RAGE
Realising an Applied Gaming Eco-System

Cátedra Telefónica-Complutense
Educación Digital y Juegos Serios

Telefónica Cátedras Telefónica

beaconing
BREAKING EDUCATIONAL BARRIERS WITH CONTEXTUALISED PERVASIVE AND GAMEFUL LEARNING

Gaming Learning Analytics: Contributing to the Serious Games Ecosystem

European Conference in Game-Based Learning (ECGBL 2016), Paisley, Scotland, UK

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http://www.slideshare.net/BaltasarFernandezManjon

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Serious Games Market

2014-2019 Global Market Forecasts for Game-based Learning and Simulation-based Learning

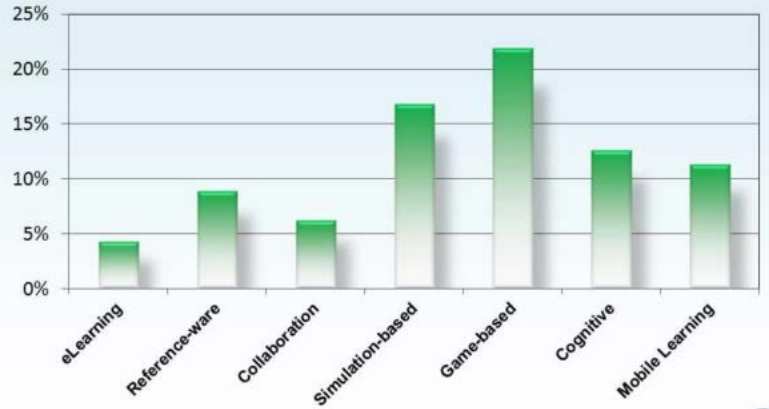
- Ambient Insight separates Game-based Learning revenues and Simulation-based Learning revenues
- There are distinct pedagogical differences between Game-based Learning and Simulation-based Learning
- Our definitions are based on the definitions developed by Alessi and Trollip

Global Revenues by Learning Product Type***	2014 Revenues in US$ Millions	2019 Revenues in US$ Millions	Five-Year CAGR 2014-2019
Simulation-based Learning	$3,823.29	$8,307.95	*16.8%*
Game-based Learning	$1,841.41	$4,954.12	*21.9%*
Total	**$5,664.70**	**$13,262.55**	***18.5%***

*** *Does not include hardware*

Ambient Insight 2015

2014-2019 Worldwide Five-year Growth Rates by Seven Learning Technology Product Types



Ambient Insight 2015

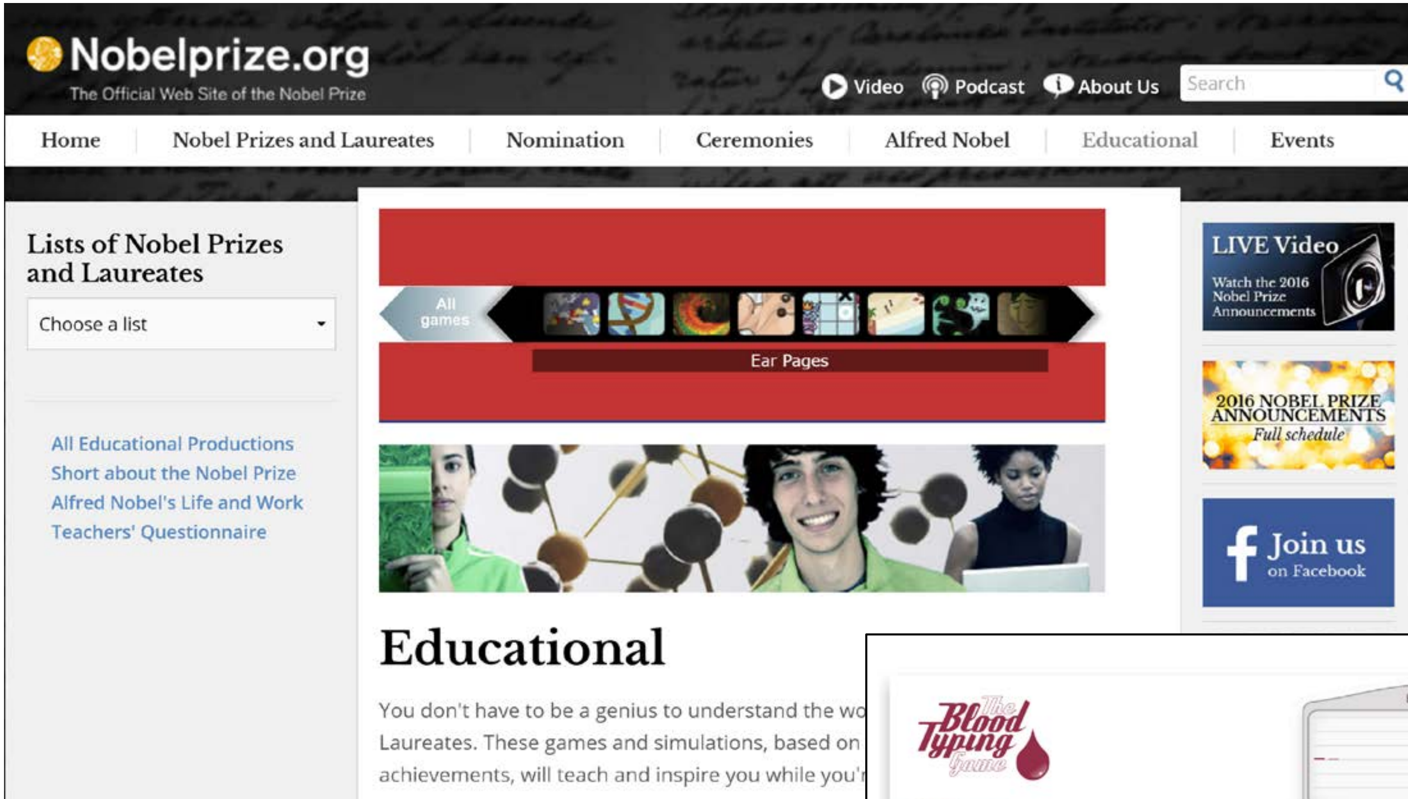
Sam S. Adkins. (2015). *The 2014-2019 Global Edugame Market*. *Ambient Insight, LLC*.

DRAGONBOX: ALGEBRA BEATS ANGRY BIRDS

WIRED

ALL RIGHT, KIDS! Raise your hand if you like algebra! Hmmm. Now, raise your hands if you like *Angry Birds*! I see. What if I were to tell you that *Angry Birds* had been surpassed in the App Store — by a game that involves solving algebra equations? Because that's what *DragonBox* did.

