Ανάλυση Μαθησιακών Δεδομένων (*Actionable* Learning Analytics)

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Θέματα

Α ενότητα

- Ορισμοί Μαθησιακής Αναλυτικής (ΜΑ) (5’)
- Διαστάσεις ΜΑ (10’)
- Μαθησιακή Αναλυτική & Ανεστραμμένη Τάξη (5’)
- Μαθησιακή Αναλυτική και Αυτορρυθμιζόμενη Μάθηση (5’)
- Motivational Interviewing (5’)
- Πεδία Μαθησιακής Αναλυτικής (text analytics) (**10**’)

Β Ενότητα

- Εργαλεία Μαθησιακής Αναλυτικής (ΜΑ) – Instructional Design (**45**’)

Γ Ενότητα

- Διδακτικά Σενάρια εμπλουτισμένα με ΜΑ (Μοντέλο Gagne) – Learning Design (30’)
- Ζητήματα Ηθικής και ΜΑ (10’)
- State of the art (SoLAR) (10’)
- Επόμενο βήμα (Orange3, Anaconda) (**20**’)

Λέξεις κλειδιά

- Σχολική τάξη
- Επεξεργασία, ανάλυση και αξιοποίηση Εκπαιδευτικών Δεδομένων
- Data literacy skills
- Ψηφιακά εργαλεία ΜΑ
- Διδακτικά σενάριο
- Προκλήσεις

ΘΕΩΡΗΤΙΚΟ ΥΠΟΒΑΘΡΟ

What are learning analytics?

Learning analytics are software algorithms that are used to predict or detect unknown aspects of the learning process, based on historical data and current behavior. There are four main categories of learning analytics:

- descriptive (what happened?)
- predictive (what will happen next?)
- diagnostic (why did it happen?)
- prescriptive (do this to improve)

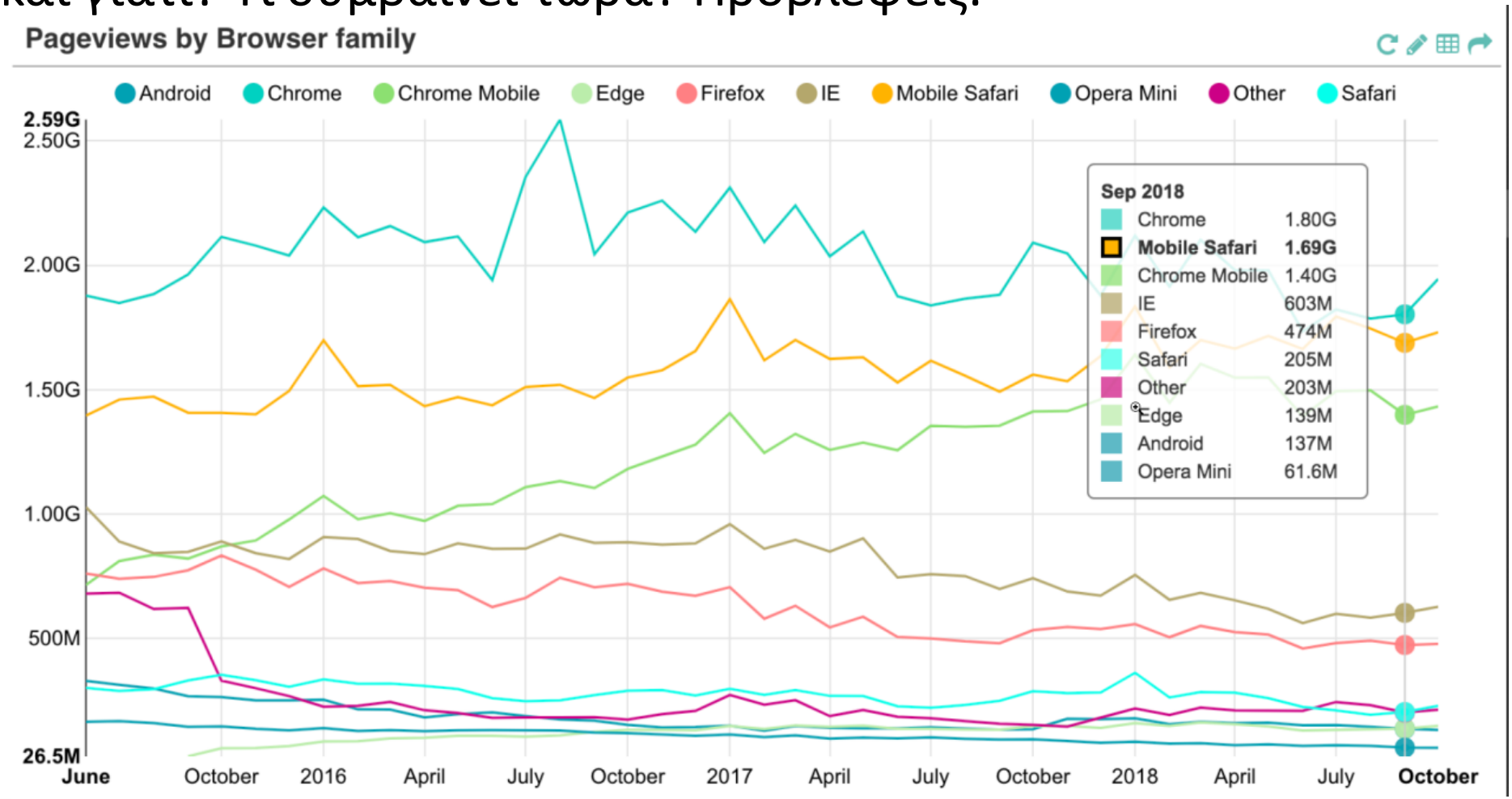
Most commercial solutions are descriptive only. Those that are predictive or proactive make certain assumptions about learning that don't apply to everyone.

Reading data is like reading the digital body language of your audience.

