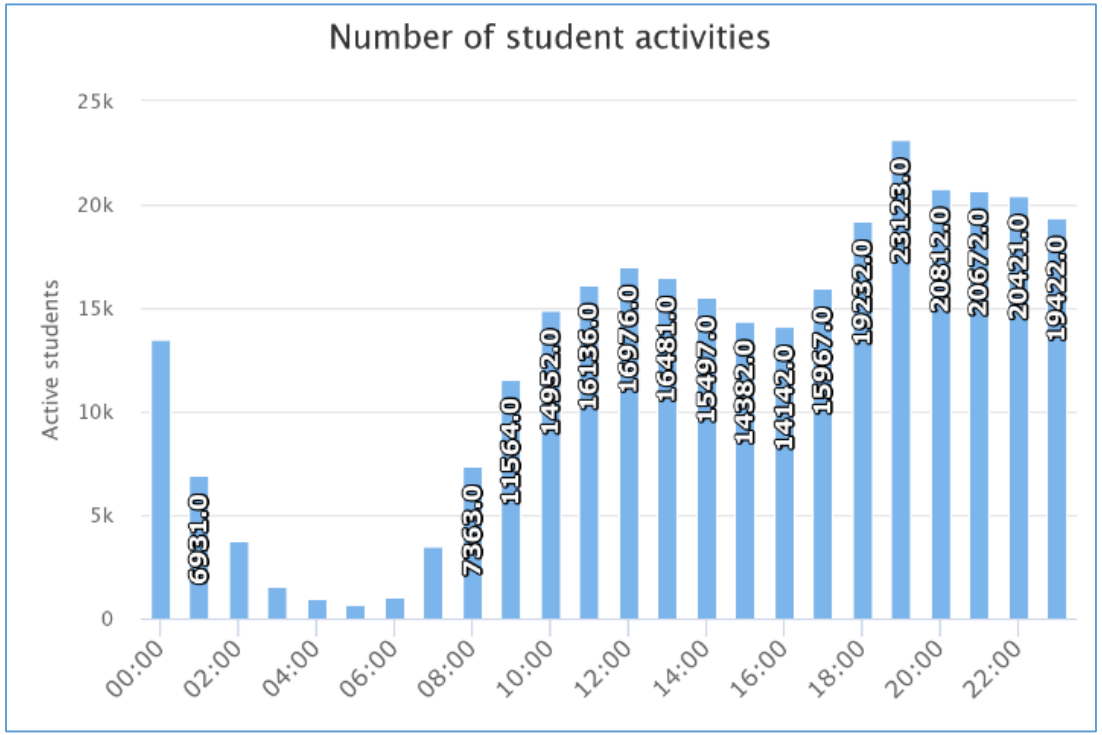


Online tests and content access distribution graphs

** Created using Moodle Forum Graph plugin*

Students' Activity Visualization