https://www.wired.com/2012/06/dragonbox/


Nobelprize.org
The Official Web Site of the Nobel Prize
Video
Podcast
About Us
Search
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Nobel Prizes and Laureates
Nomination
Ceremonies
Alfred Nobel
Educational
Events
Lists of Nobel Prizes and Laureates
Choose a list
All Educational Productions
Short about the Nobel Prize
Alfred Nobel's Life and Work
Teachers' Questionnaire
All games
Ear Pages
Educational
You don't have to be a genius to understand the wo
Laureates. These games and simulations, based on
achievements, will teach and inspire you while you'
LIVE Video
Watch the 2016 Nobel Prize Announcements
2016 NOBEL PRIZE ANNOUNCEMENTS
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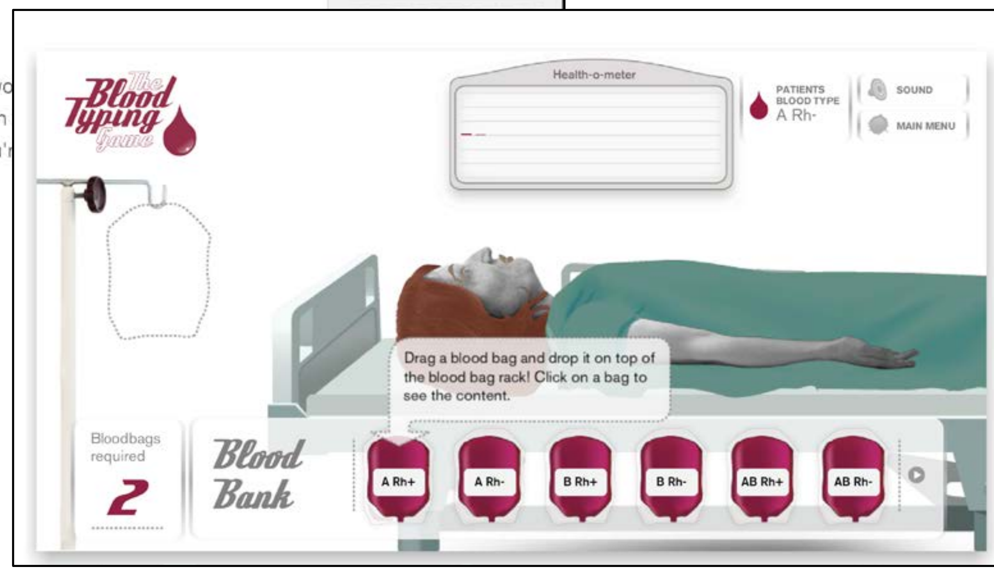
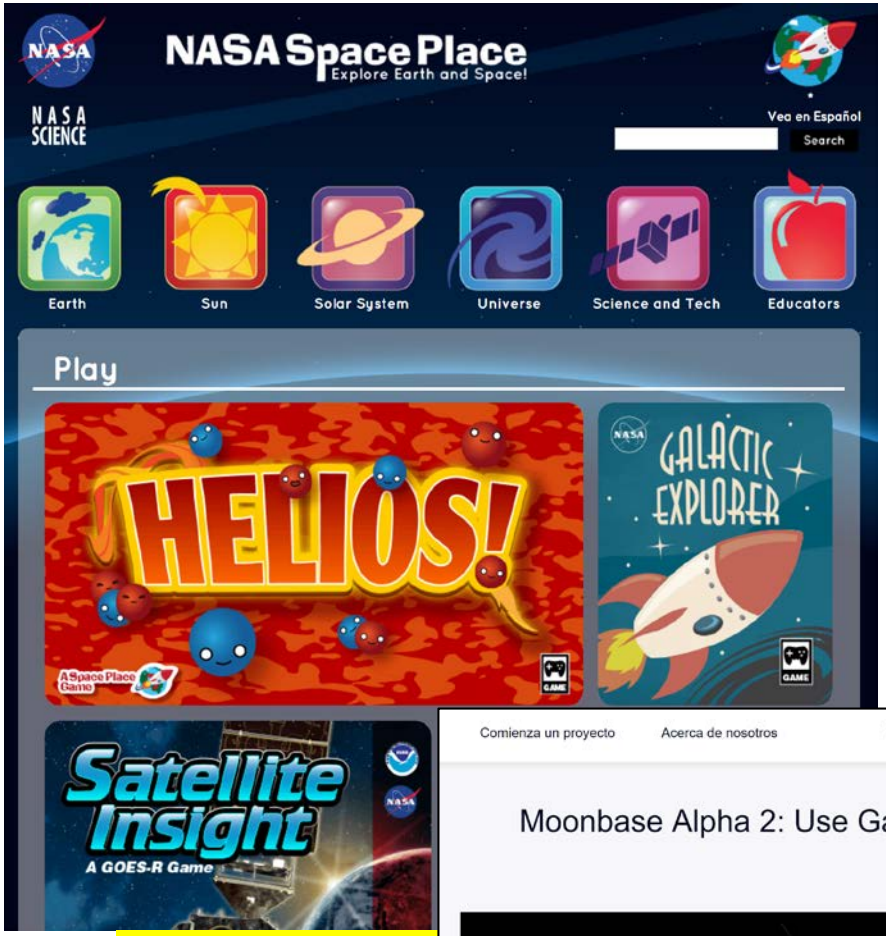
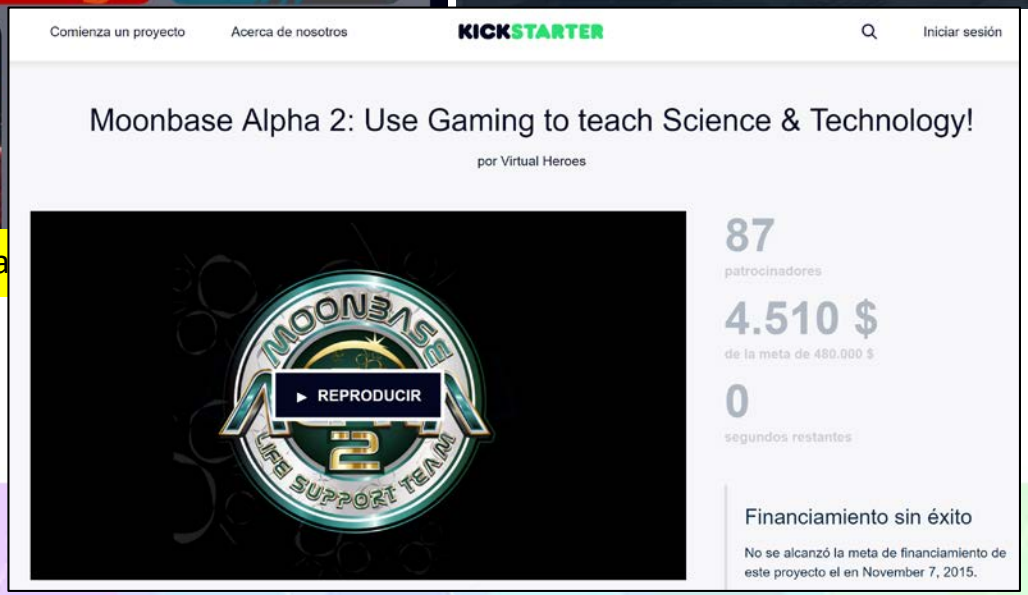
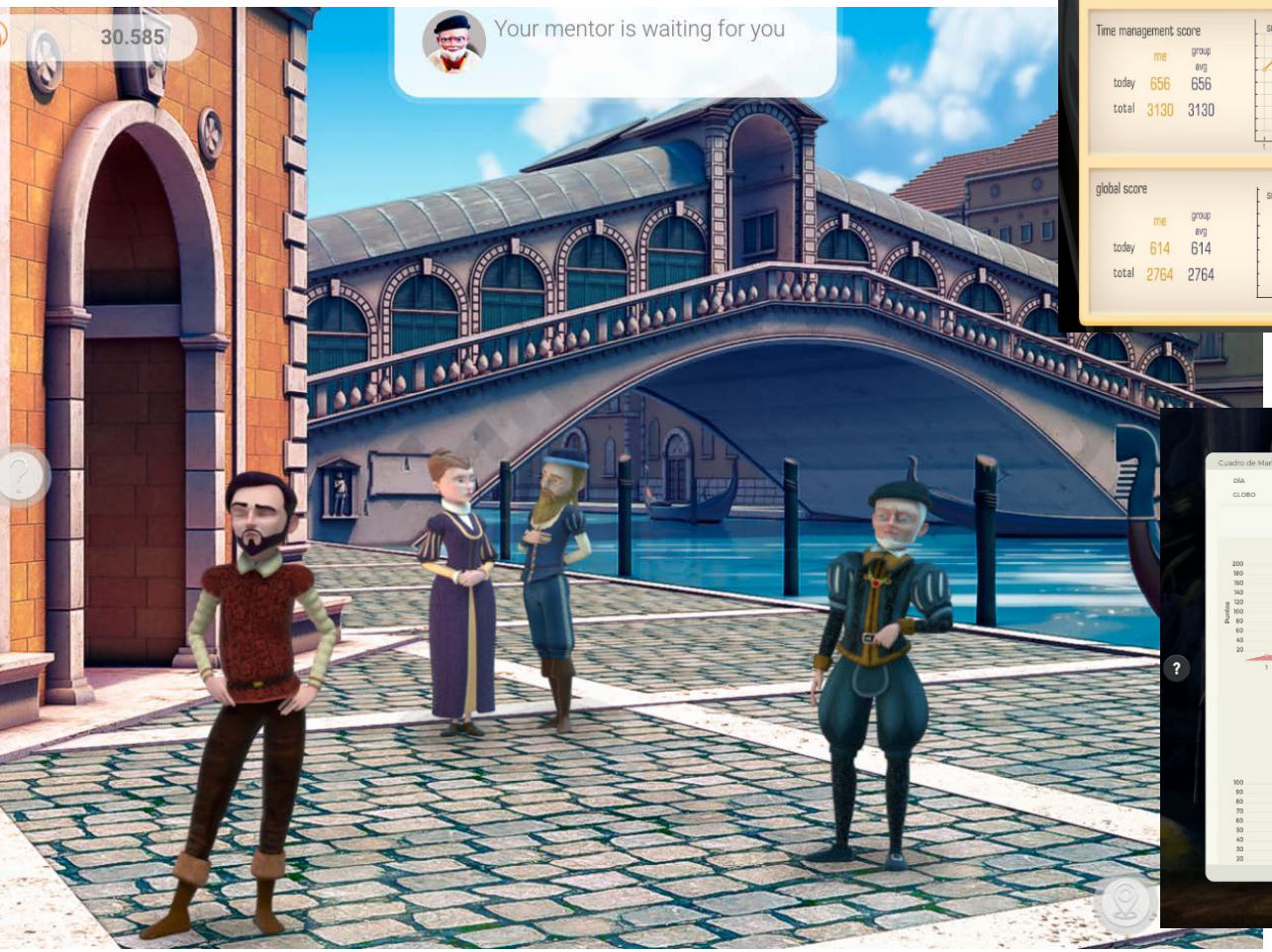

The Blood Typing Game
Health-o-meter
PATIENTS BLOOD TYPE
A Rh-
SOUND
MAIN MENU
Drag a blood bag and drop it on top of the blood bag rack! Click on a bag to see the content.
Bloodbags required
2
Blood Bank
A Rh+
A Rh-
B Rh+
B Rh-
AB Rh+
AB Rh-