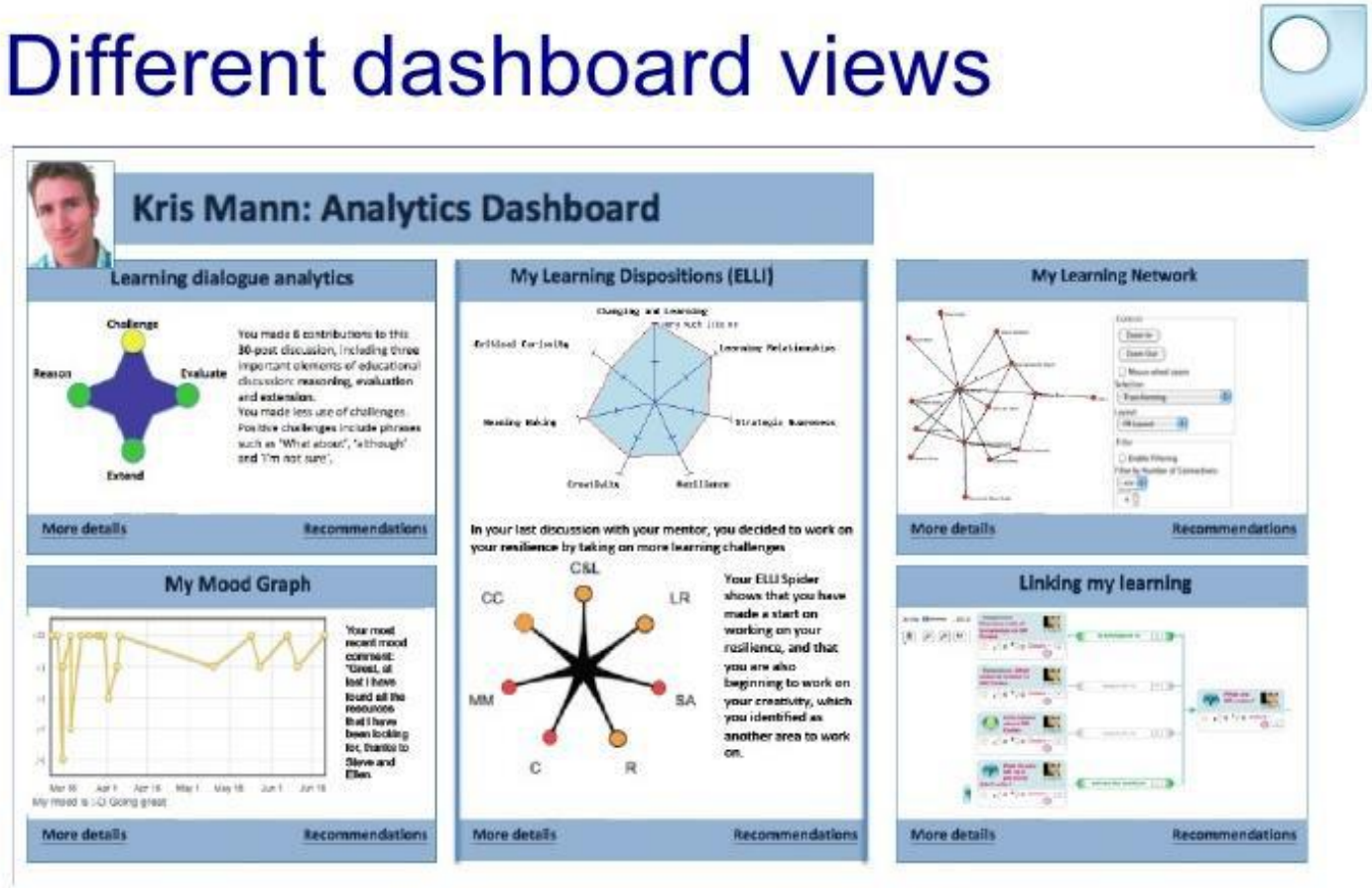
Τι είναι η ανάλυση δεδομένων

- Εξάγει σχέσεις και πρότυπα και απαντά σε ερωτήματα:

Τι συνέβη, πως και γιατί? Τι συμβαίνει τώρα? Προβλέψεις.



