



The VITAL project: empowering students and instructors through the use of learning progress data

14 April 2018, Humane seminar

A. Gelan

Overview

- ④ What was VITAL about?
- ④ Implementing the full LA process
- ④ Some research findings
- ④ Feeding back findings to students and instructors for data-informed action
- ④ Lessons learned
- ④ University management uptake

④ What was VITAL about?

VITAL project Learning Analytics in HE

1st



Co-funded by the
Erasmus+ Programme
of the European Union

4

Blended learning courses
Distance



Course design: how do students really use online learning resources



Why Learning Analytics?

④ Definition of LA

- “the measurement, collection, analysis and reporting of data about learners in their context, for purposes of understanding and optimizing learning and the environment in which it occurs” (Long, Siemens, Conole, & Gasevic, 2011)

④ Academic Analytics?

④ Educational Data Mining?

📌 Implementing the full LA process

1. Select & prepare data: specific for each course

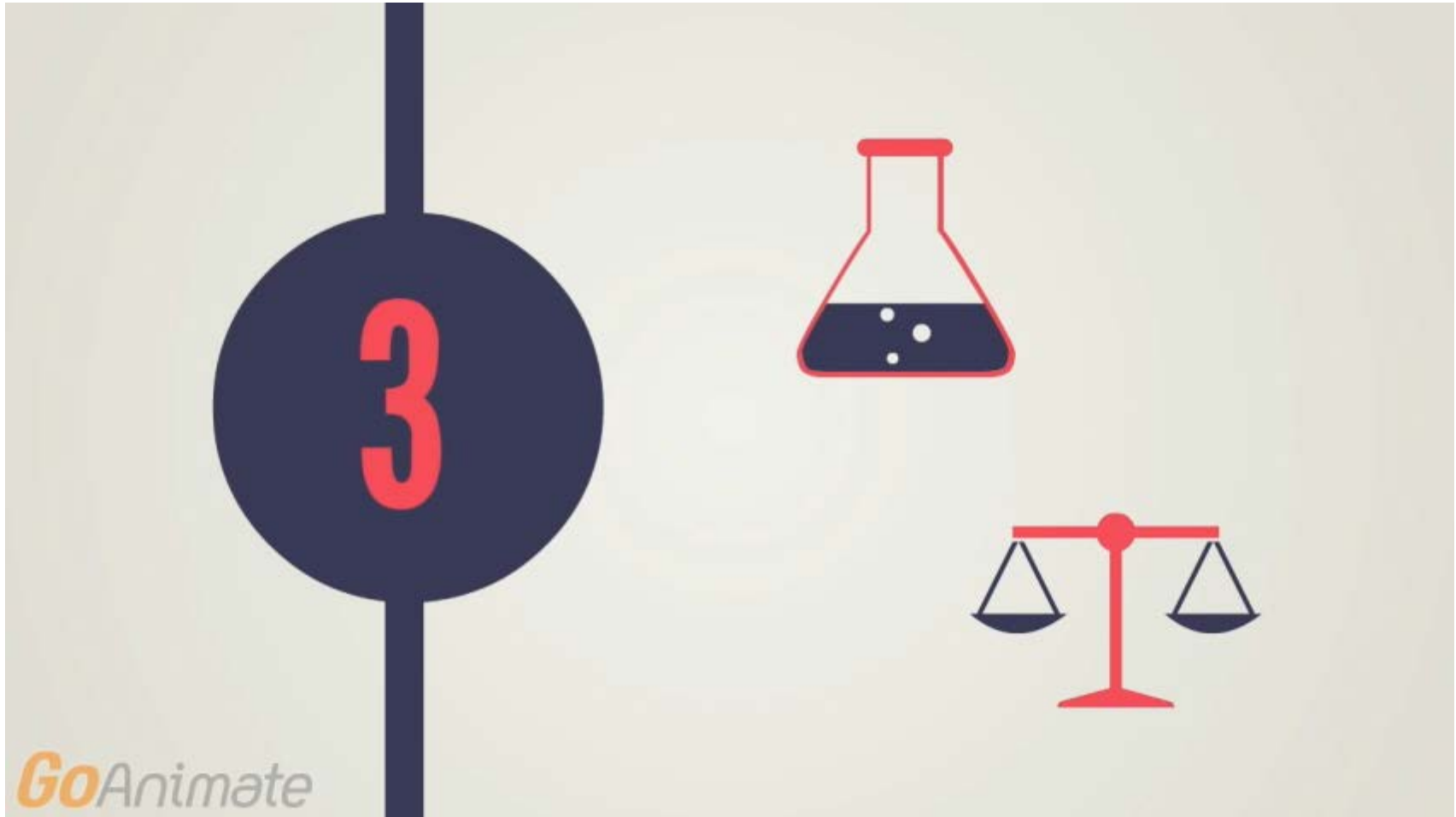


2. Collect 1 semester data in Learning Record Store

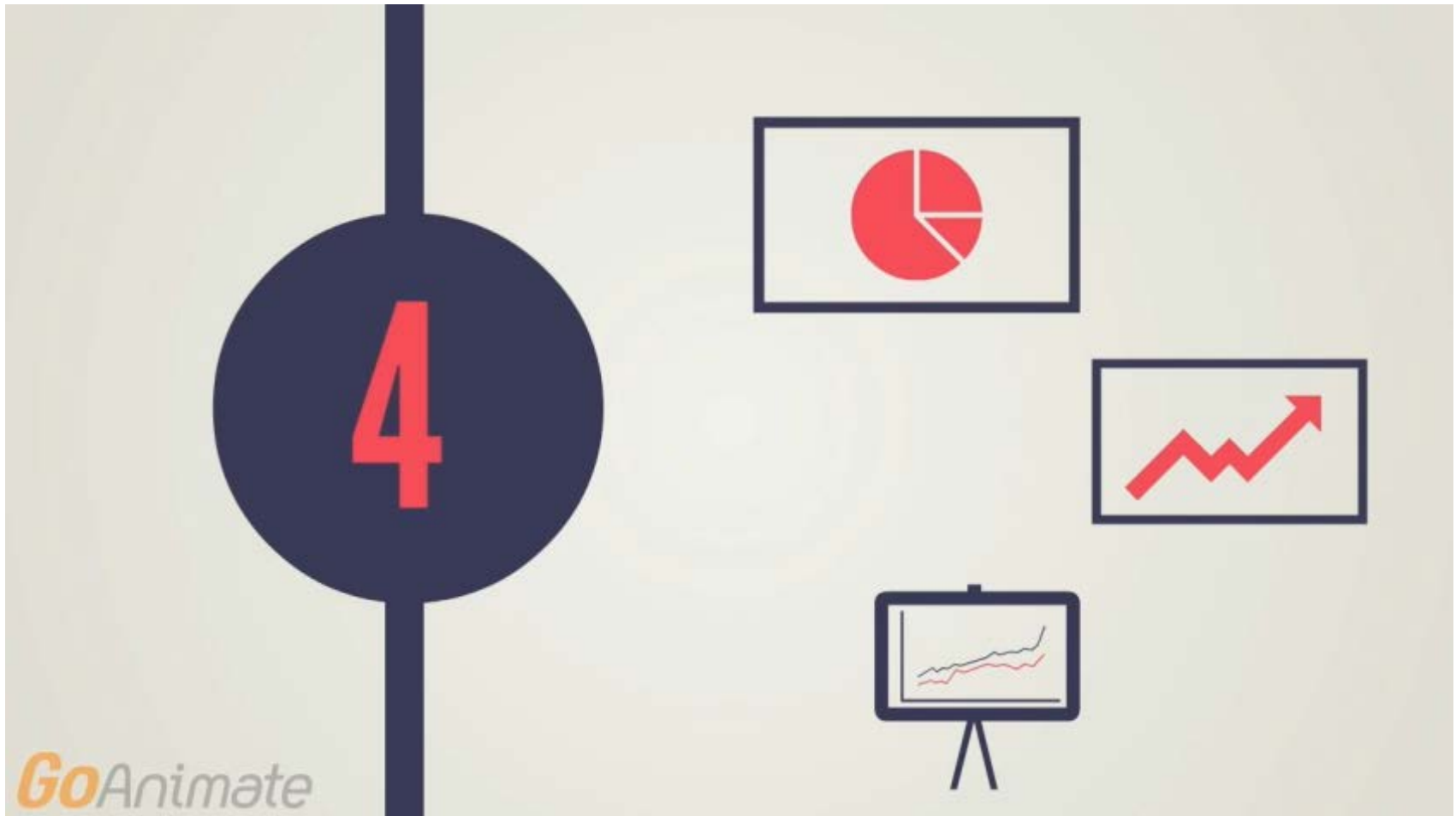
Action plan for legal and ethical aspects of LA:
inform students
define uses of data



3. Analyse the data: statistical & process mining techniques



4. Share and report the data – dashboards



📈 Some research findings

Statistical and process mining analysis

④ Student interaction patterns:

- Order of use of learning activities

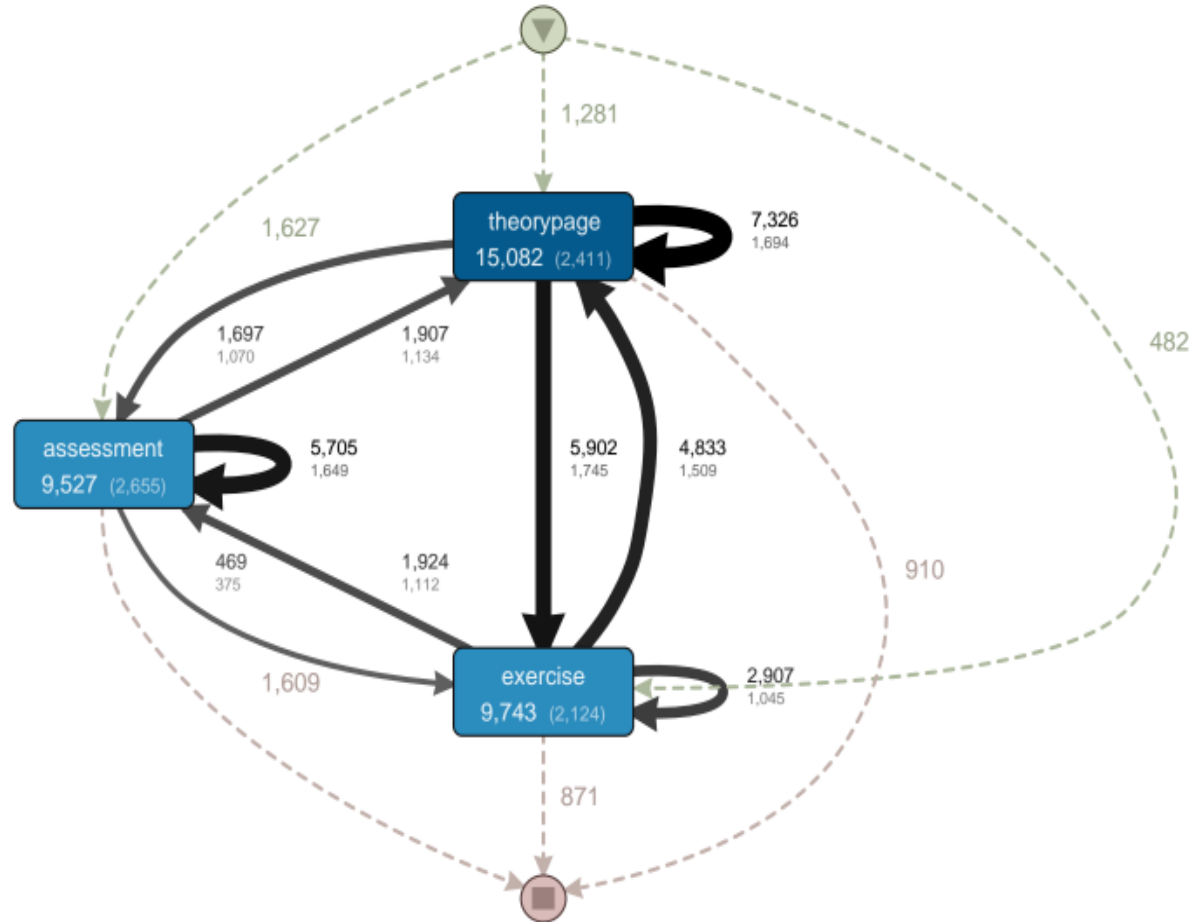
④ Learning analytics metrics:

- Quantify student behaviour: use of activities, timing, ...
- Based on pedagogical and technical design for each course
- Implemented in R

④ Cluster analysis:

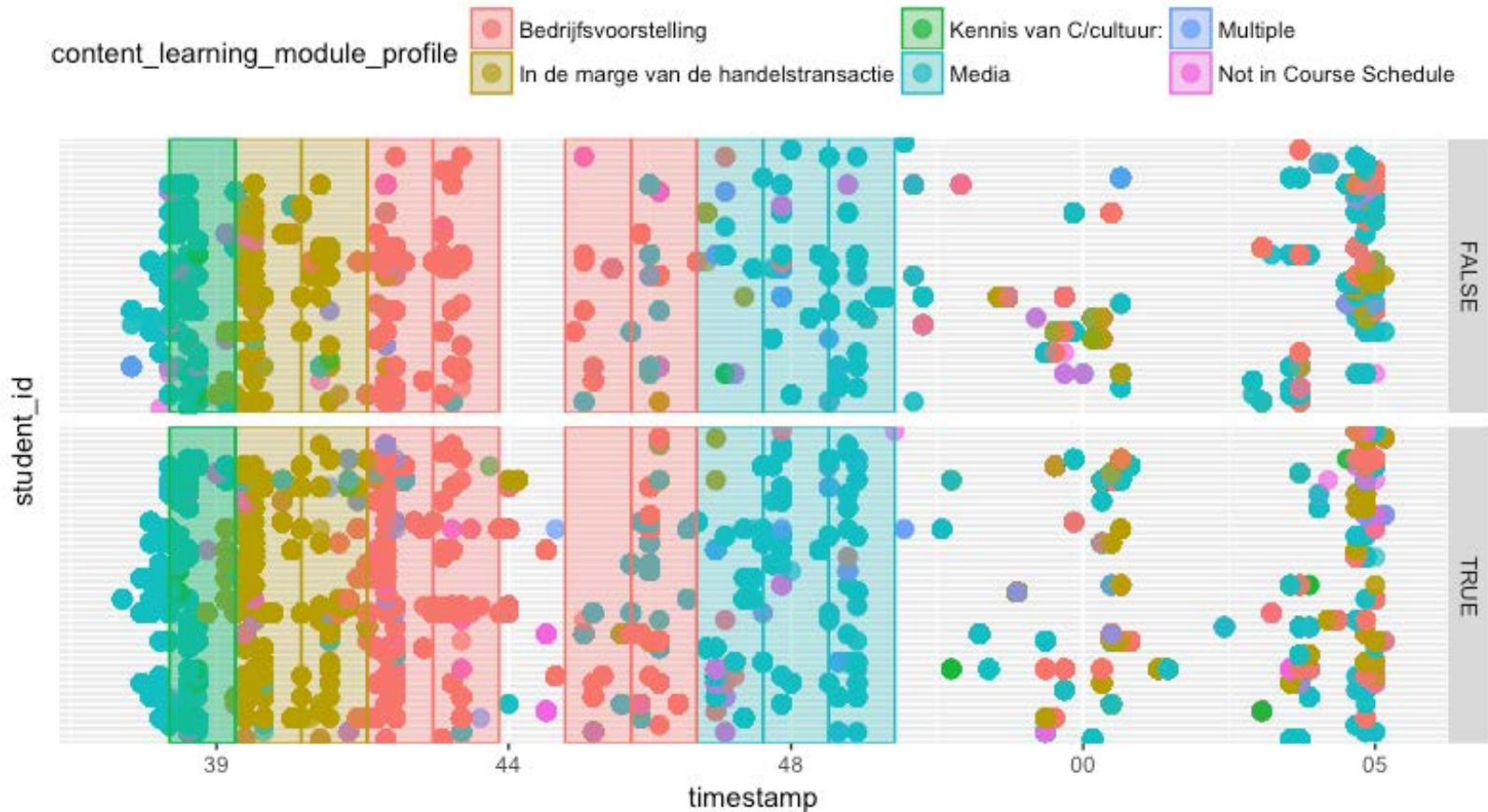
- Creation of student profiles based on online behaviour
- Learning analytics metrics as an input
- Profile clusters based on, e.g., exam score and program