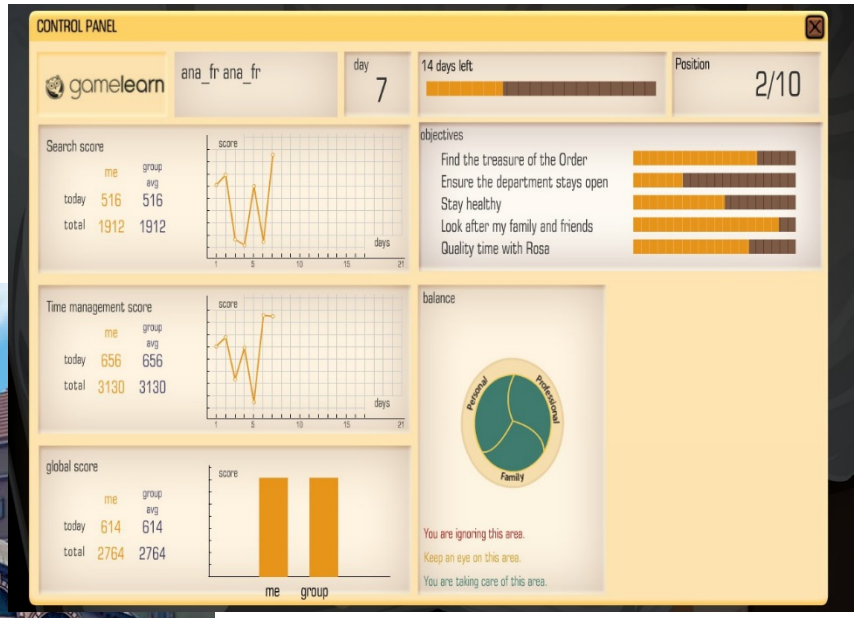


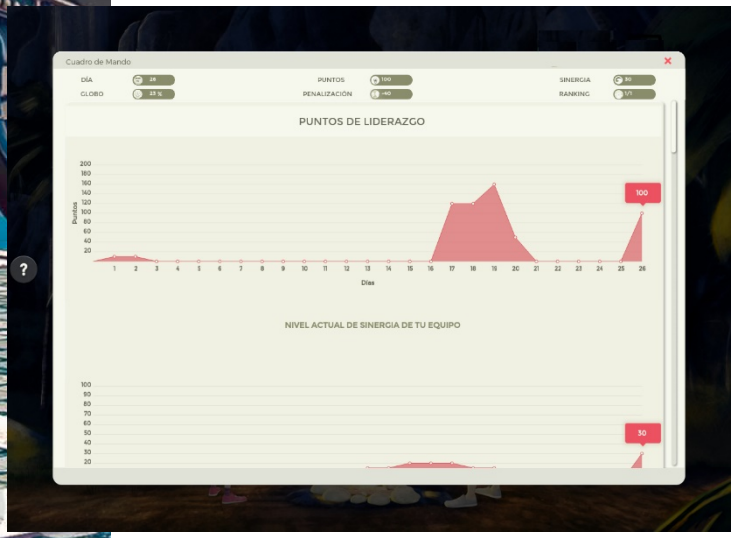
http://spaceplace.na



gamelearn


30.585
Your mentor is waiting for you


CONTROL PANEL
gamelearn
ana_fr ana_fr
day
7
14 days left
Position
2/10
Search score
me
group avg
today 516 516
total 1912 1912
score
days
objectives
Find the treasure of the Order
Ensure the department stays open
Stay healthy
Look after my family and friends
Quality time with Rosa
Time management score
me
group avg
today 656 656
total 3130 3130
score
days
balance
Personal
Professional
Family
You are ignoring this area.
Keep an eye on this area.
You are taking care of this area.
global score
me
group avg
today 614 614
total 2764 2764
score
me
group


Cuadro de Mando
PUNTOS DE LIDERAZGO
NIVEL ACTUAL DE SINERGIA DE TU EQUIPO

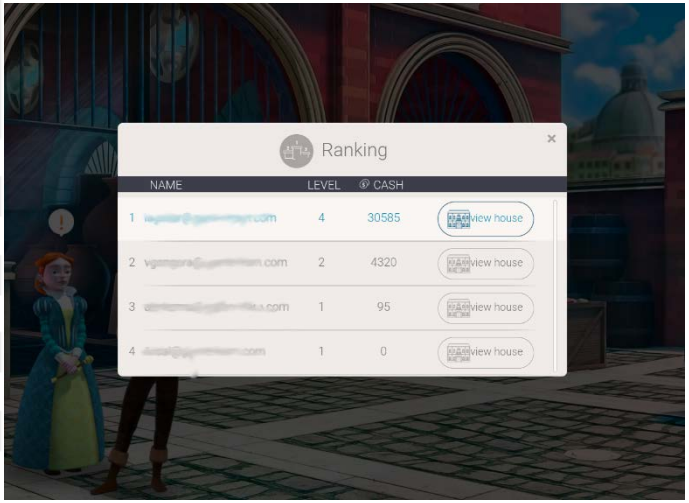
gamelearn

UCM e-learning group

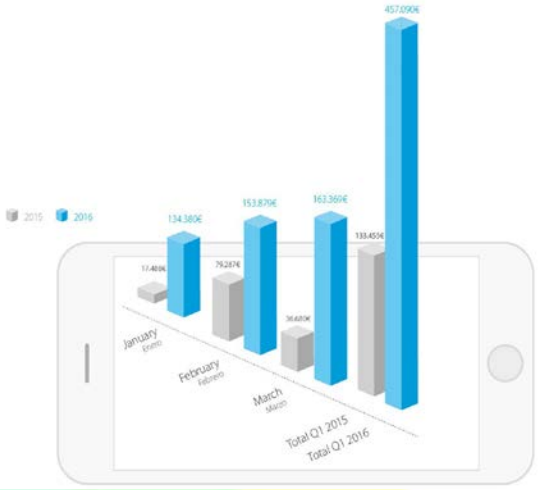
gamelearn | My groups | New Group | New Student | Log out

> Triskelion G3 2015 Octubre

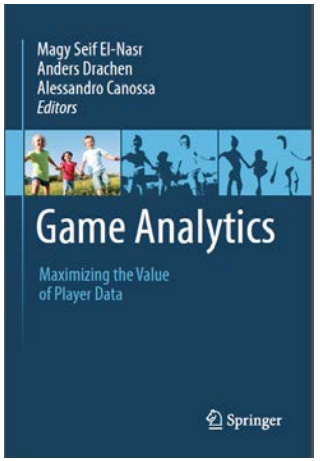
Position	Name	Surname	e-mail	Current day	Current time	Management points
1				21	23:00:00	18121
2				21	23:00:00	18319
3				21	23:00:00	17882
4				21	23:00:00	16690
5				21	23:00:00	16572
6				21	23:00:00	16498
7				21	23:00:00	16235
8				21	23:00:00	16307
9				21	23:00:00	15870



Management points	Adventure points	Total points	First connection	Last connection	Total time
18121	5344	14287	12/11/2015 15:27:28	16/12/2015 14:17:52	16:01:54
18319	4575	14195	30/10/2015 15:56:07	18/12/2015 18:34:45	16:16:59
17882	4096	13746	01/12/2015 14:29:04	29/01/2016 13:39:57	10:59:33
16690	5001.5	13183	10/11/2015 13:29:35	18/11/2015 16:55:58	11:12:49
16572	4947	13084	11/11/2015 15:27:42	14/12/2015 08:07:44	14:01:48
16498	4732	12968	30/11/2015 16:06:56	16/12/2015 18:15:51	15:33:30
16235	5008	12866	21/10/2015 13:28:55	16/12/2015 20:29:09	16:58:56
16307	4691	12822	11/11/2015 15:41:04	16/12/2015 10:09:38	16:20:48
15870	5218	12674	21/10/2015 16:29:53	10/12/2015 21:03:13	13:25:38



Game Learning Analytics



- **Learning Analytics** Improving education based on data analysis
  - Data driven
  - **Evidence-based education**
- **Gaming Learning Analytics** is a specific case when all interaction data is used in serious games for improving the learning process supported by the games
  - Educational games not as “black boxes”
  - In games is called Telemetry or Game metrics
- **GLA allows for new business models for serious games**
  - **Serious game as a service**

Manuel Freire, Ángel Serrano-Laguna, Borja Manero, Iván Martínez-Ortiz, Pablo Moreno-Ger, Baltasar Fernández-Manjón (2016): ***Game Learning Analytics: Learning Analytics for Serious Games***. In Learning, Design, and Technology (pp. 1–29). Cham: Springer International Publishing. http://doi.org/10.1007/978-3-319-17727-4_21-1.

Uses of Gaming Learning Analytics in educational games

- Game testing – game analytics
  - It is the game realiable?
  - How many students finish the game?
  - Average time to complete the game?
- Game deployment in the class – tools for teachers
  - Real-time information for supporting the teacher
  - Knowing what is happening when the game is deployed in the class
  - “Stealth” student evaluation
- Formal Game evaluation
  - From pre-post test to evaluation based on game learning analytics??

It is GLA feasible for a SME?

- Game Learning Analytics imposes new requirement on already struggling Game developers
  - Not many of the SME that develop games are collecting and exploiting learning analytics data
  - GLA requires different technology and expertise
  - When done it is very “game dependent”

But there are new specifications and developments that could systematize the work