Τεχνικές Ανάλυσης Δεδομένων

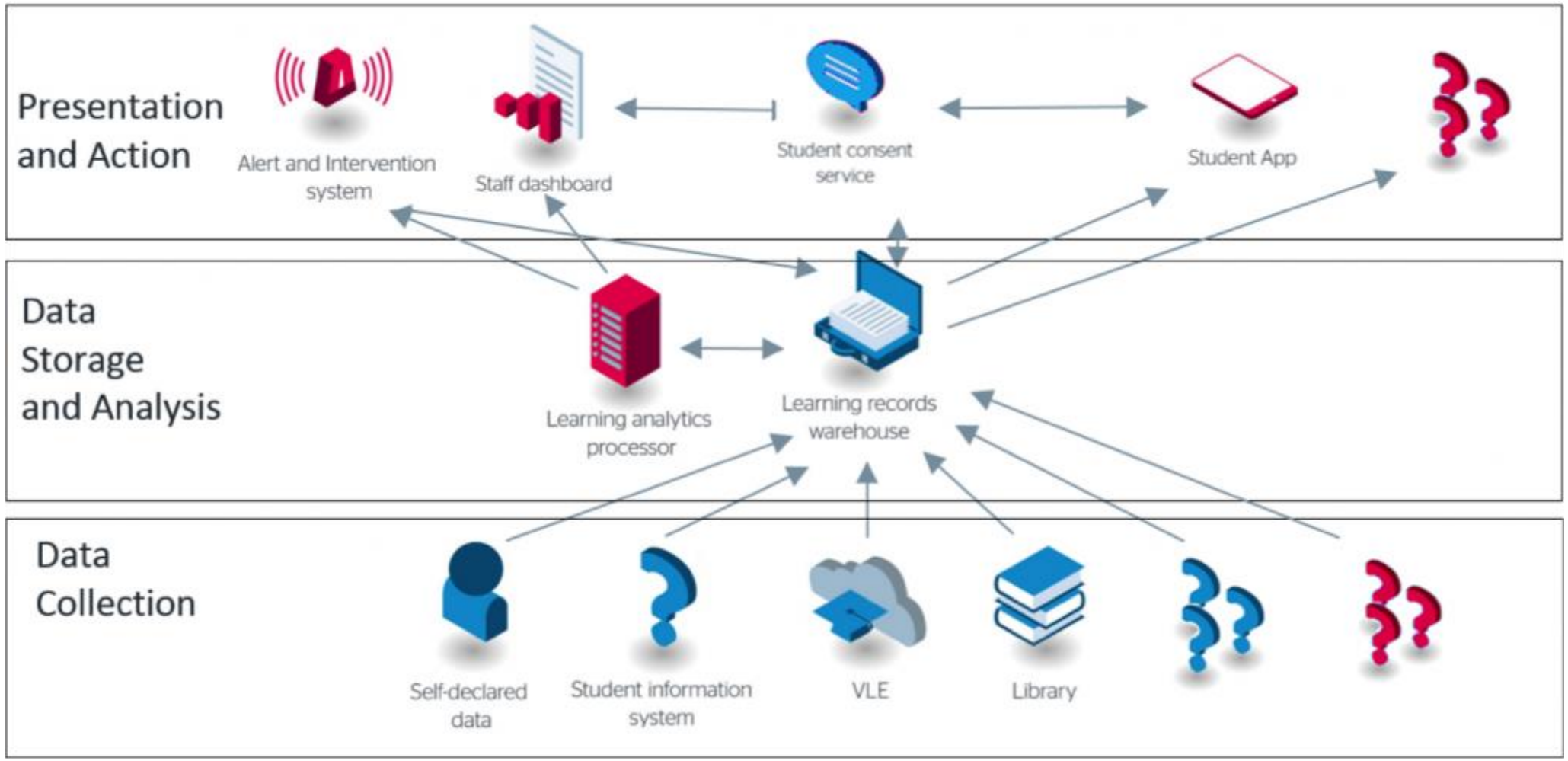


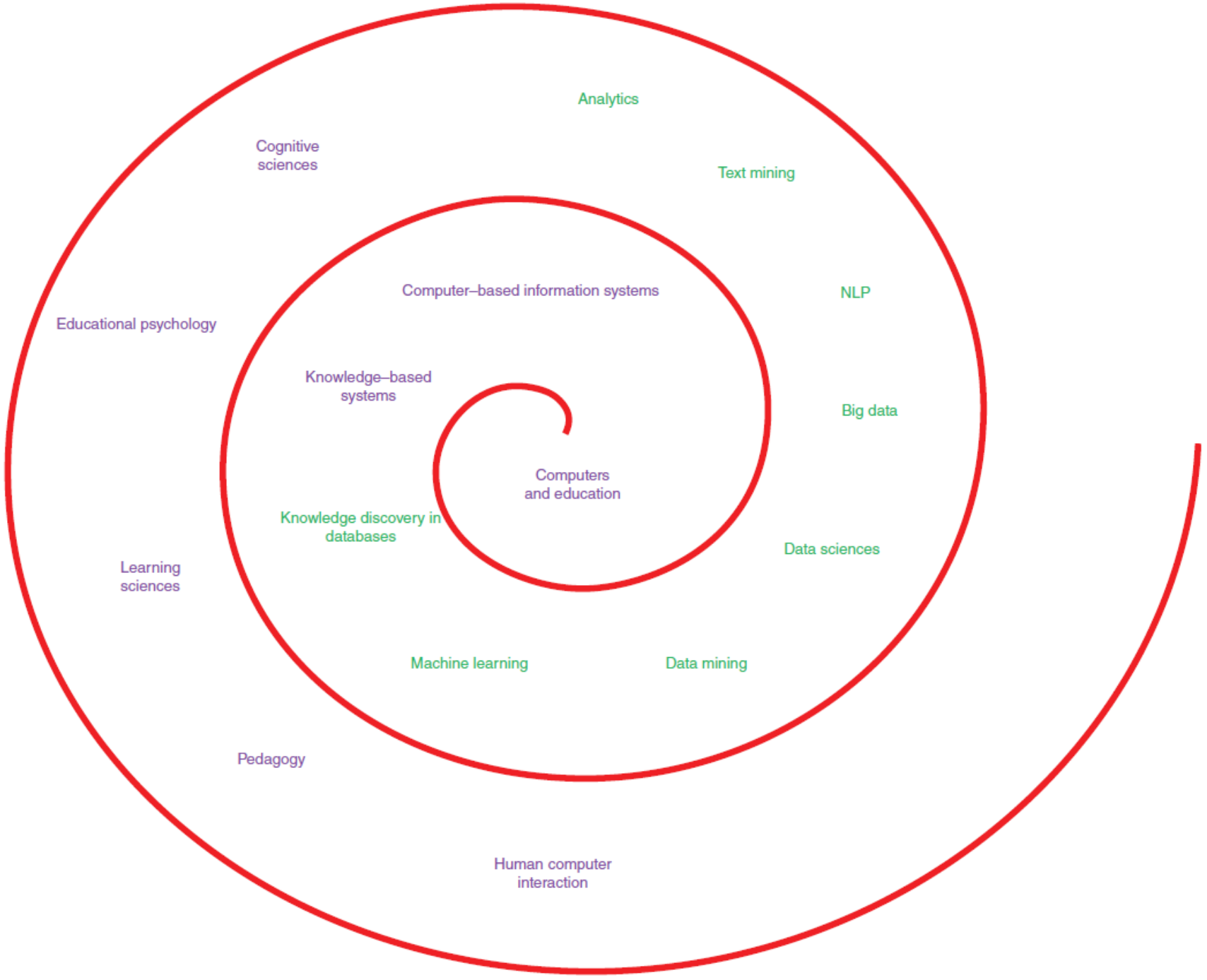
SocialLearn

Ορισμοί MA (Background)

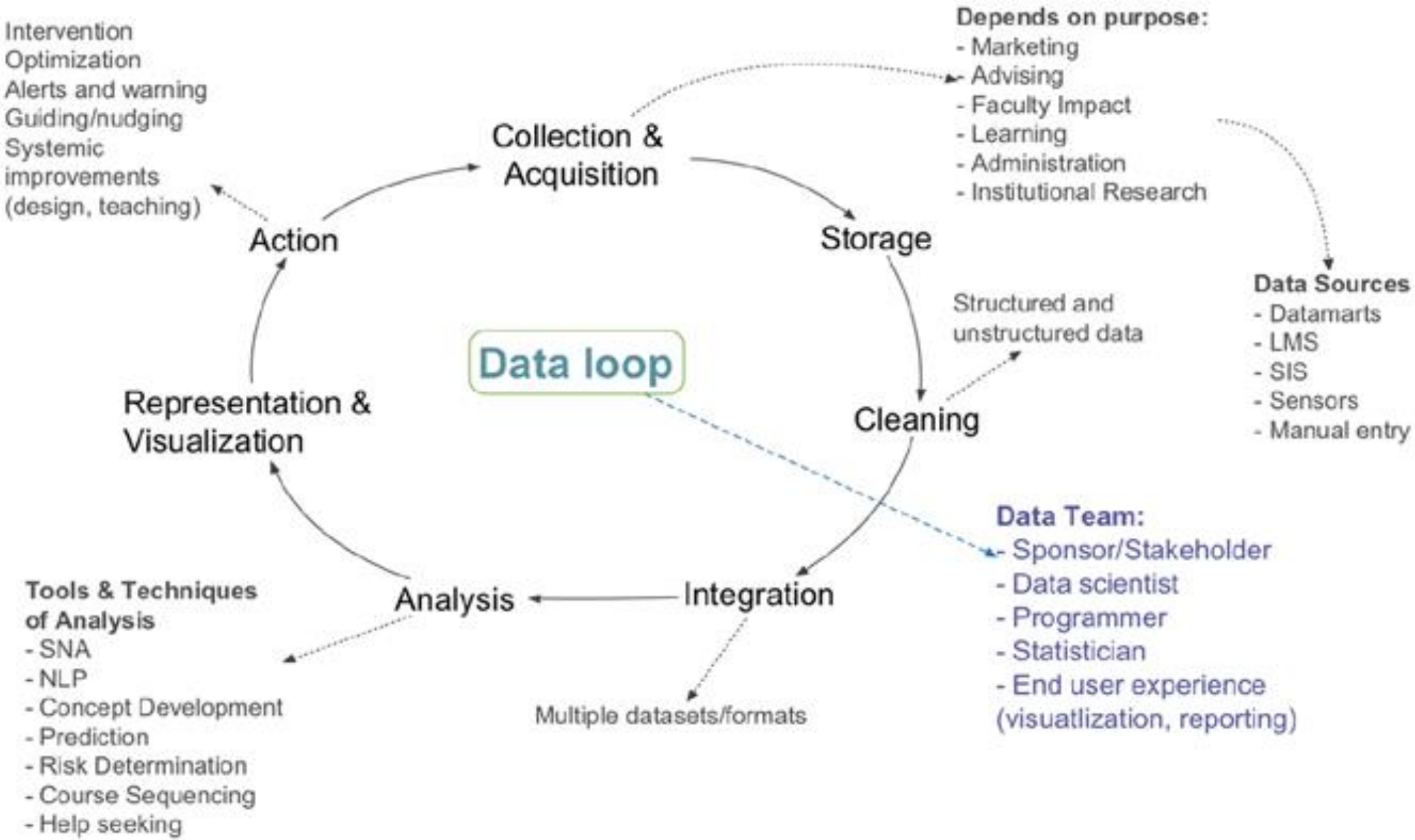
- Impact (satisfaction, performance, motivation, engagement, behavior change)
- Actionable LA

Learning analytics (LA) collects, analyses, and reports big data about learners to optimise learning. The Society for Learning Analytics Research (SoLAR) (Lang et al., 2017) defines LA as “the measurement, collection, analysis, and reporting of big data about learners and their contexts and behaviours, for purposes of understanding and optimising learning and the environments in which it occurs” (Siemens & Long, 2011, p. 33). Learning analytics combines information retrieval, machine learning (ML), data visualisation, and statistical algorithms … human-centered design perspective for Learning Analytics.