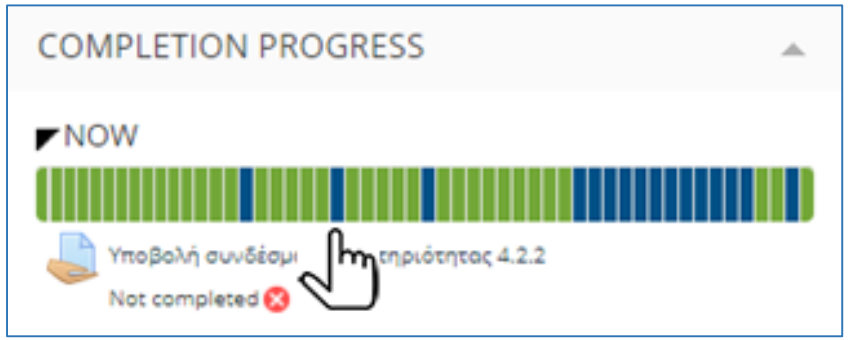




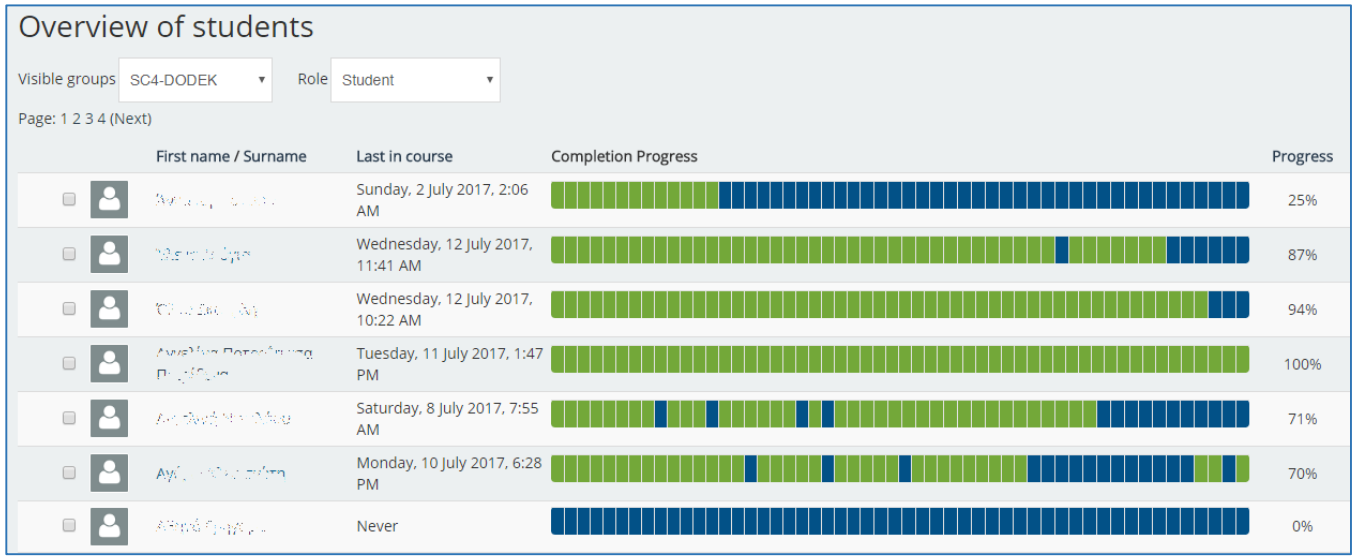
The distribution of active students and students' activities to daily hours