H2020 RAGE project

RAGE

Realising an Applied Gaming Eco-System

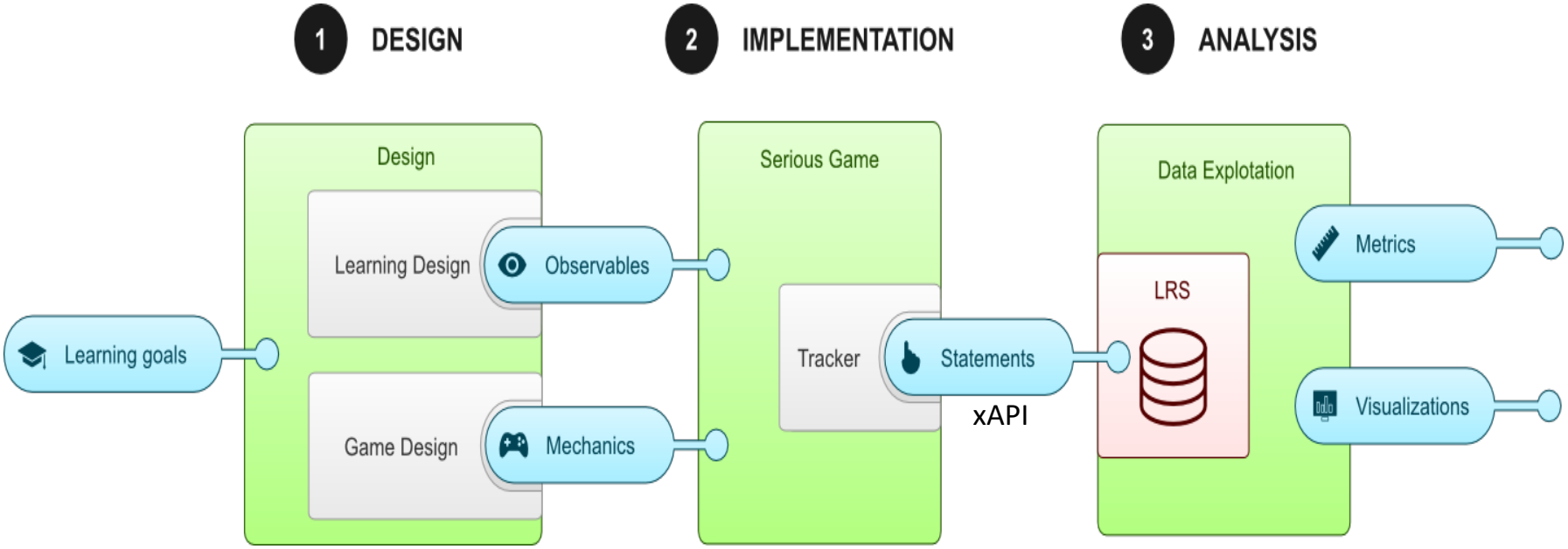
- RAGE will deliver advanced technology and know-how to support the European Applied Games industry build-up and job creation
  - February 2015, 4 years, 19 partners, 9M
- Creating a new serious games ecosystem by making available a set of reusable technology components for developing advance serious games easier, faster and more cost-effectively
- **Open source gaming learning analytics framework**
  - provide all the required services (e.g. game tracker, learning analytics server, visualization of analytics information)
  - easy inclusion of gaming learning analytics techniques in the new games

User Data Analytics Outline

- Collecting and assessing game-based user data
  - the collection and aggregation of data
  - the interpretation of the data to support further intervention
- Solid data protection and authentication procedures
  - Data anonymization when possible
- Generalization of the approach
  - Applicable to different kind of games
- Use of standards

User Data Analytics Approach

Collecting data: xAPI application profile for serious games with ADL



- We can collect the relevant data in a standard format using xAPI
- **Creation of an xAPI serious games profile with ADL**
- This will simplify the analysis and visualization of data (e.g. dashboards)

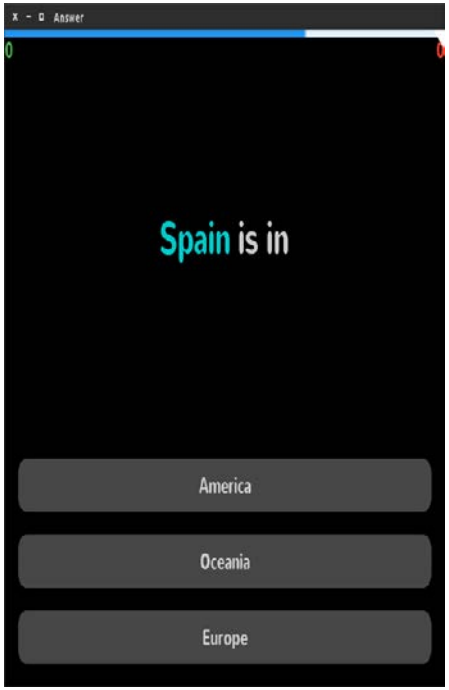
Ángel Serrano-Laguna, Iván Martínez-Ortiz, Jason Haag, Damon Regan, Andy Johnson, Baltasar Fernández-Manjón (2016): ***Applying standards to systematize learning analytics in serious games***. Computer Standards & Interfaces (in press) http://dx.doi.org/10.1016/j.csi.2016.09.014.

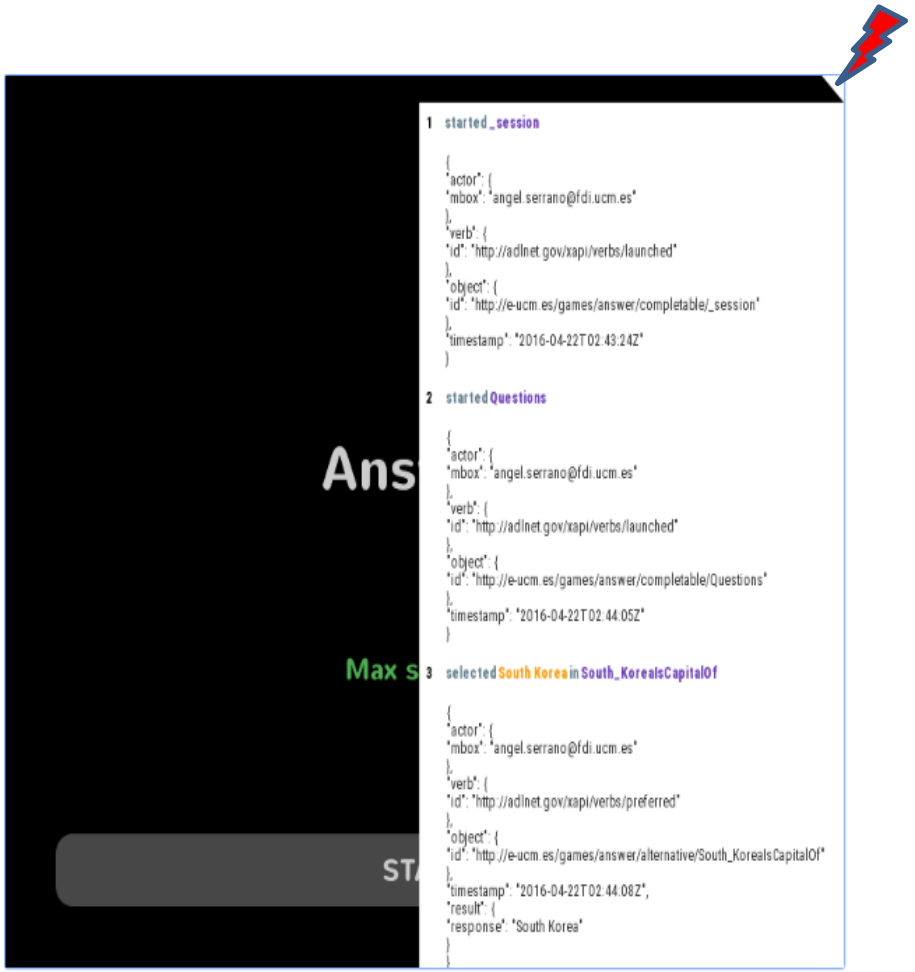
xAPI profile for serious games developed with ADL

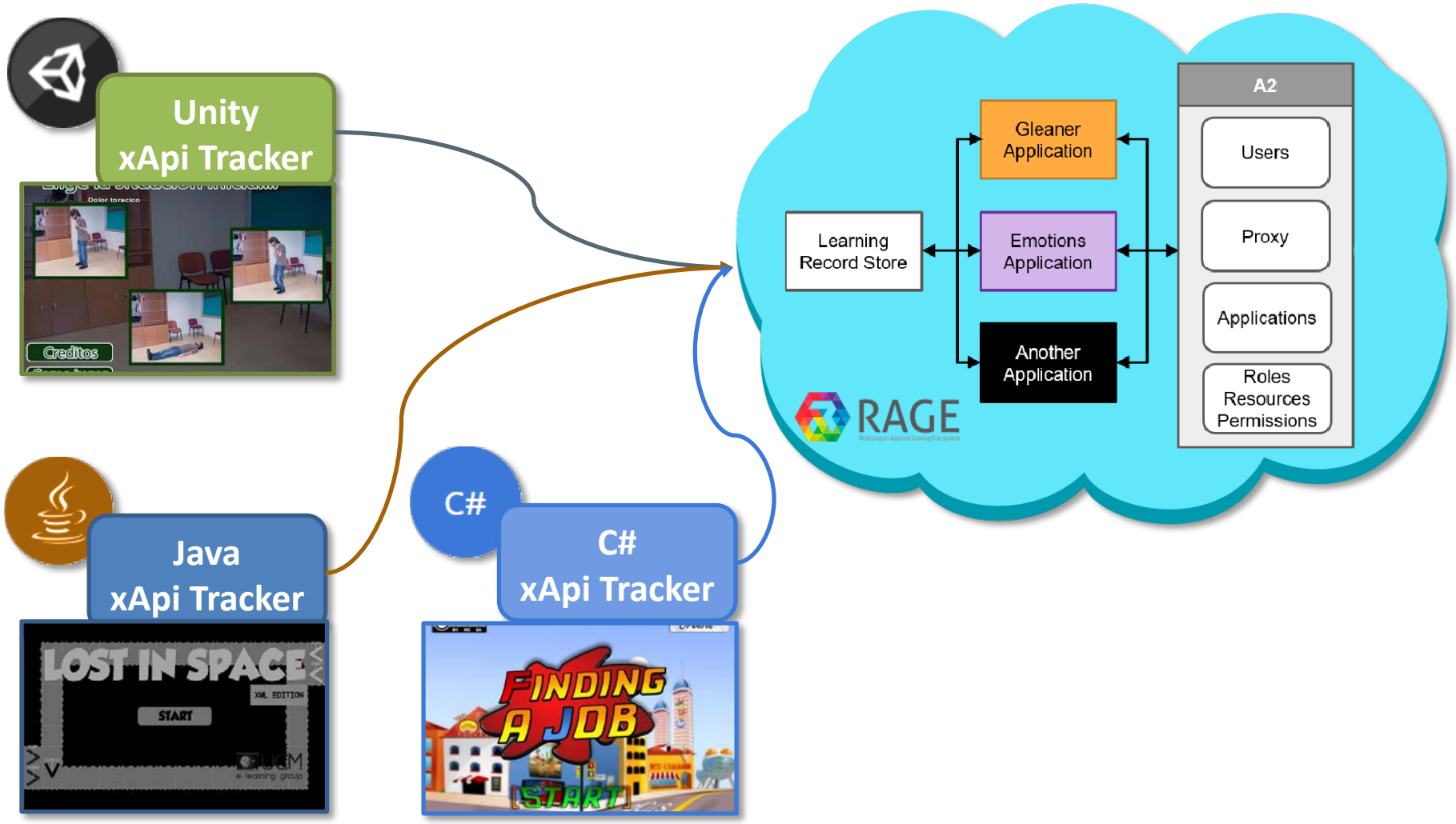
- Definition of a general interaction model for appliying Game Learning Analytics with serious games
  - Completion (A level/stage/puzzle or completion percentage)
  - In-game choices (player selections in the game)
  - Meaningful variables (i.e. Score, Coins …)
  - Meaningful actions (i.e. ask for help, …)
  - Custom interactions (Game-specific interactions)
- Definition of an xAPI application profile for serious games
  - implementation of our general model in xAPI