Presentation and Action
Alert and Intervention system
Staff dashboard
Student consent service
Student App
Data Storage and Analysis
Learning analytics processor
Learning records warehouse
Data Collection
Self-declared data
Student information system
VLE
Library

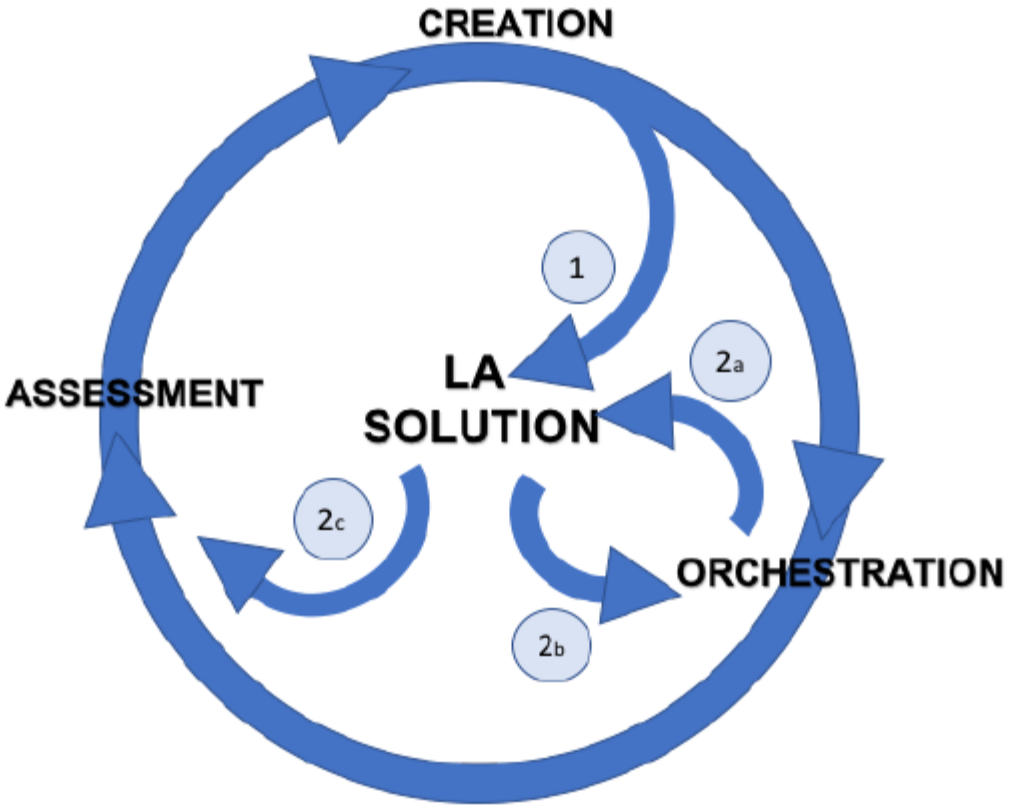

Analytics
Cognitive sciences
Text mining
Computer–based information systems
NLP
Educational psychology
Knowledge–based systems
Big data
Computers and education
Knowledge discovery in databases
Data sciences
Learning sciences
Machine learning
Data mining
Pedagogy
Human computer interaction

Analytics Model



Actionable LA

Finding the right balance between humans and digital tools with respect to the orchestration load and **agency** can be challenging.



The integration of LA development into the learning design cycle. 1 – LA design: learning elements selected as targets for LA solution; 2 – LA implementation: a.) data from LA targets ized by the LA tool, and the resulting LA informs: b.) orchestration, c.) and assessment

3 Principles for the process of Human-Centered Design

After providing a brief view of what have been the main trends of LA research, and based on the aforementioned literature survey and authors' first-hand experience in co-designing LA innovations with teachers and other stakeholders (to be presented below), we can conceptually distil three basic HCD principles to govern the process of designing actionable LA solutions:

1. Agentic positioning of teachers and other stakeholders
2. Integration of the learning design cycle and the LA design process
3. Reliance on educational theories to guide the LA solution design and implementation.

The three principles reflect a human-centered perspective, since learning design and orchestration are typically carried out by teachers and instructional designers, and educational theories are produced by researchers.

Approaches to LA

Which of the following statements best describe how your institution is attempting to solve the identified problems?

We measure learning performance.
We try to understand how students learn.
We try to identify learning bottlenecks.
We produce reports based on institutional data.
We measure teaching performance.
We send alerts to students based on analytics results.
We send alerts to teaching staff / tutors based on analytics results.
We predict learning outcomes based on institutional data.