** Created using Moodle Analytics Graphs plugin*

Monitoring Activity Completion



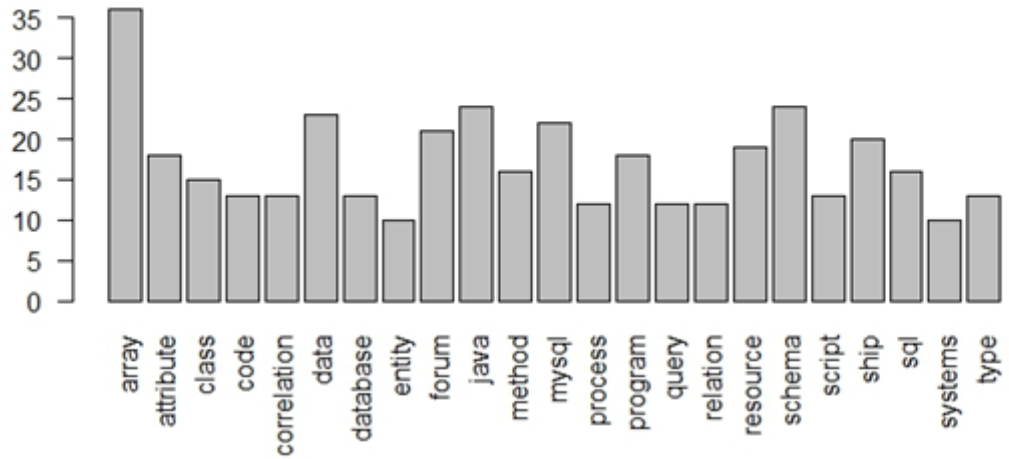
Student's progress bar

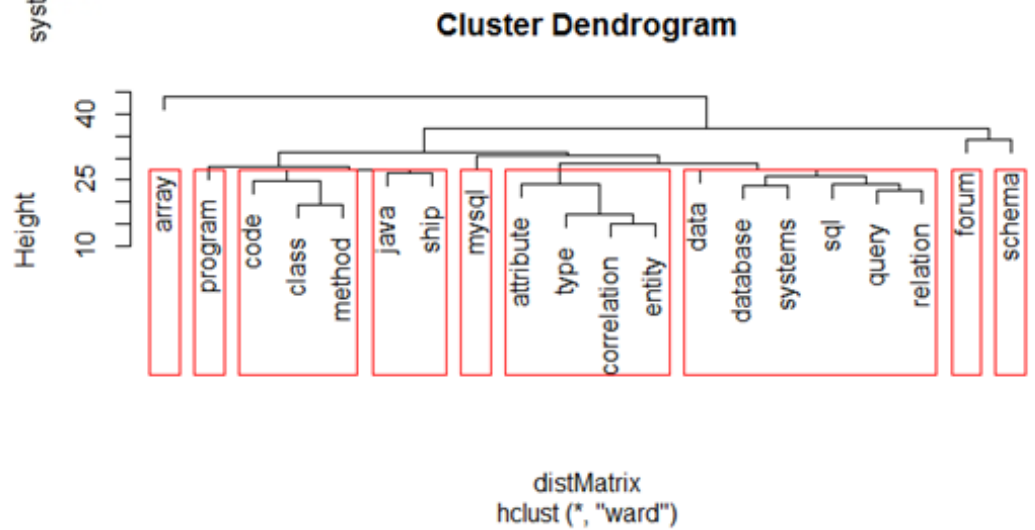


Tutor's overview page