Countrix: Demo Quiz Game

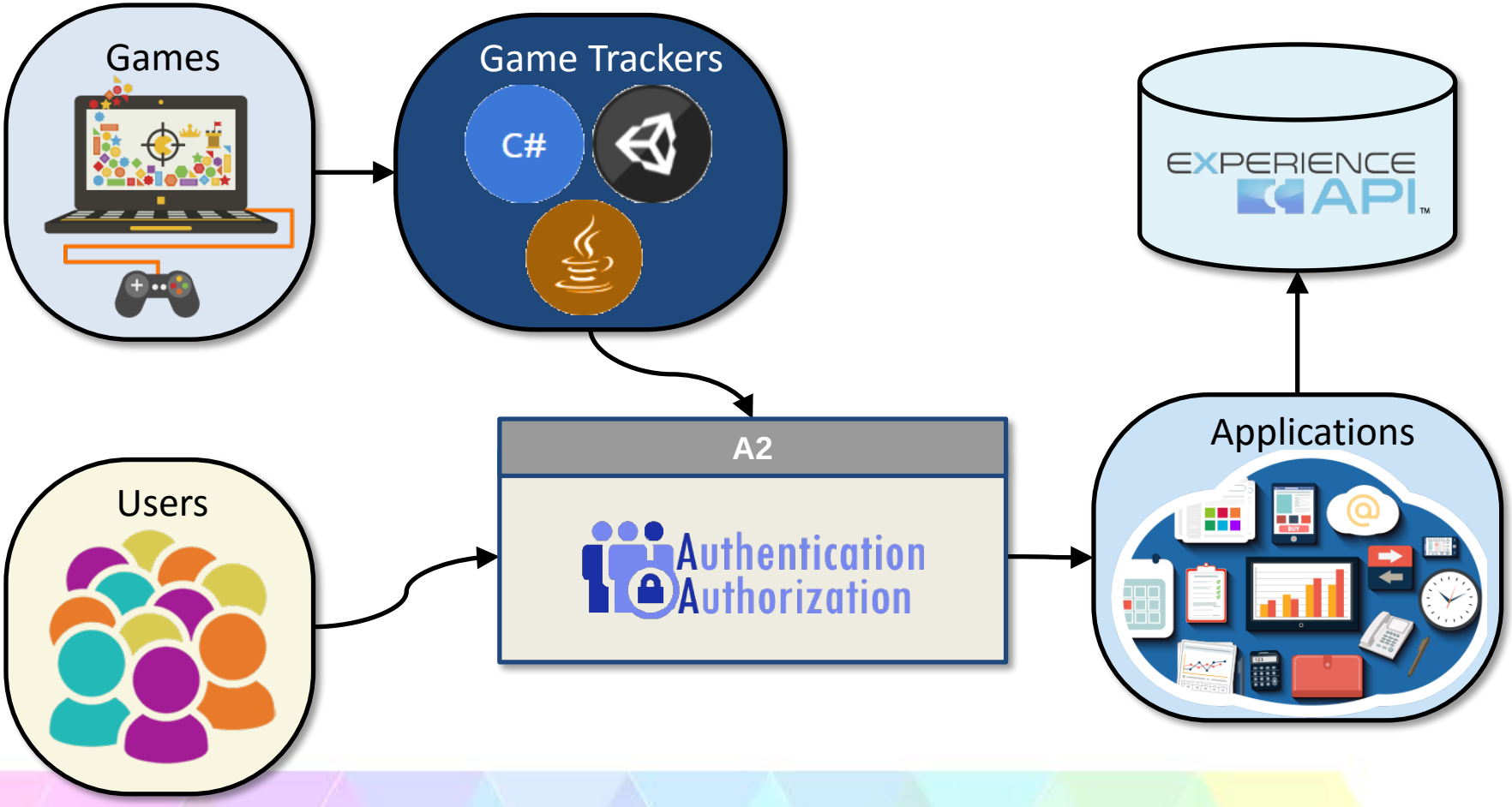
- Available at Google play



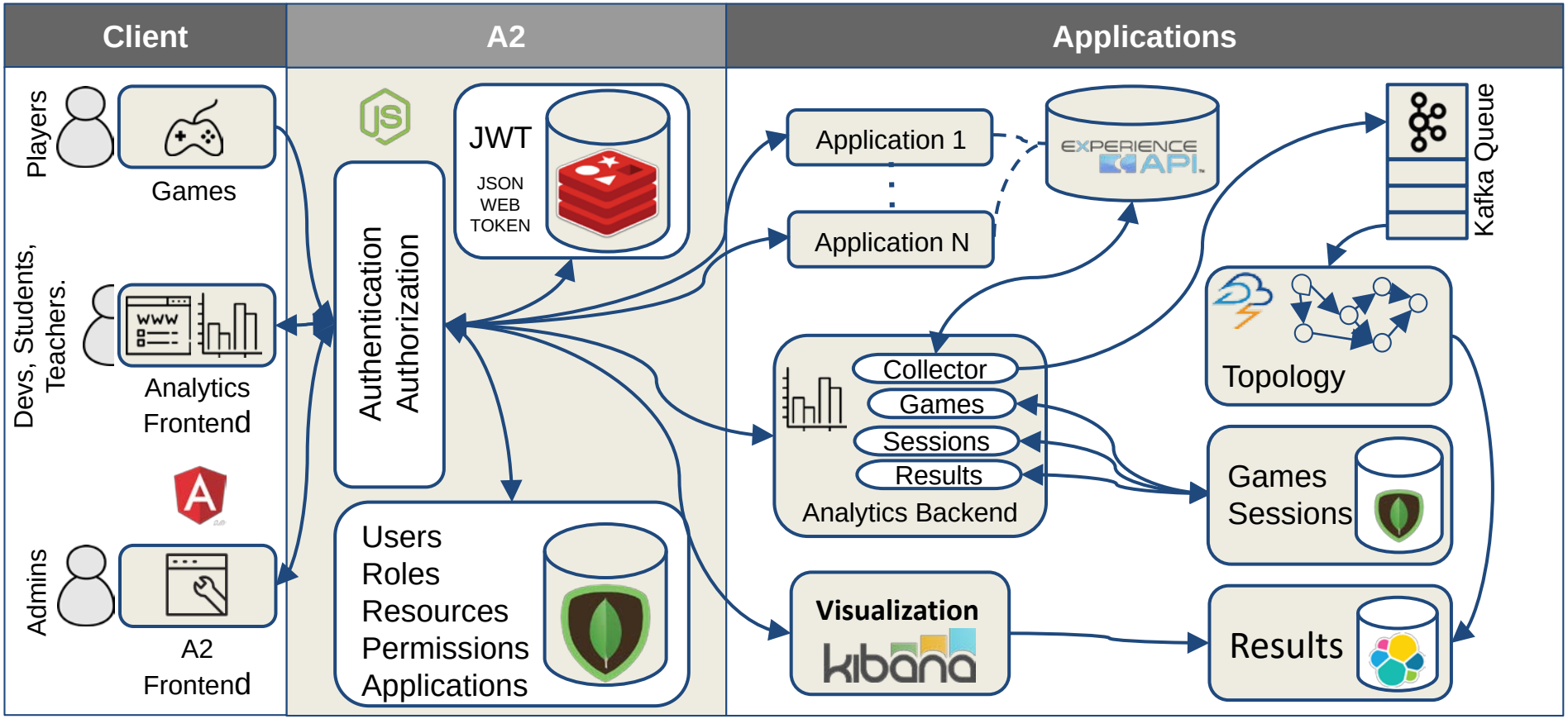



Unity
xApi Tracker
Creditos
Java
xApi Tracker
LOST IN SPACE
START
C#
C#
xApi Tracker
FINDING A JOB
START
Learning Record Store
Gleaner Application
Emotions Application
Another Application
RAGE
A2
Users
Proxy
Applications
Roles
Resources
Permissions

RAGE


Games
Game Trackers
C#
EXPERIENCE API
A2
Authentication
Authorization
Users
Applications