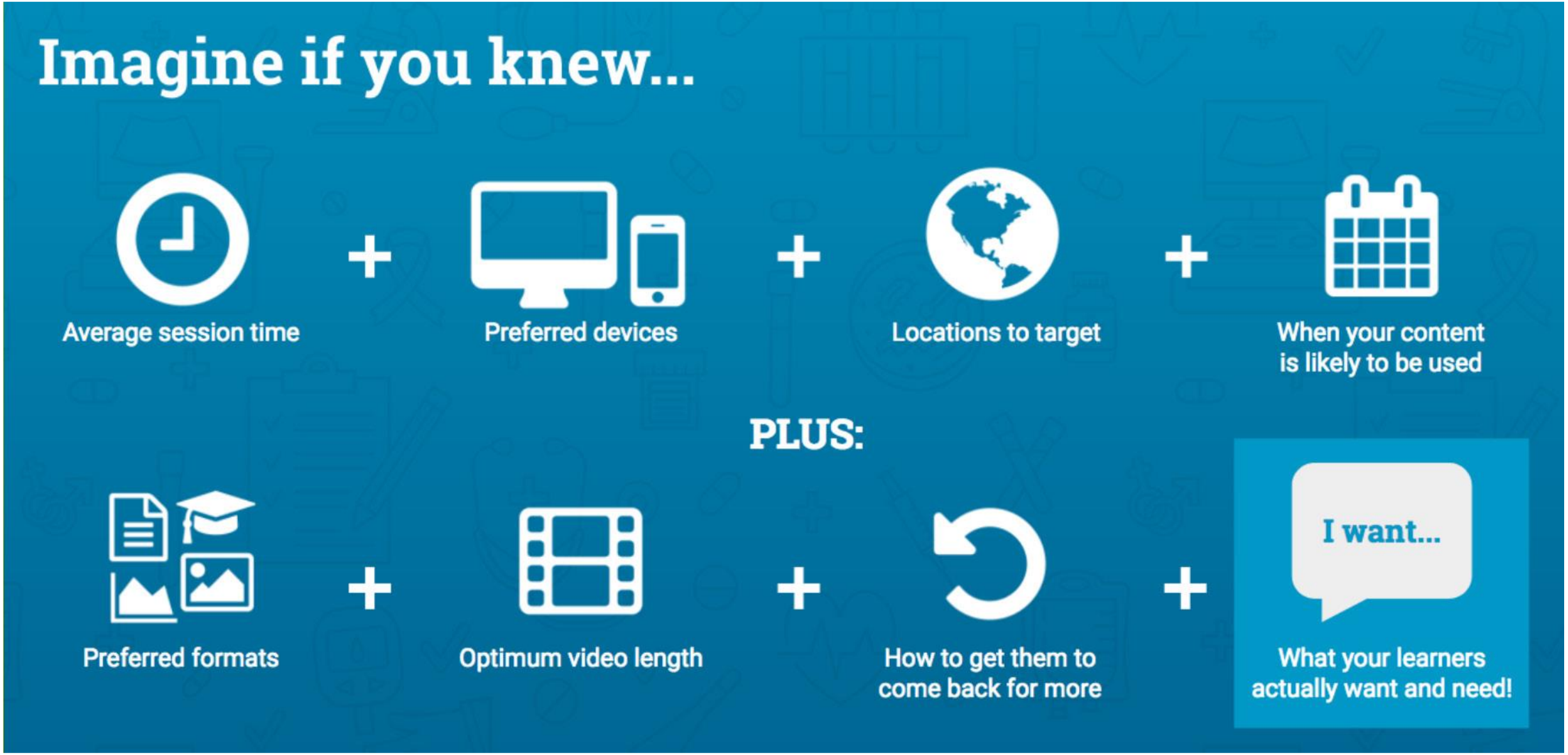
What are the motivations for your institution to adopt learning analytics?

	Counts	**% (n=46**
To improve student learning performance.		
To improve student satisfaction.		
To improve teaching excellence.		
To improve student retention.		
To explore what learning analytics can do for our institution/staff/students.		
To provide personalised learning support.		
To increase learning motivations.		
To inform curriculum.		
To encourage self-regulated learning		
To improve student-teacher communication.		
To improve student recruitment.		

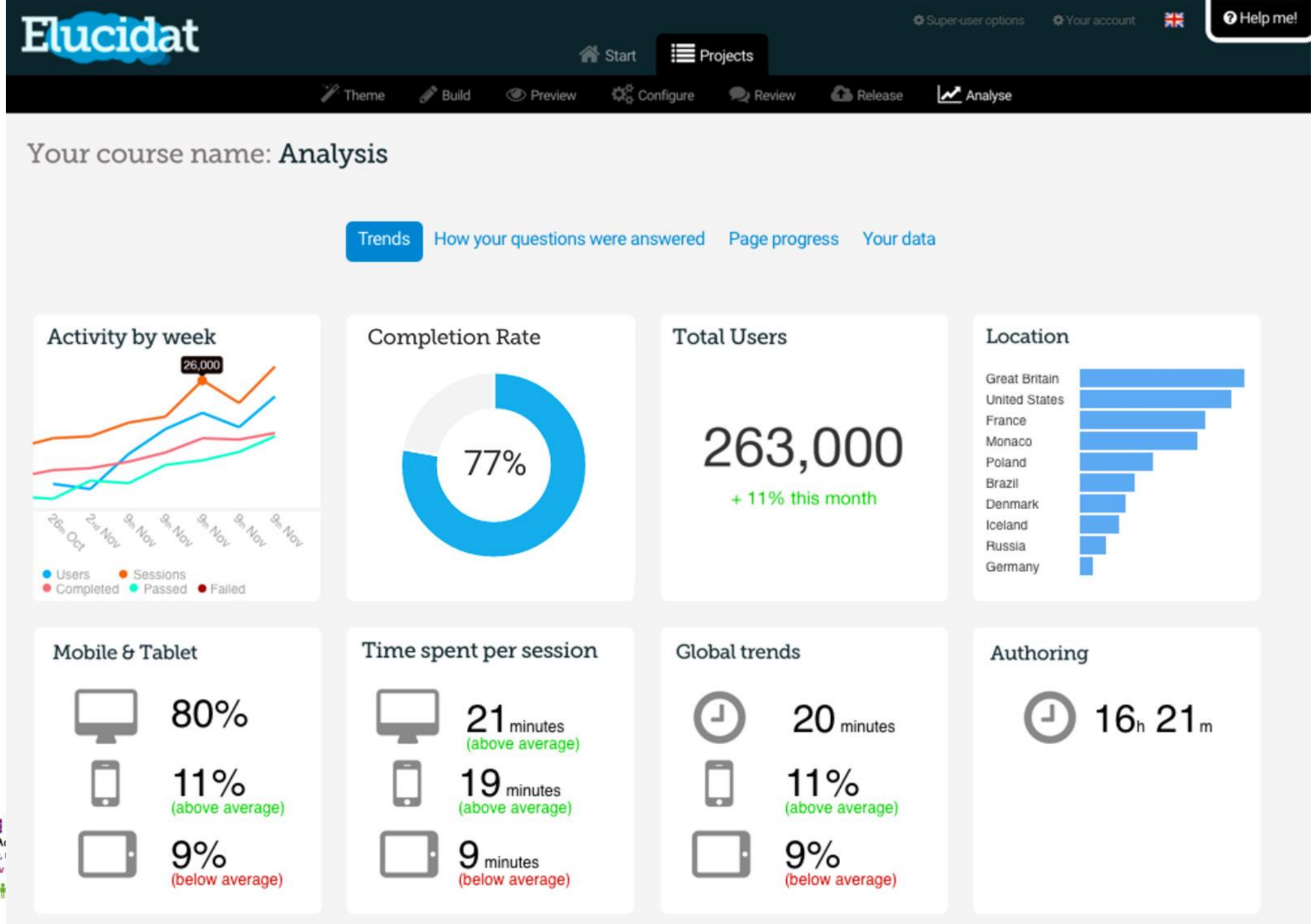
Χρονοεξέλιξη της ΜΑ

Generation of LA	Important points	Time-slot
Pre-LA based Education	One-size-fits-all learning, based on binary decisions.	-2011
The first generation of LA-based Education	Personalized, adaptive diagnosis, support & feedback. LMS centric approach.	-2013
The second generation of LA	Instructional interventions, behavior change, what should learners do	-2017
Next generation of LA	Ubiquitous, holistic, pedagogic, trusted LA with sophisticated, interdisciplinary, plug and play LA products, based on new advanced types of datasets (e.g., emotional); learning meta-analytics; Integration with Conversational Agents; From processing to understanding.	2017+

Background


Imagine if you knew...
Average session time
+
Preferred devices
+
Locations to target
+
When your content is likely to be used
PLUS:
Preferred formats
+
Optimum video length
+
How to get them to come back for more
+
I want...
What your learners actually want and need!