** Created using Moodle Completion Progress plugin*

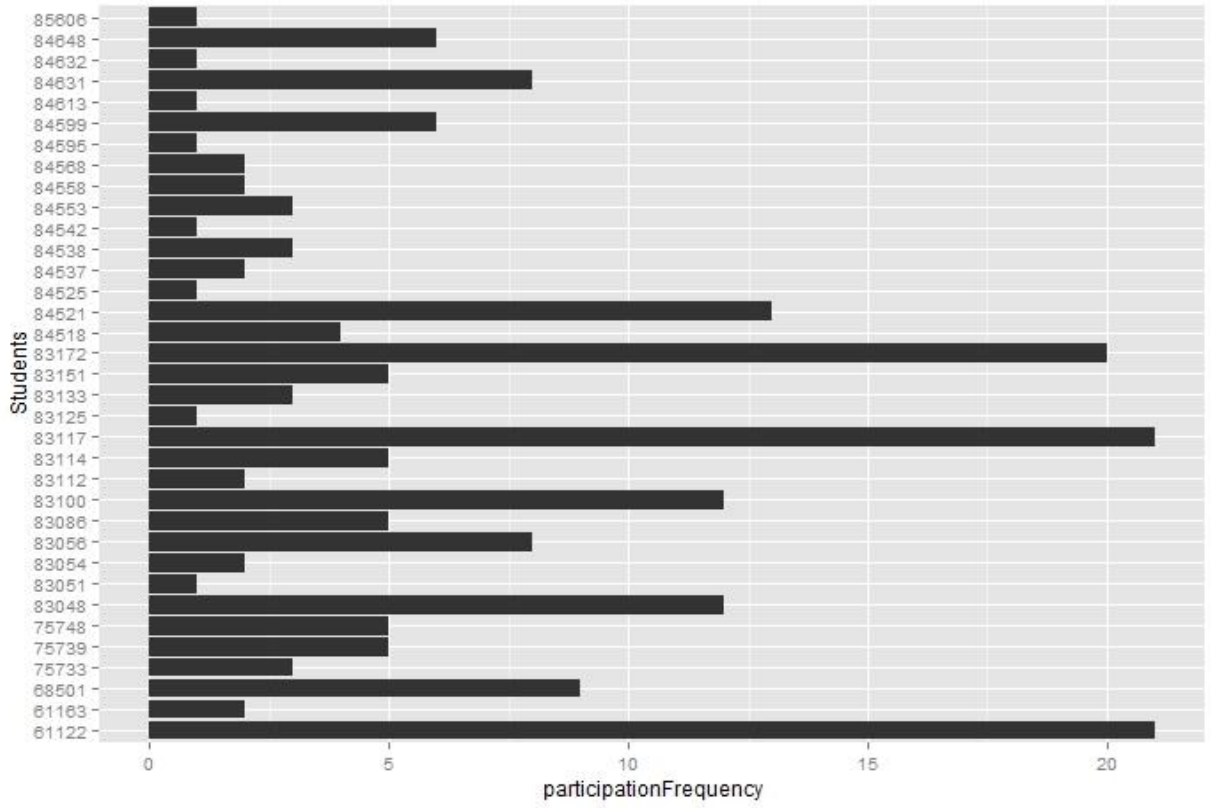
Text Mining in Forum Data

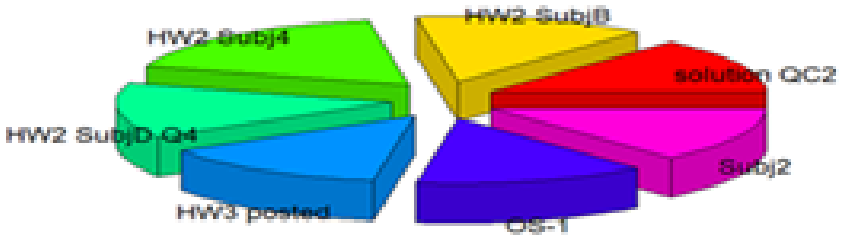




** Created using R packages*

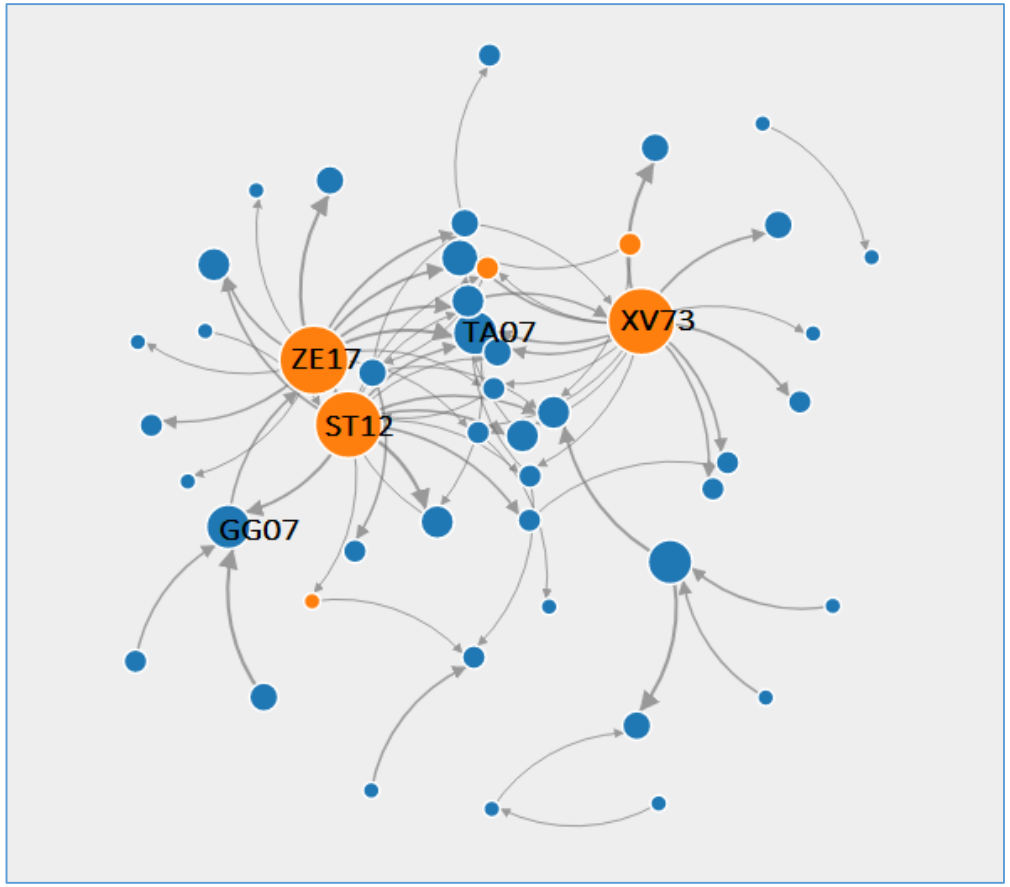