Architecture and technologies



H2020 Beaconing project

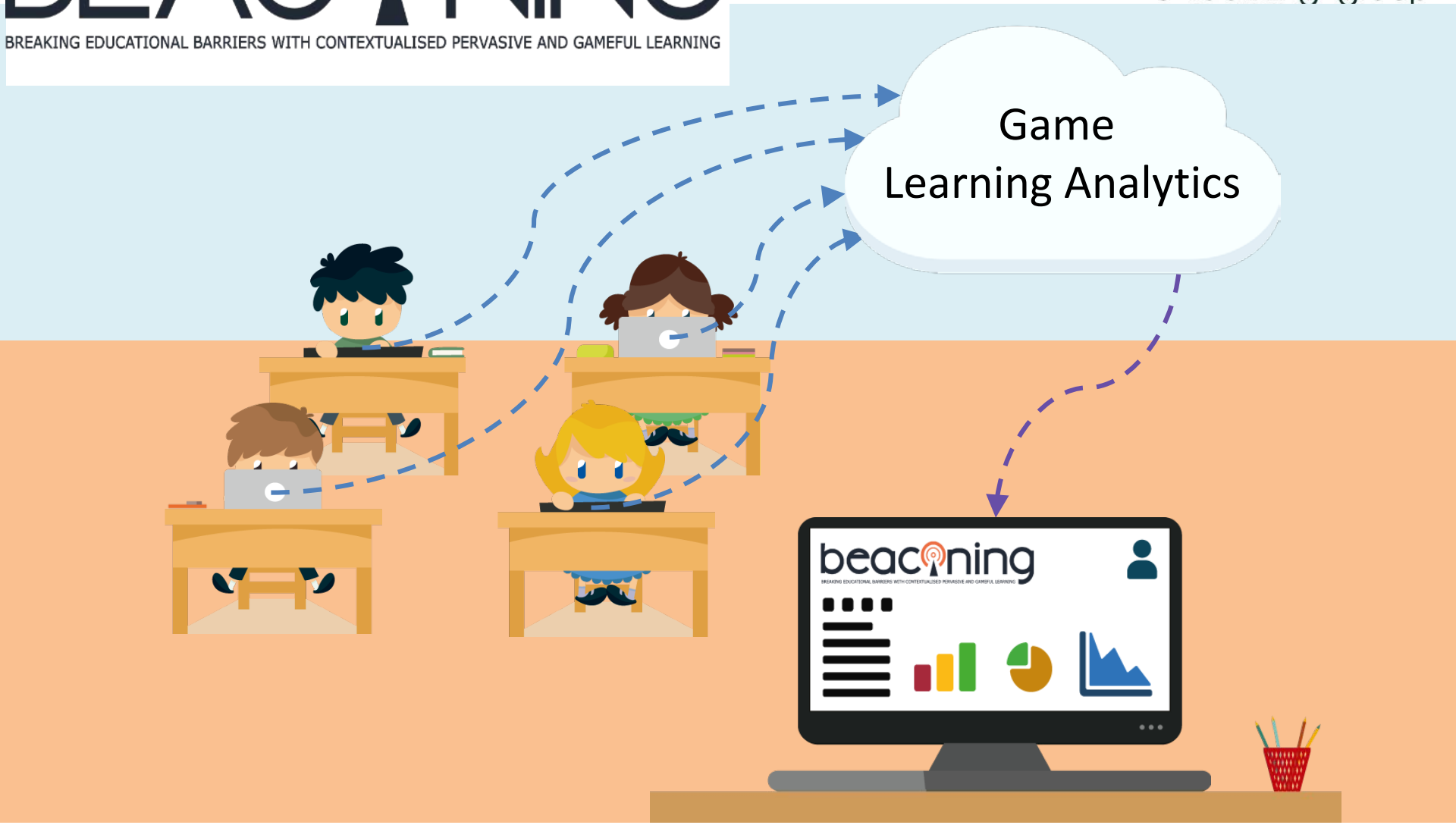
BEACONING
BREAKING EDUCATIONAL BARRIERS WITH CONTEXTUALISED PERVASIVE AND GAMEFUL LEARNING

- BEACONING stands for ‘Breaking Educational Barriers with Contextualised, Pervasive and Gameful Learning’
  - Started in january 2016, 15 partners, 9 countries, 6M
- Global goal is learning ‘anytime anywhere’
  - Exploitation of technologies for contextual pervasive games and use of gamification techniques
  - Enriching the Gaming Learning Analytics data model with the contextual, geolocalized and accessibility information
- Large pilots in real settings with content providers
  - Formal and informal learning across virtual and physical spaces
- LA is a key element in the games and pilots evaluation
- Using RAGE infrastructure and extending it for these new requirements and applications

BEACONING

BREAKING EDUCATIONAL BARRIERS WITH CONTEXTUALISED PERVASIVE AND GAMEFUL LEARNING

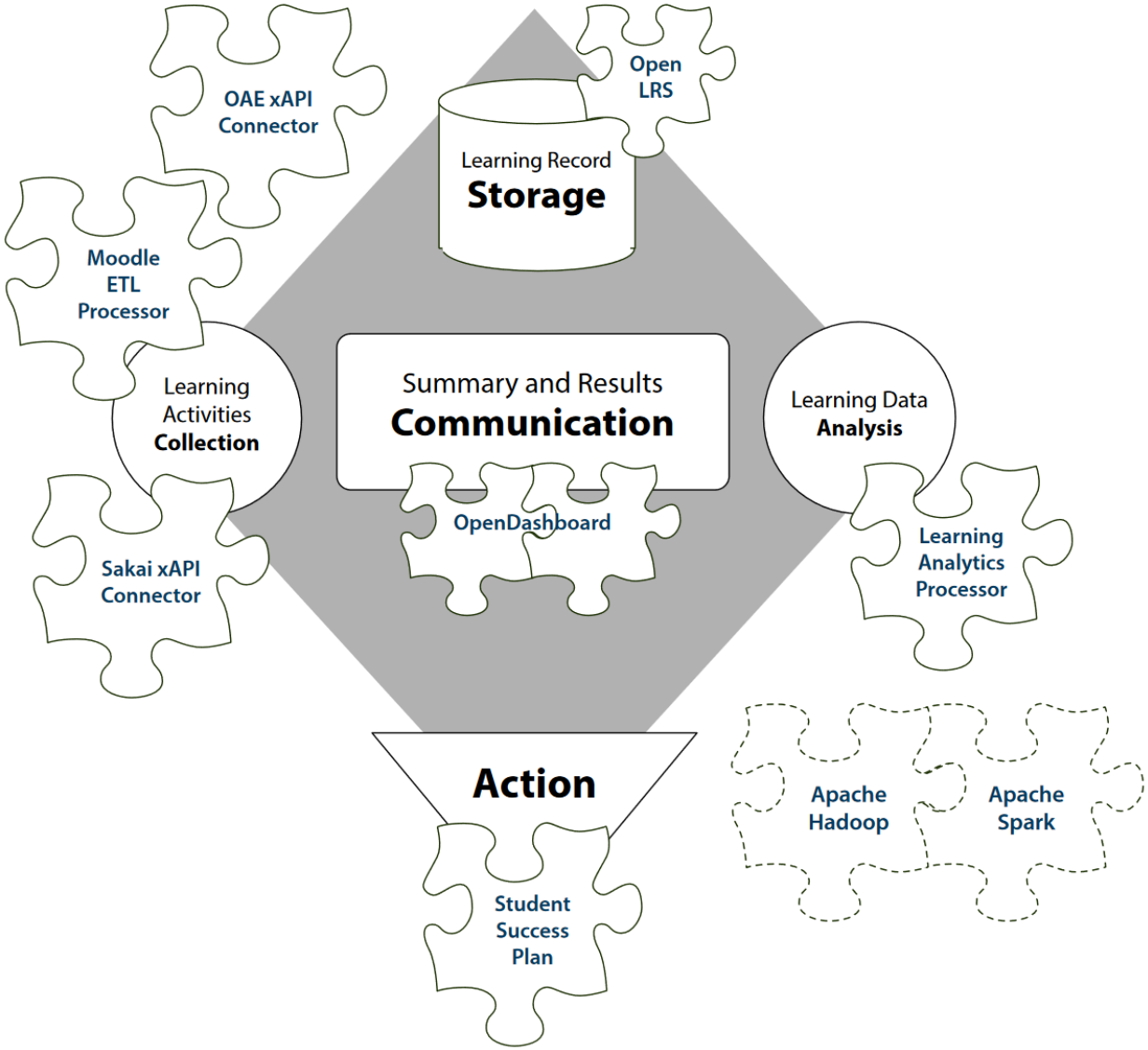
UCM e-learning group



Other initiatives: IMS Global

http://www.imsglobal.org/

Apereo & OpenDashboards



https://www.apereo.org

Testing RAGE Analytics with a previously existing game

First Aid Game - Proof of concept
Integrated Assets Demo

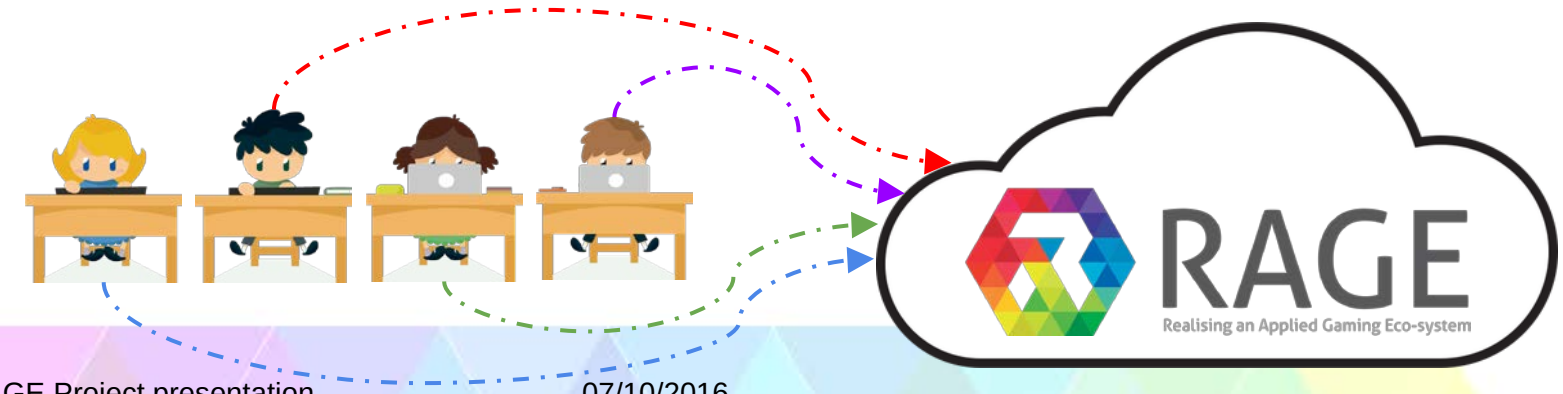
Game Client Tracker 2.1a,
Server Side interaction storage & analytics 2.1b,
Server Side Authentication & Authorization 2.4a,
Server Side Dashboard & Analytics