Interaction patterns – UvA data– activity types order of use + time spent



LA Metrics

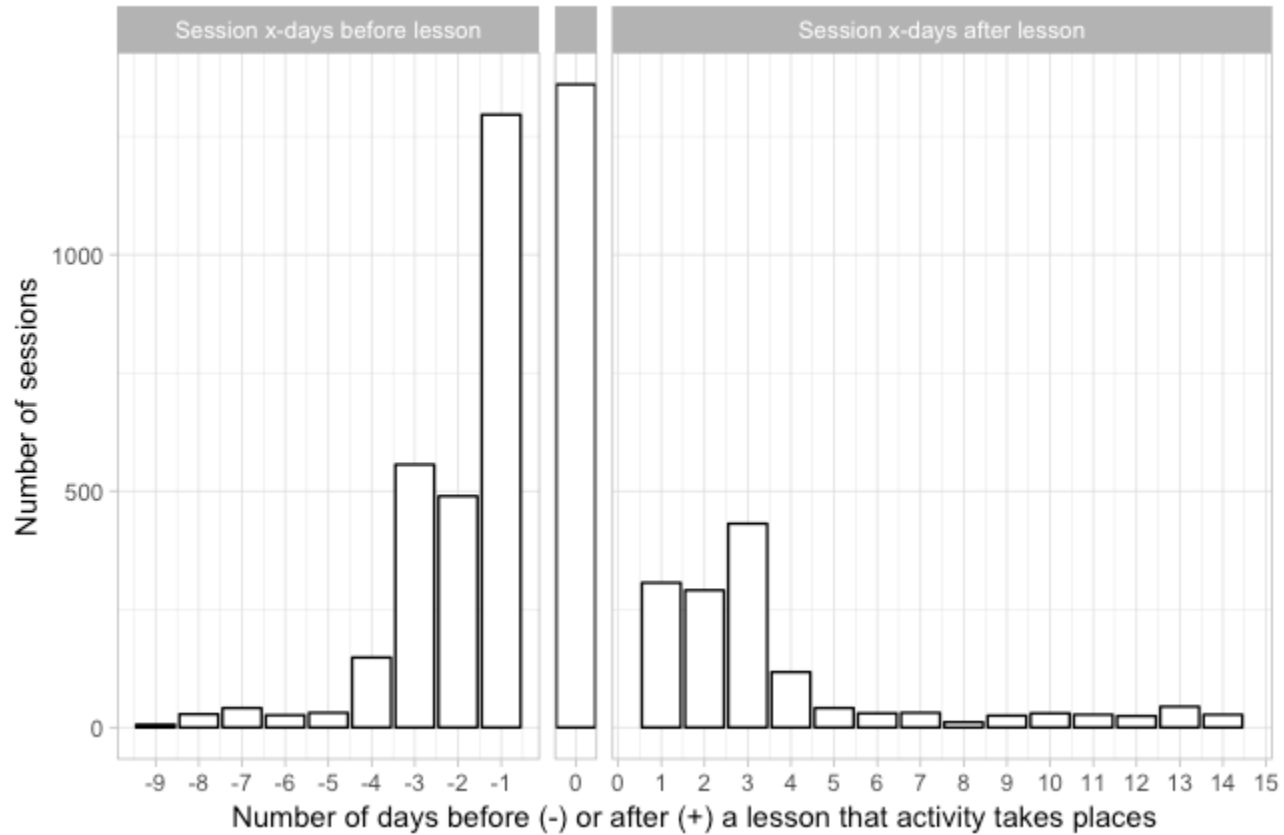
Visualisation: Do students prepare for class (content selection)?



2 bach HW

Visualisation: Do students prepare online for class (timeliness)

Peak in activity before lessons (UH)



Cluster analysis – UHasselt data

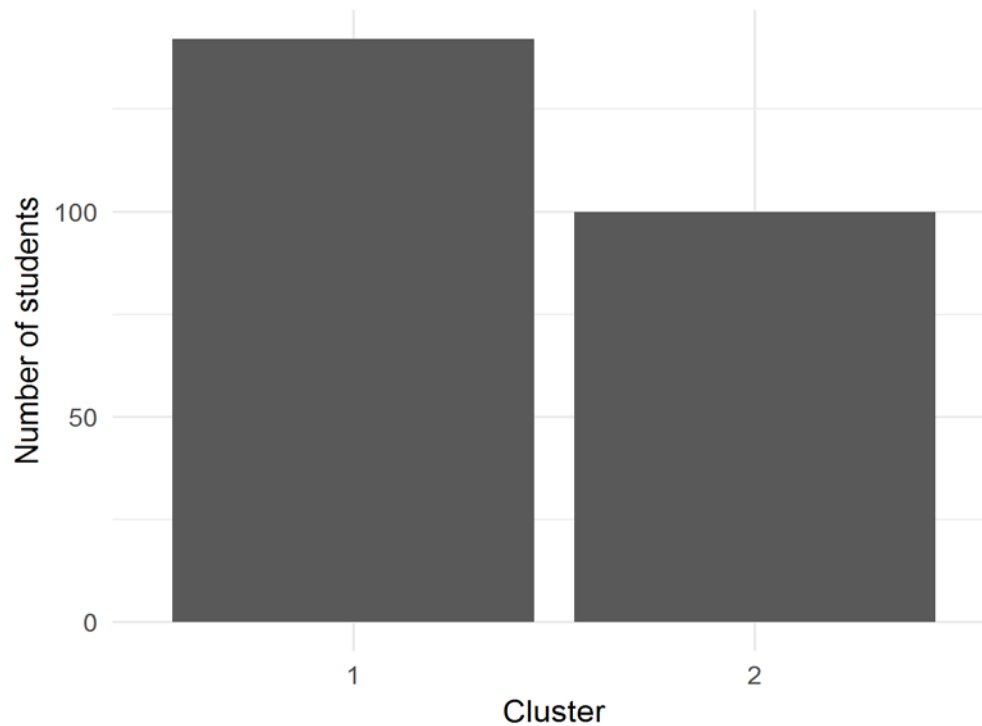
🔄 Context:

- Group students in clusters based on their behaviour
- Methodology:
 - Step 1: Create cluster table (features such as nr. of sessions, closeness to course schedule, average scaled score, use of functionalities, completed ex., retakes)
 - Step 2: Determine number of clusters
 - Step 3: Perform cluster analysis and profile clusters

Cluster analysis

⌚ Results Hasselt University:

- 2 clusters
 - Cluster 1: 142 students
 - Cluster 2: 100 students



Cluster analysis – UHasselt data

⌚ Behavioural variables:

- Number of sessions:

cluster_id	mean	median	sd	q1	q3	min	max
<int>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<int>	<int>
1	20.67606	19	10.06965	14	26.00	2	59
2	38.79000	37	12.40259	30	45.25	16	75

- Number of times learning activity type exercise appears:

cluster_id	mean	median	sd	q1	q3	min	max
<int>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<int>	<int>
1	275.4366	230.0	202.9808	128.50	372.25	5	1024
2	701.2100	640.5	277.0555	485.25	857.50	231	1562

Cluster analysis – UHasselt data

⌚ Behavioural variables:

- Number of times learning activity type theory page appears:

cluster_id	mean	median	sd	q1	q3	min	max
<int>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<int>	<int>
1	55.54225	52	34.24642	31.50	69	4	207
2	89.56000	80	39.93892	59.75	105	28	212

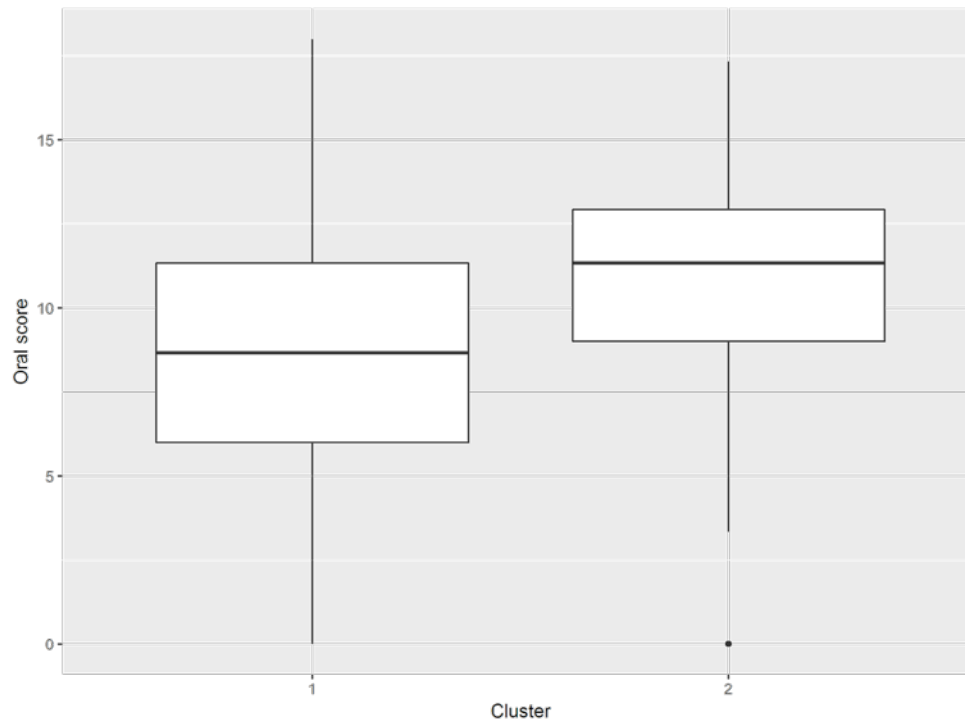
- ... (in total: 19 behavioural variables)

Cluster analysis – UHasselt data

④ Profiling variables:

▪ Oral exam score:

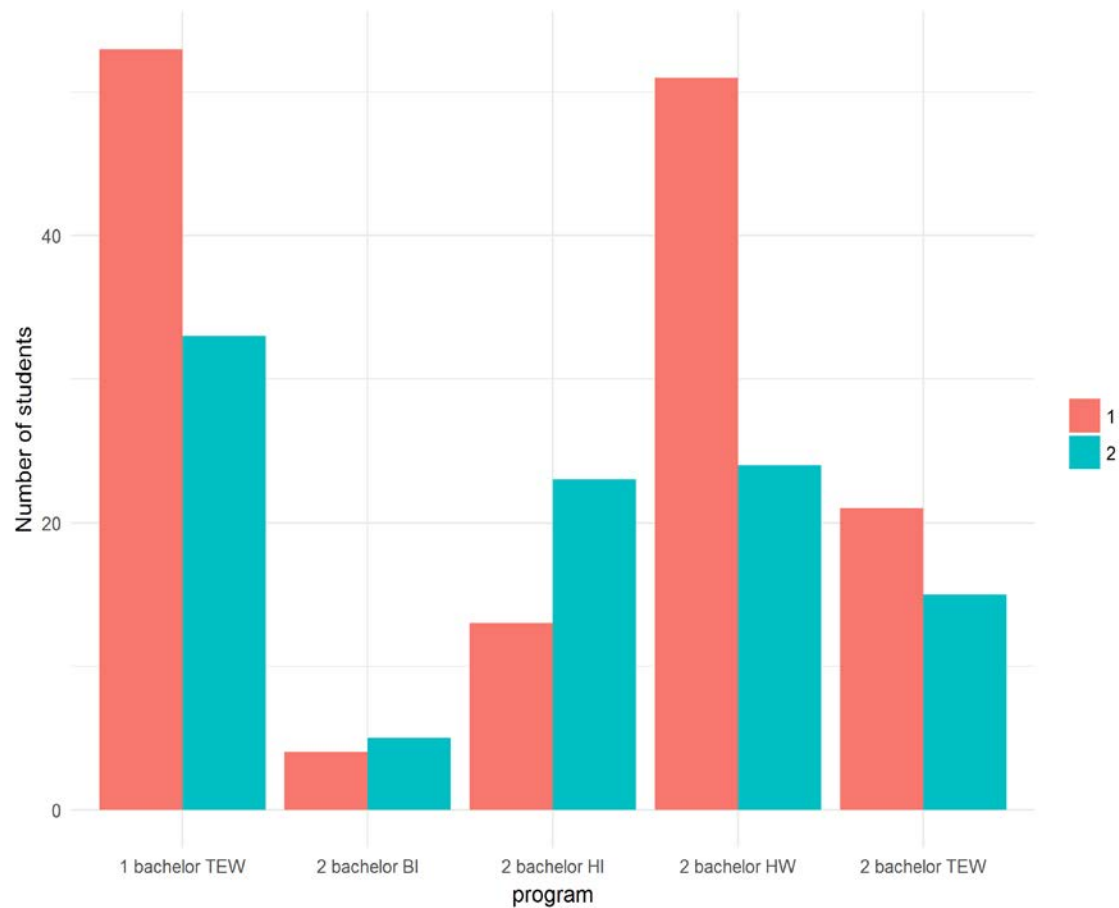
cluster_id <int>	mean <dbl>	median <dbl>	sd <dbl>	q1 <dbl>	q3 <dbl>	min <dbl>	max <dbl>
1	8.01946	8.66667	4.460156	6	11.33330	0	18.0000
2	10.89276	11.33330	3.301332	9	12.91667	0	17.3333