Background



ΠΕΚΕΣ
Συνεργασία με ΠΕ.Κ.Ε.Σ
Δ. Μακεδονίας, Πελ
Σ. Παπαδάκης, Ι. Συρρής, Δ. Τζήμας,
«Διδάσκω Πληροφορική το 2021 για τον

Διαστάσεις ΜΑ

The object of analysis – predictors
Interaction type
Use of serious games (engagement)
Click-stream behavior (login frequency) / low-level data activity
Assessments
SNA parameters
Demographics / student characteristics
Forum use
Video-based
Teacher guidance (intervention/feedback type)
Behavioral indicators
Quiz activity
Wiki metrics

Διαστάσεις ΜΑ

Dependent variables
Student performance (binary or in grades)
Personalized (timely) feedback
Engagement
Prediction (of performance)
Motivation
SRL (self-monitor/manage/reflect/assessment)
Collaboration / teamwork
Intervention
Assessment of mass projects
Retention / risk profiling / drop-out reduction
Monitoring
Class tracking-orchestrating / teacher awareness (TA)
Learning satisfaction
Critical thinking / implicit deeper learning
Adaptation/modeling of learning behavior and strategy
Time management
Confidence

Success stories

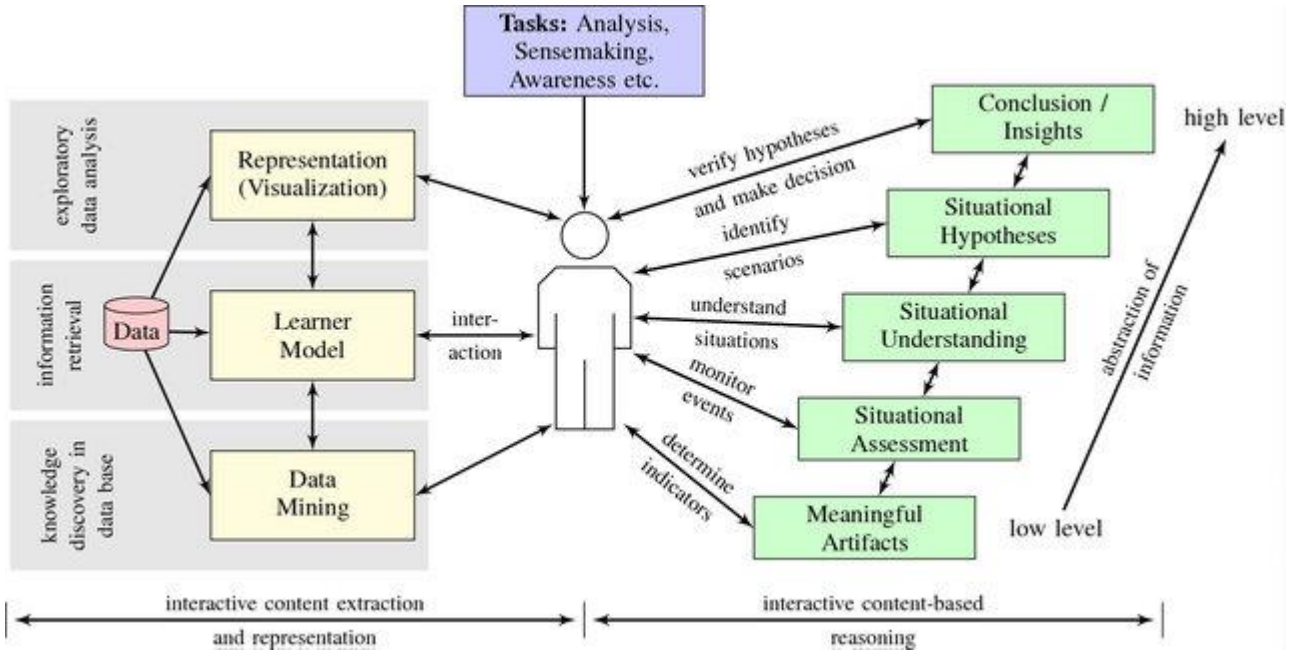
- https://www.cmu.edu/datalab/research/success-story-c-at-cm.html

Πεδία ΜΑ

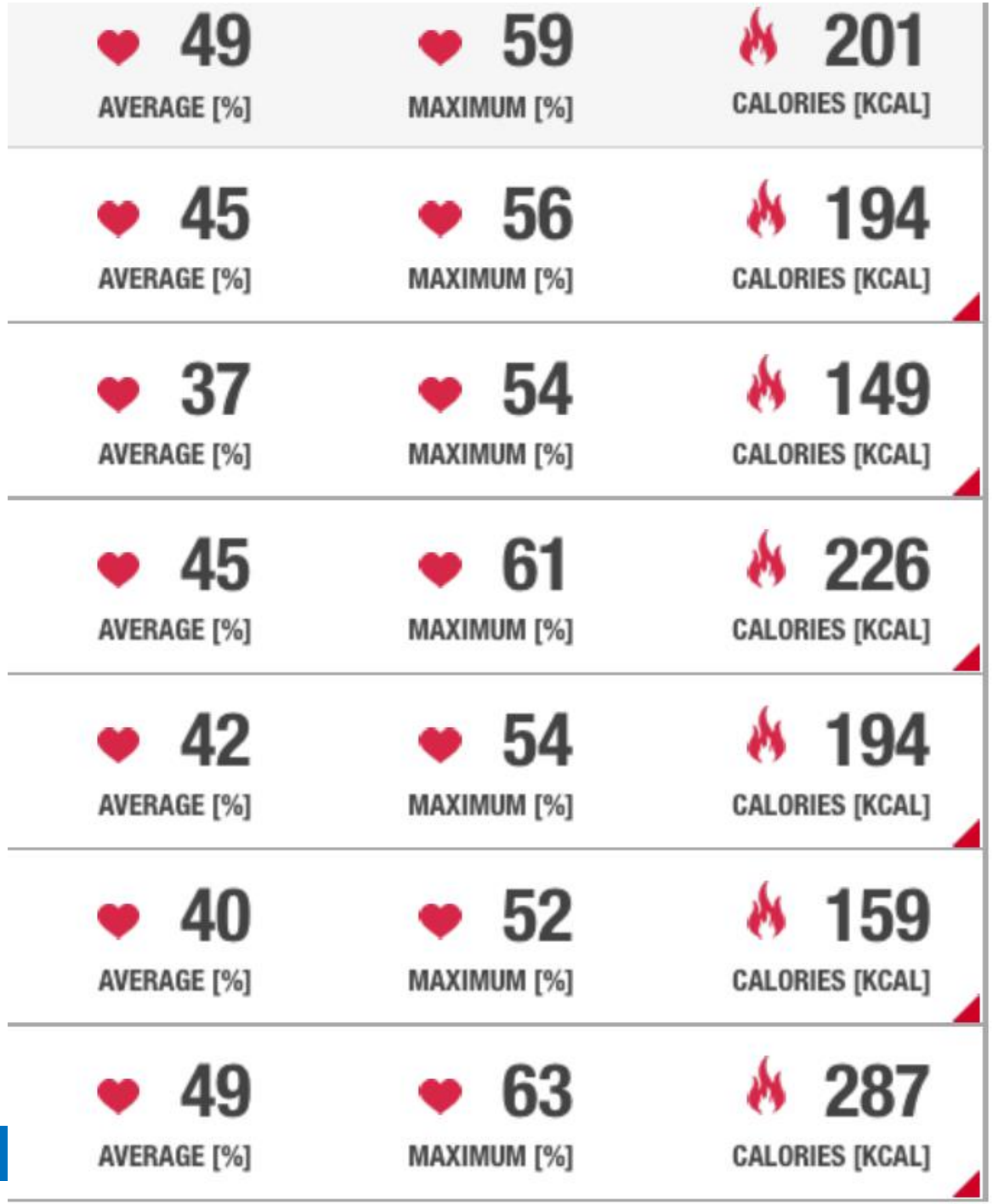
- Learning analytics
- Teaching analytics
- Academic analytics
- Text analytics
- Video analytics (https://bit.ly/2NfNIGx)
- Content analytics
- Context analytics
- Visual LA
- Social LA