About the game

- The **goal** of the game is that students learn how to correctly react under emergency situations and apply **first aid**. (Based on ILCOR 2011)
- Three situations:
  - Choking
  - Chest pain
  - Unconscious
- Game already **validated** and manually tested in **actual schools**
- Game rebuilt with uAdventure
- **Include analytics using RAGE tracker based on xAPI specification**

Connecting the game with RAGE Analytics

- Choose between three available activity trackers:
  - C# Tracker, Java Tracker
  - **Unity 3D tracker**
- Developer registers the **Game** in RAGE, and a **Tracking Code** is generated.
- For each group of players, teachers can now configure a new **Class** in RAGE.
- Once the teacher starts the **Class**, **data collection and analytics begins.**



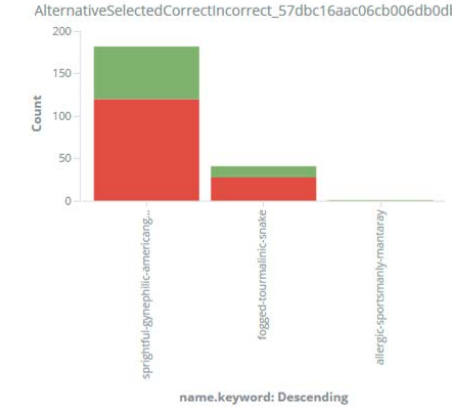
Analytics for teachers and developers

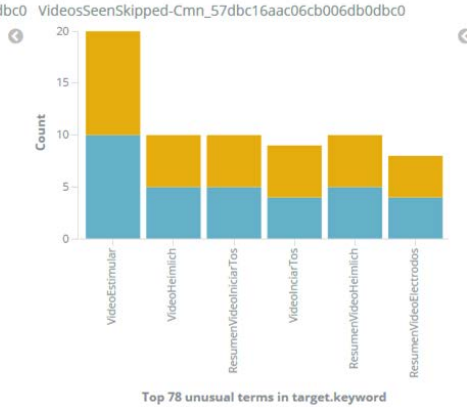
- Different data will be used and presented to different stakeholders
  - **Teacher** has access to all the data from **their classes**
  - **Developer** have **anonymized** access to data from **all classes**
  - Visualizations for each stakeholder **can be chosen** at game setup time

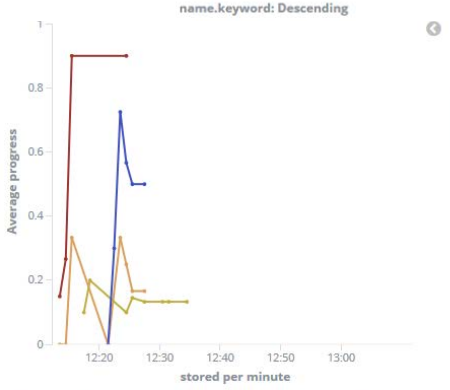
teacher	developer
Learner activity over time	Most used xAPI verb
Questions answered correct/failed	Times interacted with GameObjects, most/less used
Full game progress and each single level completion	Min, average, and max time to complete levels or even full game
Relation between videos seen/skipped	Times each video has been seen

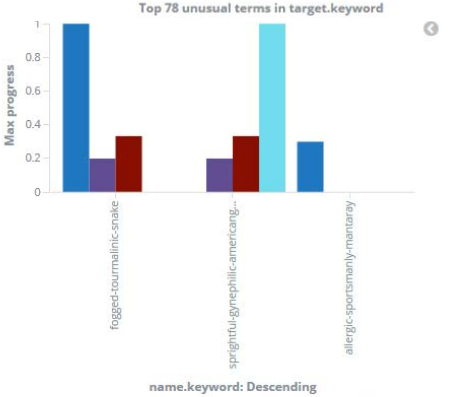
Visualizations

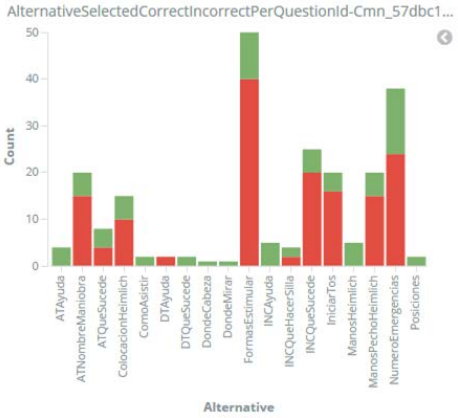
¡More than 20 different analysis and visualizations have been created!