Cluster analysis – UHasselt data

④ Profiling variables:

- Study program:



Main research findings 3 universities

- ⊗ Validation online course design UHasselt/UvA
 - a large majority of the students planned their sessions in accordance with and in preparation of the classes/assessment deadlines (planning, choice of contents)
- ⊗ More online engagement correlates with higher exam grades: UHasselt/UCLan
- ⊗ Specific activities performed significantly more by successful students
- ⊗ Some metrics correlated positively (or negatively) with study success (e.g. nr of sessions, cramming for deadlines, actively completing ex, retakes) – no cause-effect relations
 - ➔ Actionable feedback for instructors
 - ➔ Input for recommendations to students to adapt behaviour (cf. live dashboards)

- ④ Feeding back findings to students and instructors for data-informed action

Project outputs: dashboard tools

Technology

- Open source Learning Locker SaaS
- D3.js JavaScript library for producing data visualisations for web browser

Actionable feedback

- Week-by-week progress
- Compare with course schedule
- Timing of activities
- Strategies of succesful students

Student

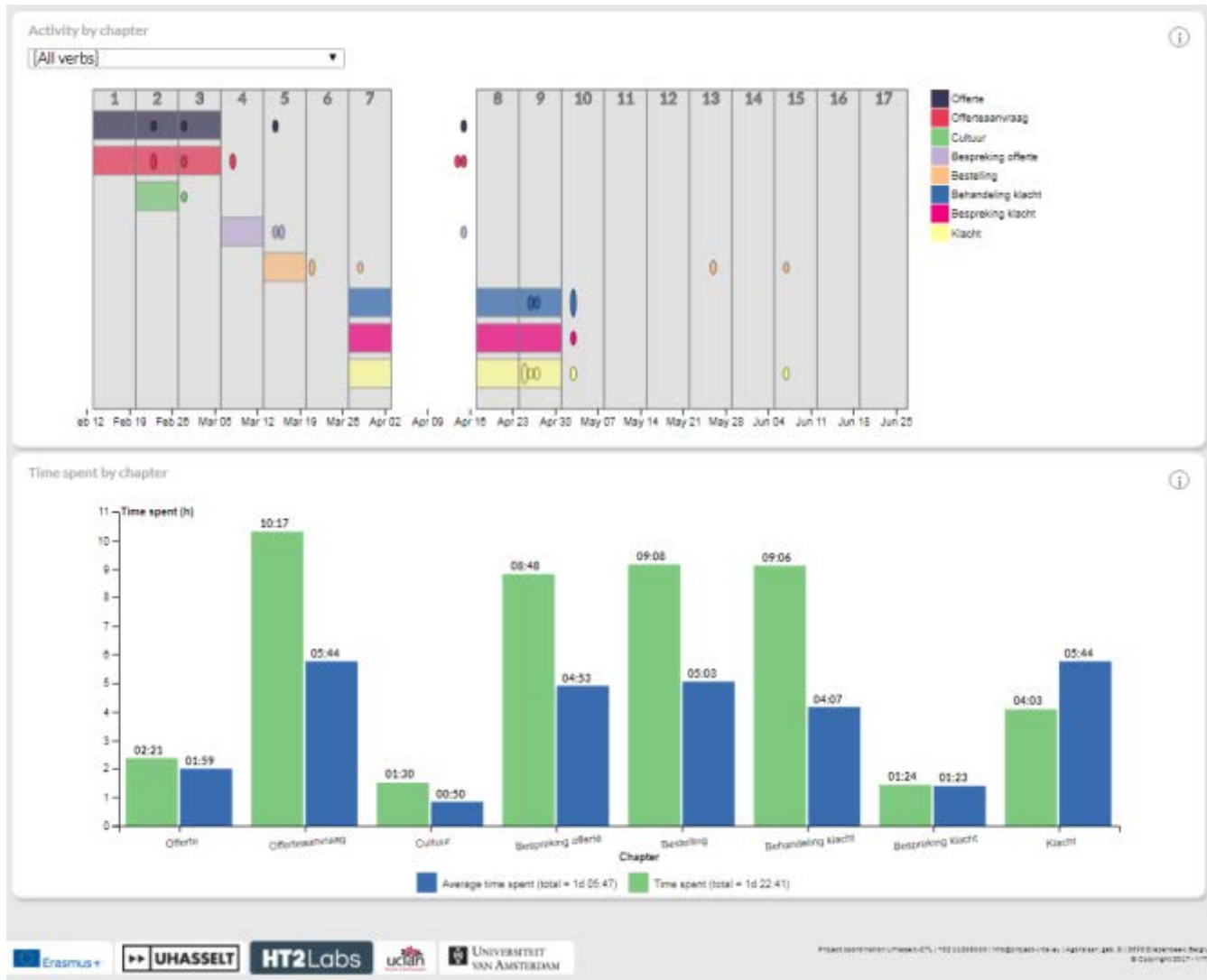
- dashboards.uhasselt.project-vital.eu
- dashboards.uva.project-vital.eu
- dashboards.uclan.project-vital.eu