Video LA

- This amount of learning activity might be converted via analytics into useful information for the benefit of all video learners. As the number of learners' watching videos on Web-based systems increases, more and more interactions have the potential to be gathered. Capturing, sharing and analyzing these interactions (datasets) can clearly provide scholars and educators with valuable information. In addition, the combination of learner profiles with content metadata provide opportunities for adding value to learning analytics obtained from video based learning.
  (PDF) Analytics on video-based learning. Available from: https://www.researchgate.net/publication/262318264_Analytics_on_video-based_learning [accessed Mar 14 2021].



Wearable LA


49
AVERAGE [%]
59
MAXIMUM [%]
201
CALORIES [KCAL]
45
AVERAGE [%]
56
MAXIMUM [%]
194
CALORIES [KCAL]
37
AVERAGE [%]
54
MAXIMUM [%]
149
CALORIES [KCAL]
45
AVERAGE [%]
61
MAXIMUM [%]
226
CALORIES [KCAL]
42
AVERAGE [%]
54
MAXIMUM [%]
194
CALORIES [KCAL]
40
AVERAGE [%]
52
MAXIMUM [%]
159
CALORIES [KCAL]
49
AVERAGE [%]
63
MAXIMUM [%]
287
CALORIES [KCAL]

Σύνδεση ΜΑ με άλλες διδακτικές τεχνικές μάθησης

Μαθησιακή Αναλυτική & Ανεστραμμένη Τάξη

- Pre-class guidance
- Ανίχνευση προαναπαραστάσεων – πρότερης γνώσης
- Χρόνος μελέτης
- Ανάλυση παρακολούθησης διαδραστικών βίντεοδιαλέξεων (https://bit.ly/3tglUB9)
- Προσέλκυση ενδιαφέροντος
- Forum topics extraction (αναστοχασμός)

ΜΑ & Ανεστραμμένη Τάξη

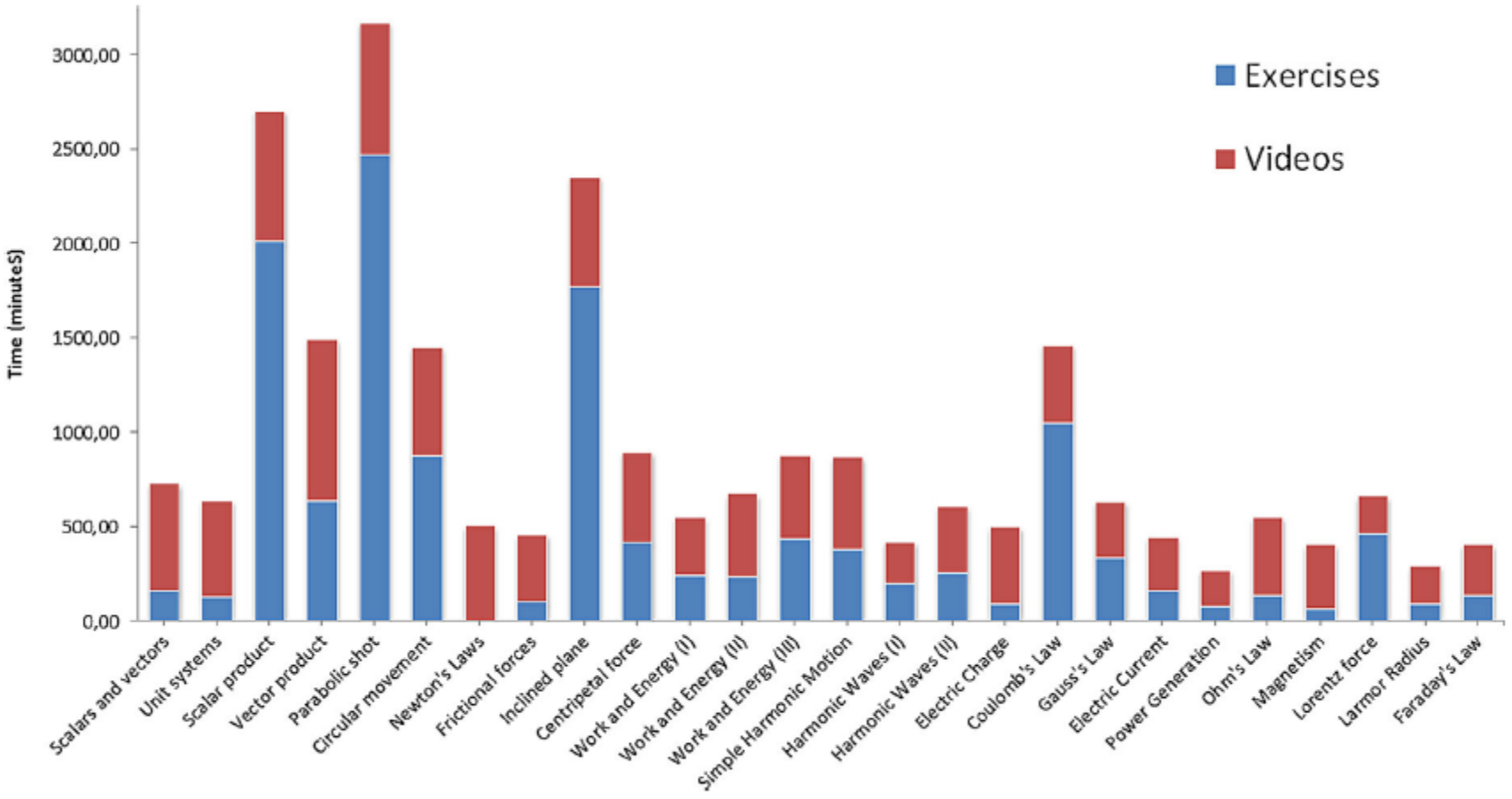


Figure 5 Time spent on each topic. Exercise time in blue and video time in red.