Forum Participation & Frequent Threads



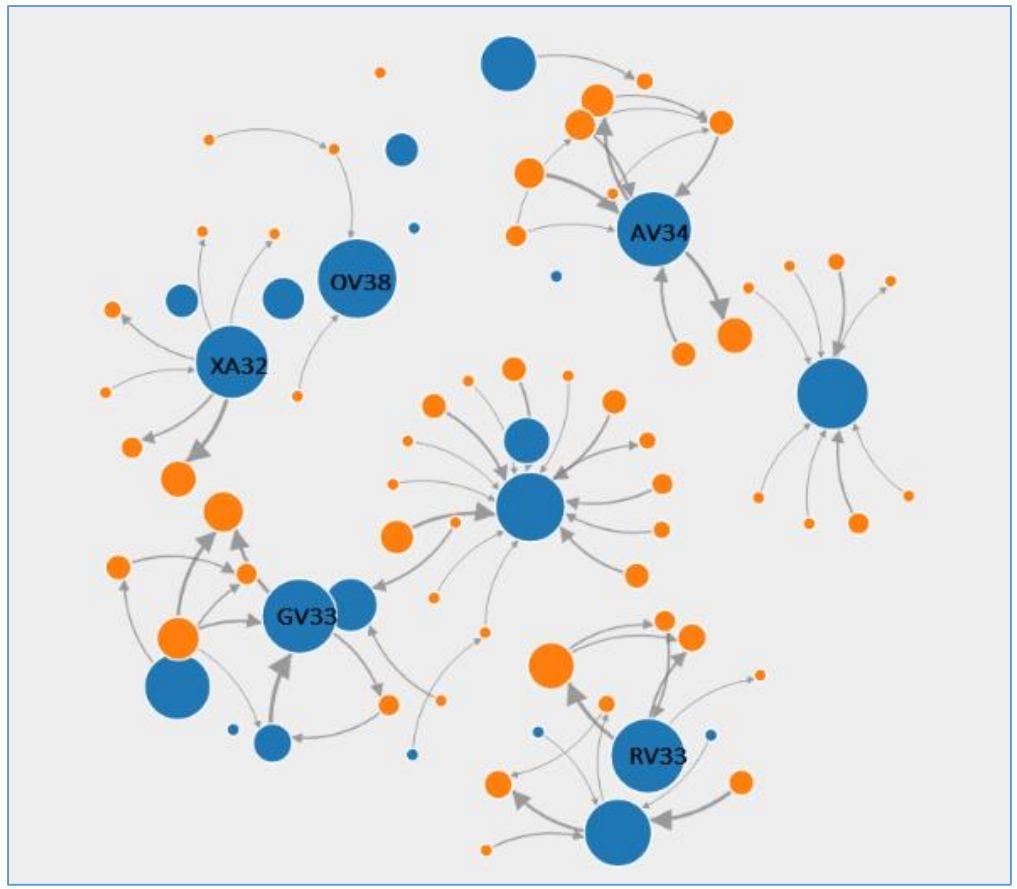


** Created using R packages*

Monitoring Participation in Forums



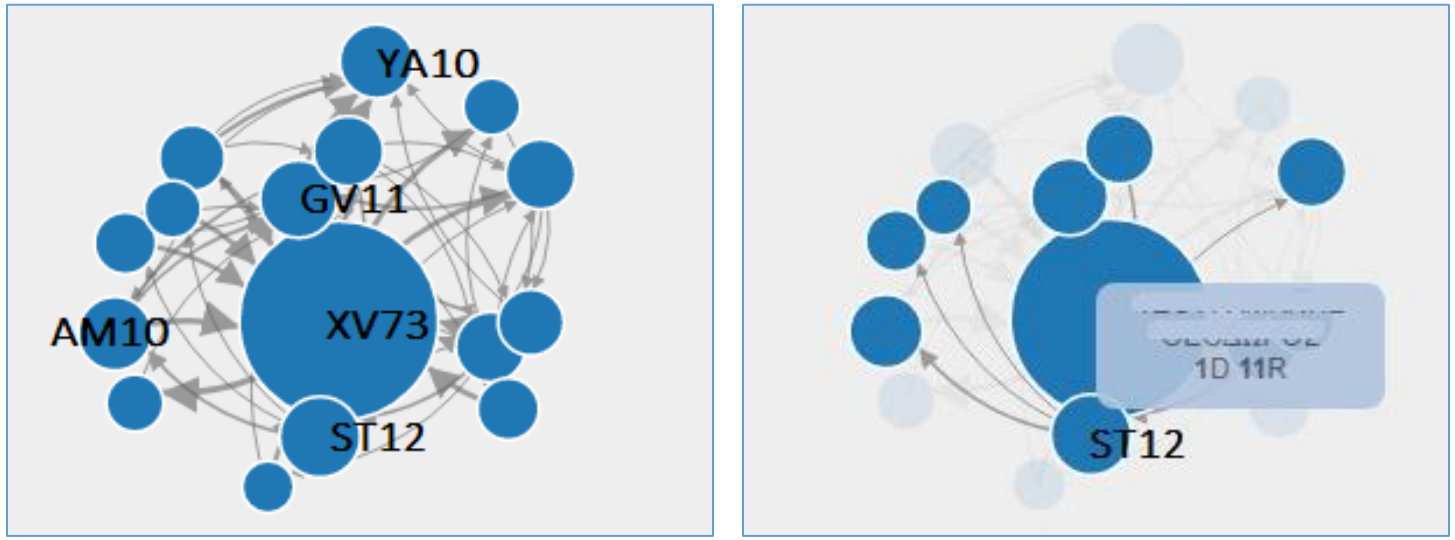