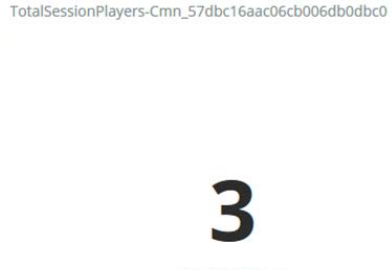


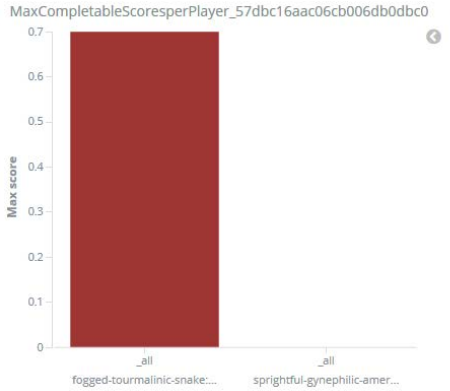


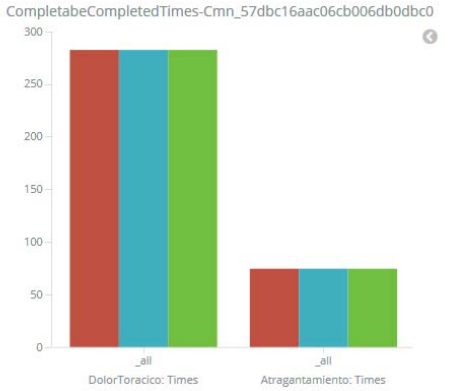


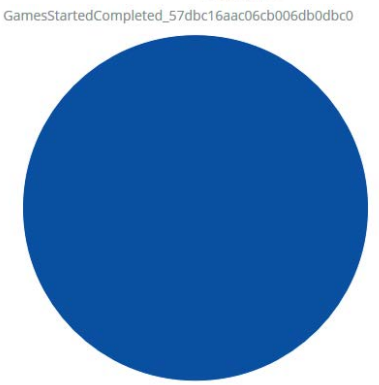


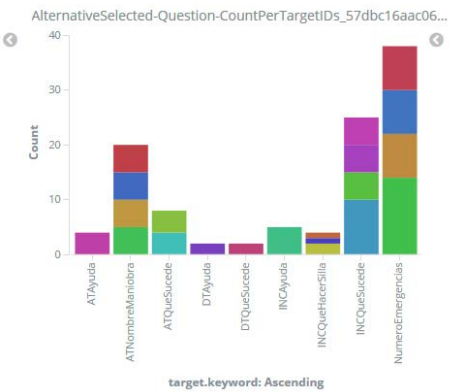




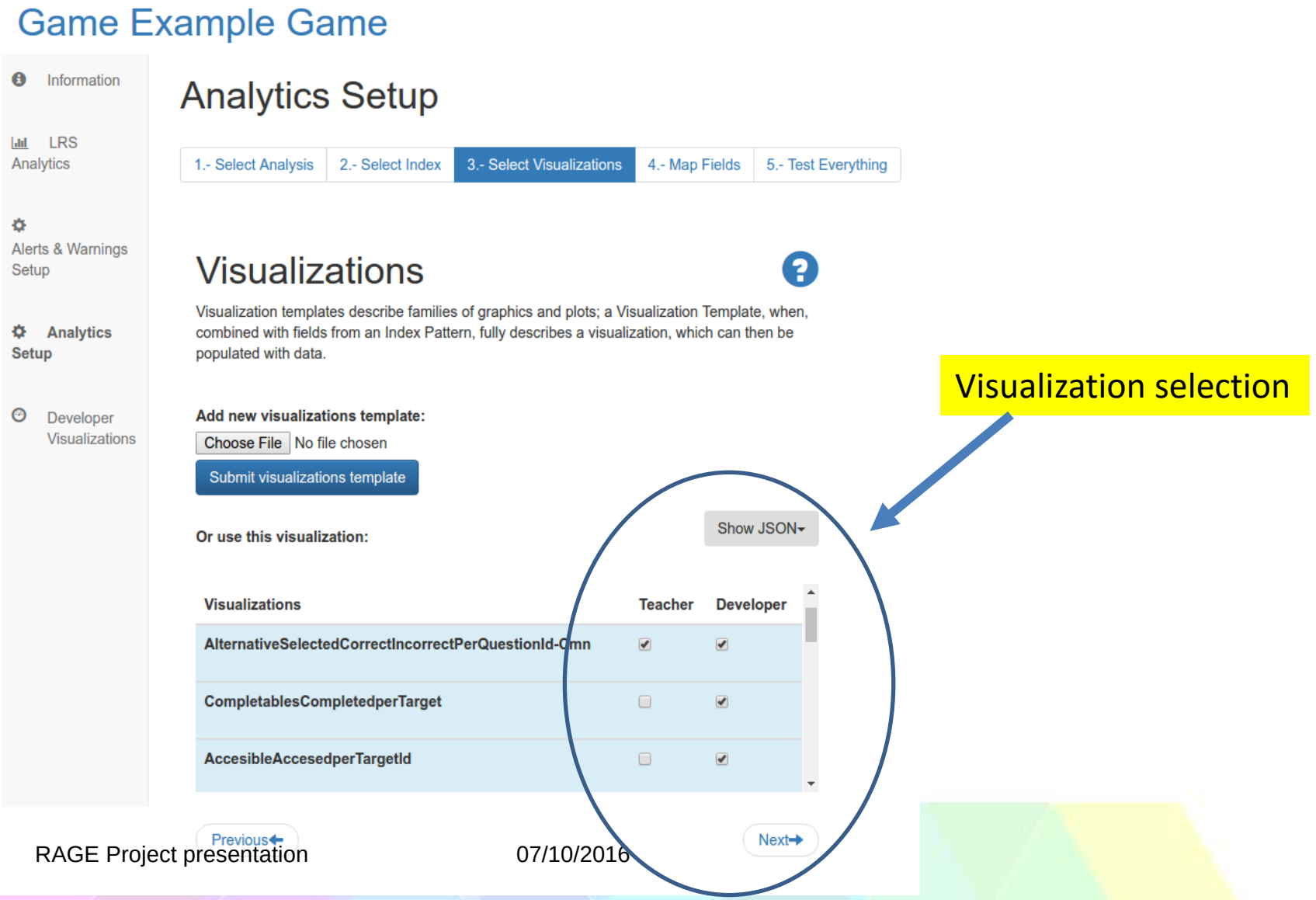








Visualizations configuration

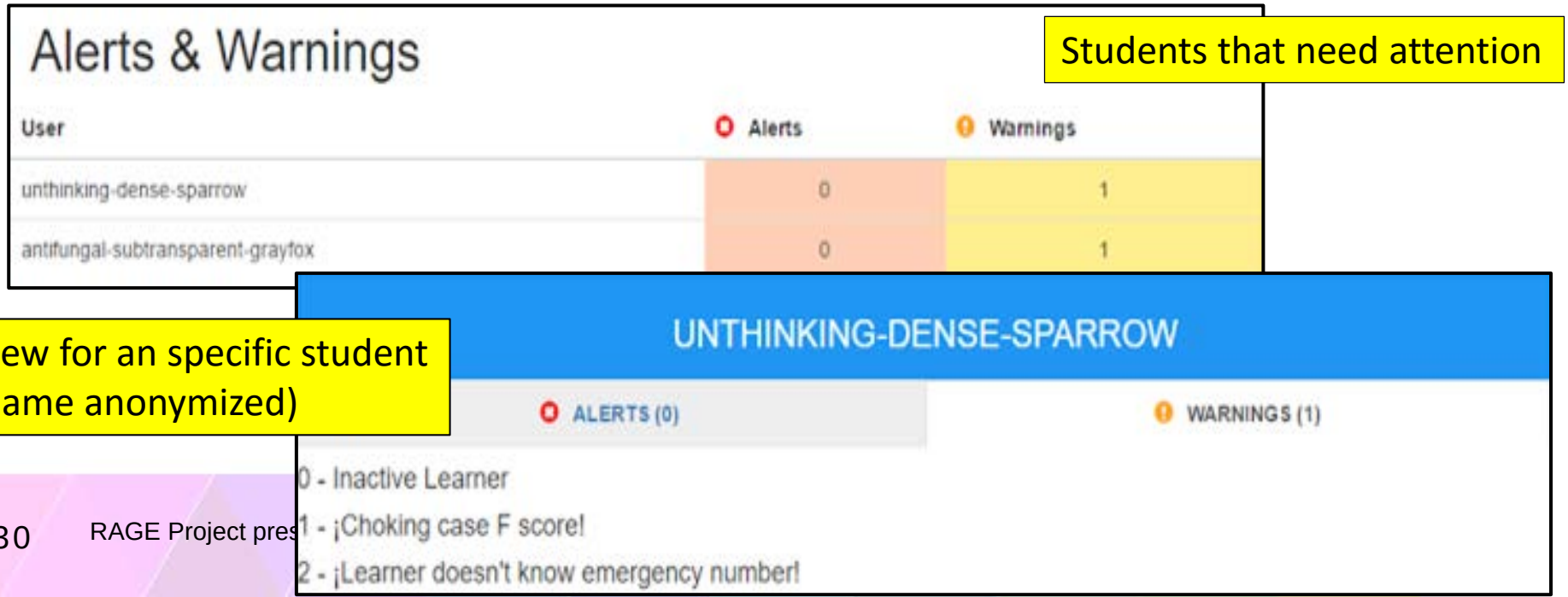


Real-time analytics: Alerts and Warnings

- Identify situations that may require teacher intervention
- Fully customizable alert and warning system for real-time teacher feedback

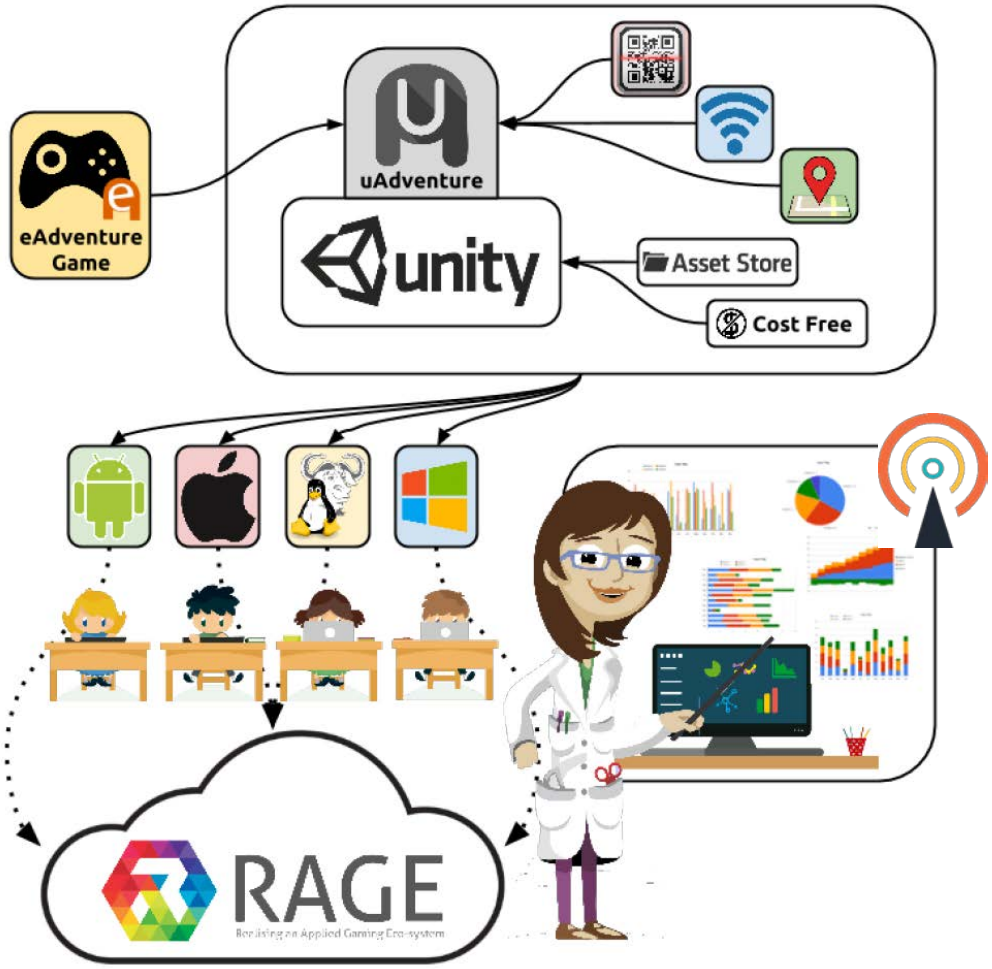
Inactive learner: triggers when no traces received in #number of minutes (e.g. 2 minutes)

> 50% incorrect answers: after a minimum amount of questions answered, if more than half of the



From RAGE to BEACONING

- Reuse of our previous experience in serious games with eAdventure
- Include learning analytics in the game design
- Simplify the full life cycle: from authoring to deployment and application



Conclusions

- Game Learning Analytics has a great potential from the business, application and research perspective

- Still complex to implement GLA in SG
  - Increases the (already high) cost of the games
  - Requires expertise not always present in SME

- New standards specifications and open software development could greatly simplify GLA implementation and adoption

Thank you!

REFERENCES

- Manuel Freire, Ángel Serrano-Laguna, Borja Manero, Iván Martínez-Ortiz, Pablo Moreno-Ger, Baltasar Fernández-Manjón (2016): ***Game Learning Analytics: Learning Analytics for Serious Games***. In Learning, Design, and Technology (pp. 1–29). Cham: Springer International Publishing. http://doi.org/10.1007/978-3-319-17727-4_21-1.

- Ángel Serrano-Laguna, Iván Martínez-Ortiz, Jason Haag, Damon Regan, Andy Johnson, Baltasar Fernández-Manjón (2016): ***Applying standards to systematize learning analytics in serious games***. Computer Standards & Interfaces (in press) http://dx.doi.org/10.1016/j.csi.2016.09.014.