Μαθησιακή Αναλυτική & Διαφοροποιημένη Διδασκαλία

- Διαφορετικές εργασίες
- Ευέλικτες ομάδες
- Συνεχής αξιολόγηση και ρύθμιση (εκπαιδευτικού και μαθητή)

Μαθησιακή Αναλυτική και Αυτορρυθμιζόμενη Μάθηση

Μαθησιακή Αναλυτική και Motivational Interviewing

1. Informing (reflection - affirmation)
2. Asking open-ended questions (αναστοχασμός)
3. Listening (summaries)
4. Commitment talk: end of meeting

Μαθησιακή Αναλυτική & Συνεργατικός Προγραμματισμός

- Google Colab
- repl.it (https://docs.repl.it/Teams/InputOutput)

Εργαλεία ΜΑ

- **LAMS**
- **OpenEclass** (OpenEclass)
- Google Classroom
- **Moodle** analytics (https://docs.moodle.org/310/en/Analytics)
- repl.it
- Google Colab
- **LearnWorlds** (https://youtu.be/q9tox3tz5IQ)
- Open EdX (https://youtu.be/hhn-INn2drk & https://youtu.be/4zO3Z0fcgmw)
- Khan academy
- Edmodo Insights

Moodle

(Ενσωμάτωση σε εργαλεία Αξιολόγησης, Ροής, Ανατροφοδότησης και Συνεργασίας)

- **https://moodle.org/plugins/block_configurable_reports (επιτρέπει στον εκπαιδευτικό να θέσει διάφορα κριτήρια ανάλυσης των σχεδίων μαθήματος (για παράδειγμα, τι είδους δραστηριότητες έχει συμπεριλάβει, πως τις έχει κατανείμει, τι είδους εκπαιδευτικούς πόρους έχει ενσωματώσει) και παράγει γραφήματα τα οποία αναπαριστούν το αποτέλεσμα της ανάλυσης)**
- **https://moodle.org/plugins/report_engagement (Engagement Analytics αναλύει αυτόματα διάφορες πτυχές της επίδοσης του μαθητή (για παράδειγμα, συνέπεια στην υποβολή των εργασιών του μαθήματος και συχνότητα συμμετοχής στις συζητήσεις του μαθήματος) και παρέχει στον εκπαιδευτικό μια εκτίμηση για το 'ρίσκο' που αντιμετωπίζει ο κάθε μαθητής να έχει χαμηλή τελική επίδοση στο μάθημα.)**
- **https://moodle.org/plugins/gradingform_erubric (επιτρέπει στον εκπαιδευτικό να δημιουργήσει ψηφιακές ρουμπρίκες (rubrics) αξιολόγησης των μαθητών - τελικός βαθμός με βάση τα κριτήρια αξιολόγησης δημιουργείται αυτόματα από το εργαλείο)**
- **https://moodle.org/plugins/block_heatmap (συχνότητα εμπλοκής των μαθητών του με κάθε εκπαιδευτική δραστηριότητα και εκπαιδευτικό πόρο του σχεδίου μαθήματός).**

LA λογισμικά

- RapidMiner, WEKA, KEEL, KoNstanz Information MinEr (**KNIME**), **Orange**, and **Python packages (Anaconda)**, Tableau, D3.js, InfoVis, LAD, Concept Trail, Progress Statistics, LOCO-Analyst, EduAnalysis, SoftLearn, Cloud-AWAS, ALAS-KA, Ignite teaching, SmartKlass, **SNAPP**.

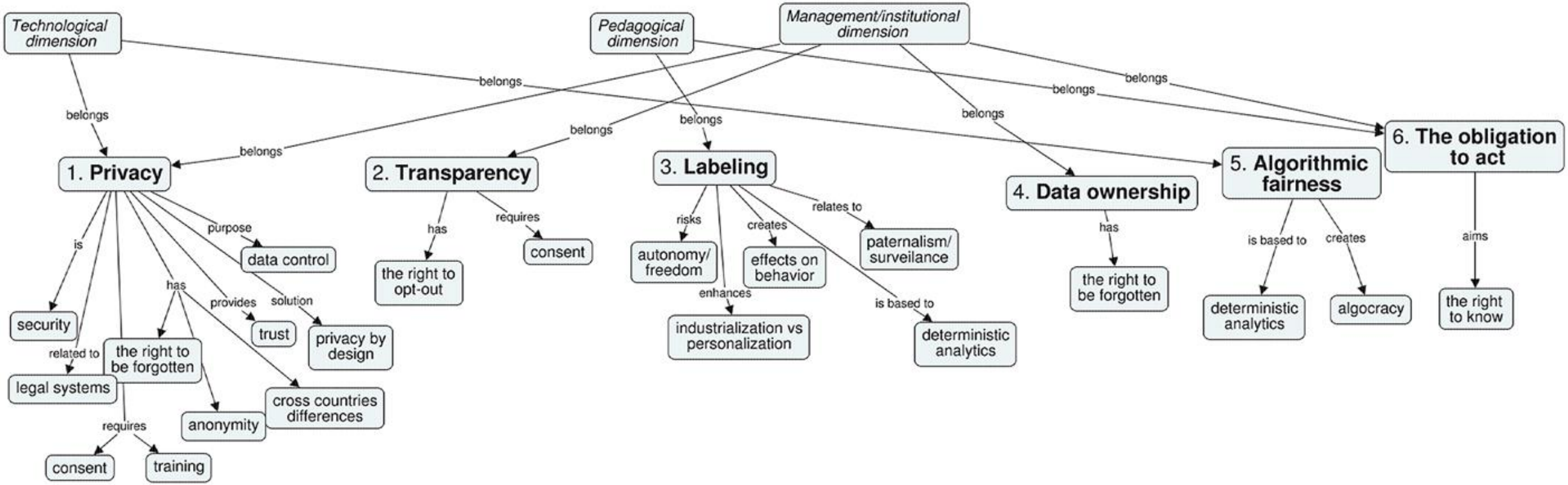
Συνεισφορά MA σε διδακτικά στάδια/τεχνικές

- Video LA -> Διαγνωστική αξιολόγηση
- Automated essay assessment -> Αξιολόγηση
- Μετρικές και κατώφλια -> Διαμορφωτική αξιολόγηση
- Text summarization -> Σύνοψη ενότητας
- Sentiment analysis -> Ικανοποίηση μαθητών
- Έγκαιρη ανάδραση (π.χ. RGB model) -> Αύξηση συμμετοχής/εμπλοκής μαθητών/-τριών
- MA & MI -> change behavior

Διδακτικά Σενάρια εμπλουτισμένα με ΜΑ (Μοντέλο Gagne) – Learning Design

Προκλήσεις - Ζητήματα “Ηθικής” και ΜΑ (10’)

- LA ethics is an interdisciplinary field of study that addresses moral, legal, and social issues; therefore, institutions are responsible for implementing frameworks that integrate these topics. Many of the ethical issues raised apply equally to educational data sets of any size.



State of the art (10’)

- https://www.solaresearch.org/events/lak/lak21/ (διεθνής κοινότητα)
- https://educationaldatamining.org/edm2021/

Επόμενα βήματα (Orange3, **Anaconda**) (20’)

- Text/code classification-clustering
- Topic modeling
- Text extraction-summarization
- Semantic analysis
- Sentiment analysis

- *ML & DL …*

Ευχαριστώ πολύ!

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