The PLI11 Module forum graph



An integrated view of the groups forum graph

** Created using Moodle Forum Graph plugin*

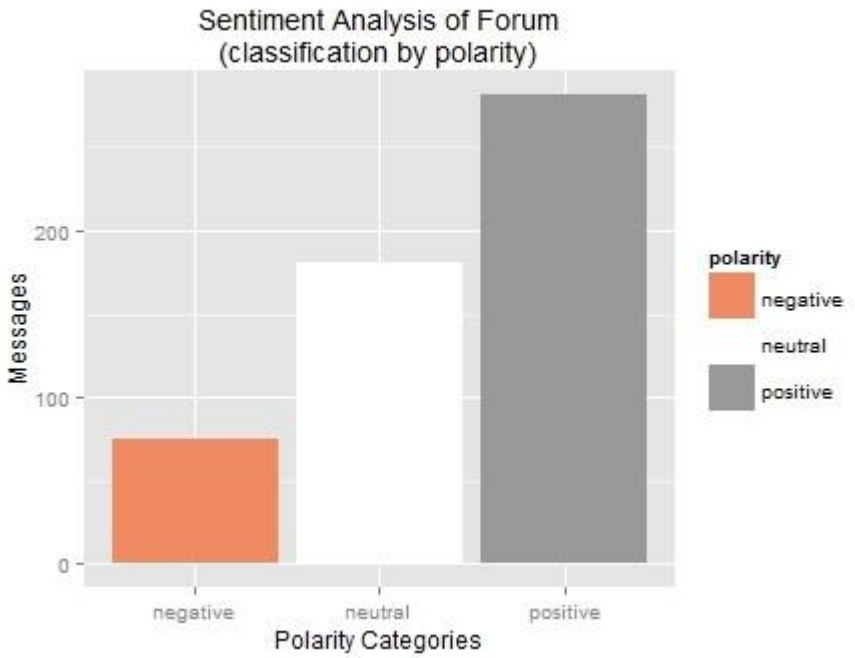
Monitoring Participation in Forums