Instructor

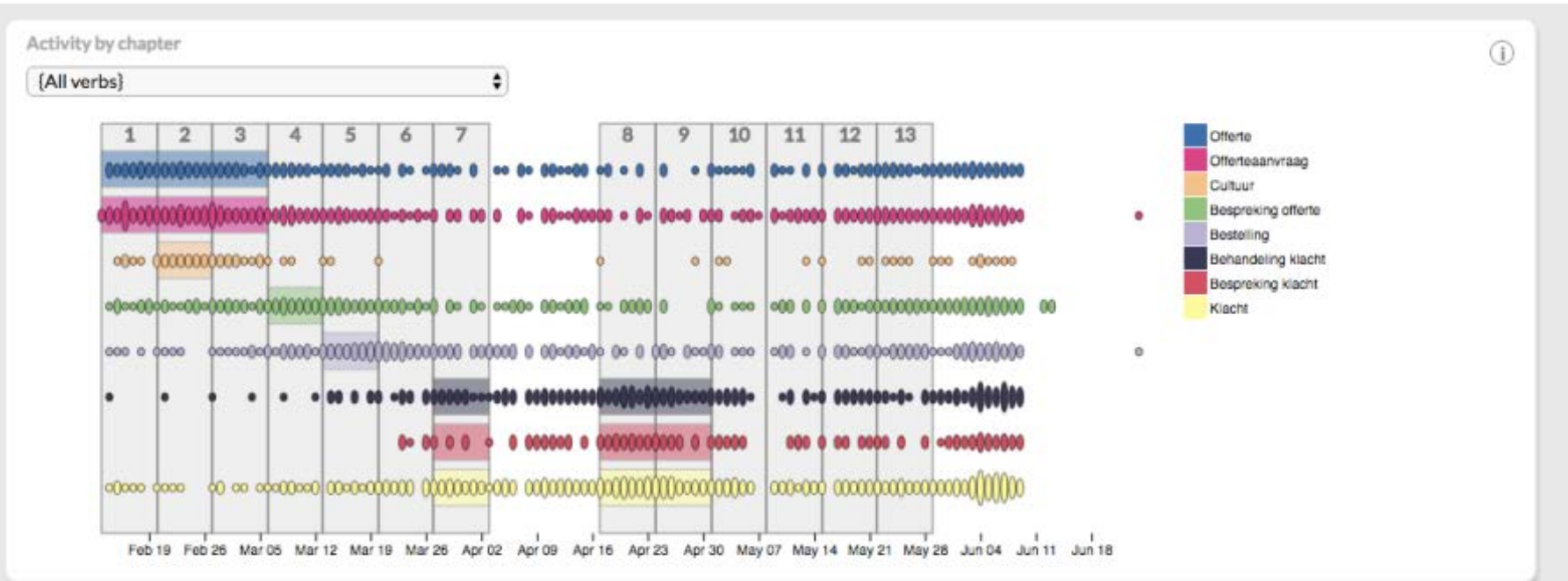
Student dashboard



Student dashboard



Instructor dashboard: group activity per chapter



Project coordination UHasselt-CTL | +32 33259660 | info@project-vital.eu | Apporiksen, geb. D | 3590 Diepenbeek, Belgium
© Copyright 2017 - VITAL

Instructor dashboard: group view

Wat is de huidige prestatie op belangrijke activiteiten?

Completed Exercises



Completed Exercises (Score > 70%)



Played Audio Fragments



Recorded Voice Fragments



Met welke oefeningen worstelen studenten het meest/minst?

Moeilijkste oefeningen op basis van verschillende criteria

#	Name	%	↺	⊙
1.	MA_Afspraak_2.3_04	0	3	03 min
2.	MA_Omgang_1.1_10	0	3	02 min
3.	MA_Afspraak_2.3_17	0	3	58 s
4.	MA_Afspraak_2.2_06	2	3	02 min
5.	MA_1eontmoet_3_03	12	3	02 min
6.	MA_Afspraak_2.3_03	20	3	09 min
7.	MA_Afspraak_2.3_06	50	3	13 min
8.	MA_Afspraak_2.2_03	46	3	03 min
9.	ME_Brief_2.5_07	0	2	06 min
10.	ME_Brief_2.5_08	0	2	04 min

First « 1 2 3 4 5 » Last

10 ↓

Welke theoriepagina's bekijken studenten het meest/míinst?