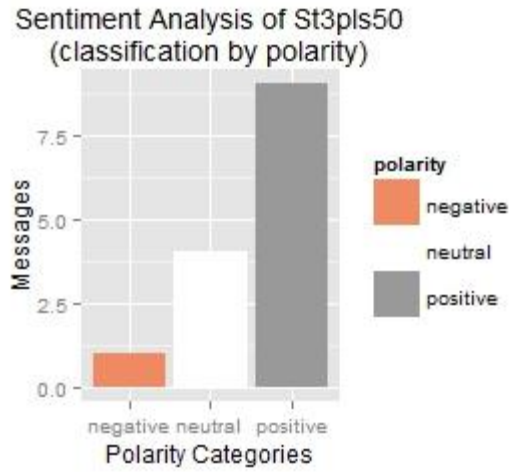


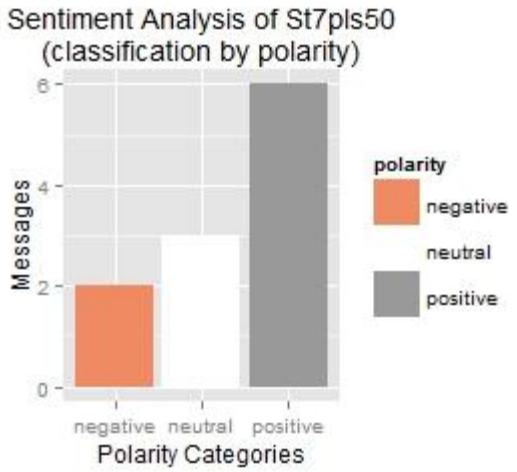
Tutors' activity in Tutors' forum of PLI11

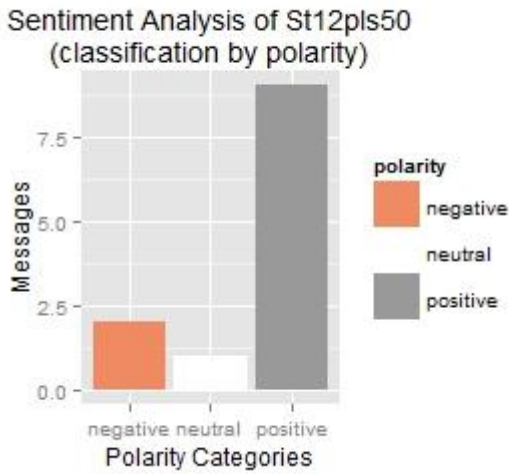
** Created using Moodle Forum Graph plugin*

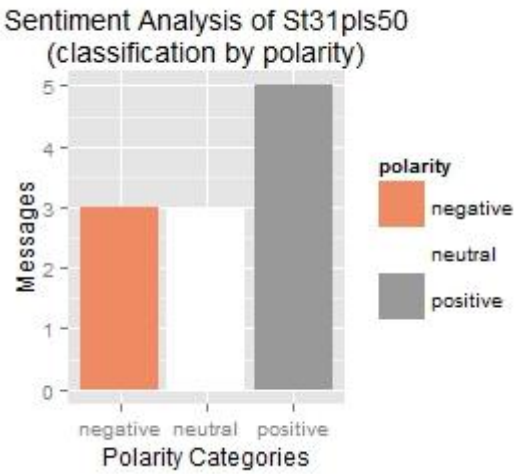
Identifying Polarity in Discussion Fora





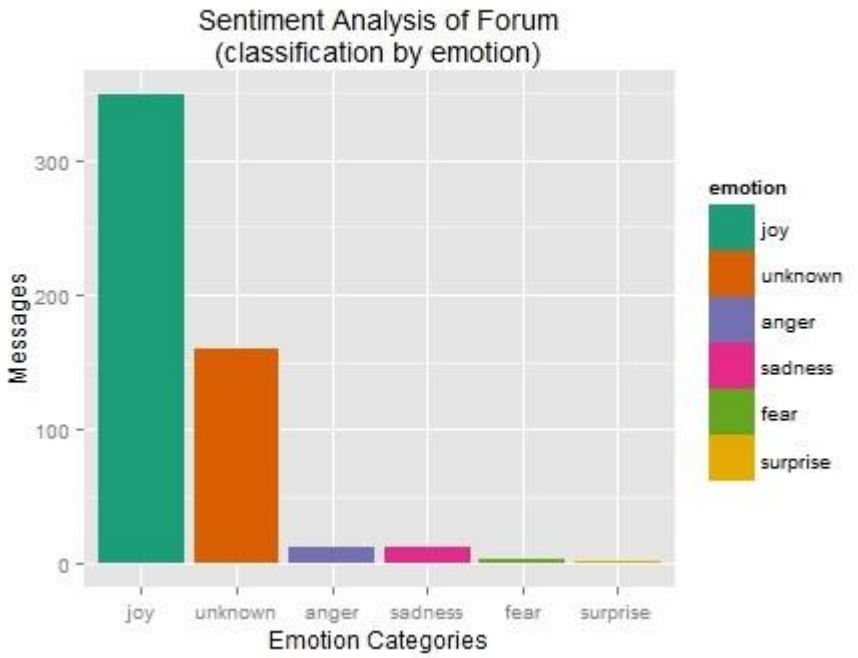


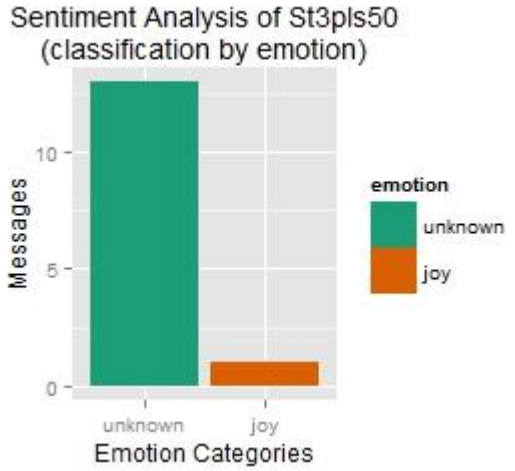


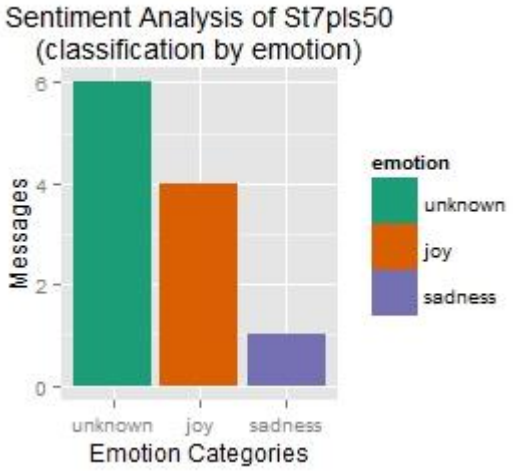


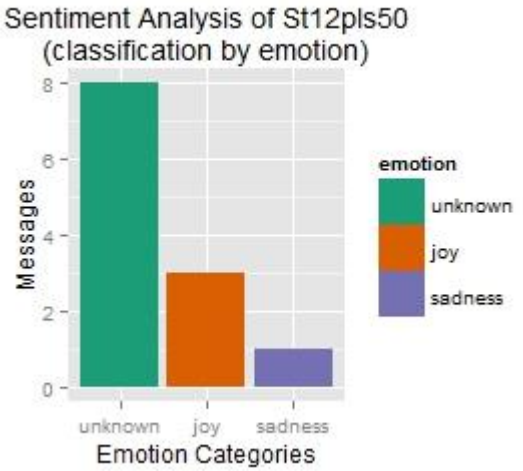
** Created using R packages*

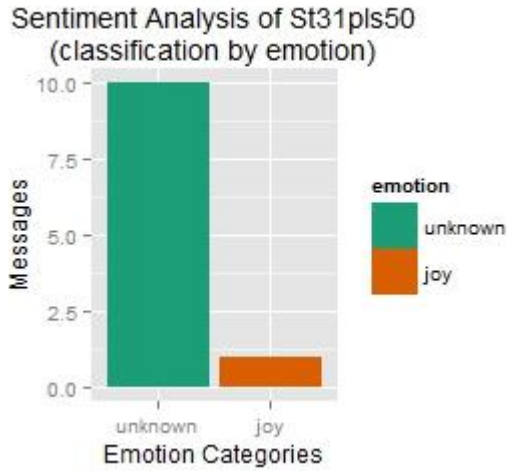
Identifying Emotion in Discussion Fora











** Created using R packages*

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