Moeilijkste theoriepagina's op basis van verschillende criteria

#	Name	↺	📄	⊙
1.	2.5.5.1 Organogram van een bedrijf	7	4	50 min
2.	Woordenschat geografische ligging	7	8	03 min
3.	2.2.1.4 Spellen internet- of e-mailadres	11	0	15 min
4.	2.5.3 Ontstaan en ontwikkeling van een bedrijf...	7	4	01 min
5.	2.2.1.2 Algemene formules	5	1	46 min
6.	2.2.2.2 Inleiding zakenbrief	8	3	57 s
7.	2.2.2.3 Centraal gedeelte zakenbrief	8	3	33 s
8.	2.2.2.4 Slotformules zakenbrief	8	3	30 s
9.	2.4.1 Voorstel aanvaarden of afwijzen (afspraak)	9	0	11 min
10.	2.2.1.5 Telefoon- en rekeningnummers	3	0	54 min

First « 1 2 » Last

10 ↓

Instructor dashboard: group view



 Lessons learned

Conclusions

- ⊗ Potential of big data and LA for educational research, quality assurance
- ⊗ Data full students cohorts (vs. experiment)
- ⊗ Data-based evaluation and monitoring already during semester
- ⊗ Students and instructors are involved from start and use their own data
- ⊗ Take care of ethical and legal dimensions of using data and implementing LA from the start
- ⊗ Potential of open source technologies: independent of (commercial) offerings of learning solutions
- ⊗ Scalable to other courses with online component
- ⊗ Reusable tools and analysis techniques
- ⊗ Maximised internally available expertise...

④ University management uptake

No project extension (other priorities)

- ⌚ Problem of digital learning readiness
- ⌚ Concerns about data privacy, data handling policies

- ⌚ Importance of management support
- ⌚ Digital learning culture:
 - Not only infrastructure but also
 - staff skills & training,
 - educational support service (IT + pedagogy),
 - valorization of teaching innovation,
 - importance of top to bottom supported innovation,
 - involve students
 - data management

Digital transformation is getting ready for higher education; but is higher education ready for digital transformation?

- ④ Prepare thoroughly for the data transformation
- ④ Capitalize on own expertise & bring together different disciplines
- ④ Support staff & stimulate innovation
- ④ Intelligence from own data, contextualized in own organization
- ④ Not let big companies take over, jump on big data train (already behind)
- ④ Collaborate – national support services
- ④ Protect & build on their own data - trust
- ④ Involve staff & students

More info & project deliverables


www.project-vital.eu

anouk.gelan@uhasselt.be

anouk.gelan@innoenergy.com

Gelan, A.; Fastré, G.; Verjans, M.; Martin, N.; Janssenswillen, G.; Creemers, M.; Lieben, J.; Depaire, B. & Thomas, M. (2018) *Affordances and limitations of learning analytics for computer-assisted language learning: a case study of the VITAL project*. In: *Computer Assisted Language Learning*, 31(3), p. 294-319.

4 courses – a common approach to LA

Partner	MODALITY	WEEKLY COURSE SCHEDULE	ONLINE LEARNING ENVIRONMENT	BEHAVIOURAL DATA xAPI standard	METADATA	
UCLan course 1	Blended  Flipped Full distance	120h F2F group sessions 280h self-study with discussion boards	Weekly classes 12 weeks	Blackboard LMS	Engagement <ul style="list-style-type: none"> • Use of resources/ functionalities • Activity types • Order of use • Time spent • Weekly planning 	<ul style="list-style-type: none"> • Course metadata (contents/ week) • Class schedules or assessment deadlines • Student metadata, e.g. SE programme final exam grade
UHasselt		24h F2F group sessions 57h individual self-study instructional modules	Weekly classes 12/13 weeks	EMCG in-house learning environment	Performance <ul style="list-style-type: none"> • Exercise scores 	
UvA		10h F2F group sessions 52 individual self-study instructional modules	Weekly deadlines 9 weeks	SOWISO in-house learning environment	<ul style="list-style-type: none"> • Online assessment scores 	
UCLan course 2		20 credits Self-study with discussion boards	12 weeks	Blackboard LMS		

Approach to Learning Analytics

- ④ **Bottom-up approach: contextualised at course level**
 - descriptive-explorative research design
 - no predictive or prescriptive aim
- ④ **Interpretation of data:**
 - pedagogical assumptions of courses under analysis
 - learning activities in online learning environment or LMS (blended or distance learning): only part of learning process
- ④ **Actionable feedback:**
 - room for pedagogical interventions
 - adapt behaviour to improve learning
- ④ **Privacy & ethical treatment of data**
 - student consent
 - transparency
 - anonymised data processing
 - interpretation by instructor
 - student access to data (dashboards)

Common tracking design based on Experience API specification

(Extract from xAPI recipe: list of events)

Event name	Activity type	Verb
application login	application	logged in
access course	course	accessed
access chapter	module	accessed
attempt interaction (exercise)	interaction	attempted
access page	page	accessed
complete interaction	interaction	completed
play video	media	played
complete audio	media	completed
dictionary search	media	searched
record voice	media	voice-recorded
attach bookmark	bookmark	attached
complete assessment	assessment	completed
access grade book	grade classification	accessed
post on discussion board	discussion	posted

Data analysis using process mining

④ Process mining:

- Extraction of knowledge from process-related data
- Illustration:

<i>Student id</i>	<i>Timestamp</i>	<i>Learning activity</i>	<i>Status</i>	<i>...</i>
...
19548	17/04/2017 17:44:22	Logged in	Logged in	...
19548	17/04/2017 17:44:33	Exercise 214	Accessed	...
19548	17/04/2017 17:48:22	Exercise 214	Attempted	...
14277	17/04/2017 17:49:07	Theory page 66	Accessed	...
19548	17/04/2017 17:50:07	Exercise 214	Completed	...
16217	17/04/2017 17:51:09	Theory page 70	Accessed	...
...

④ Pilot phase:

- Application of several process mining methods on test data
- Report available on project website