

# Use of Learning Analytics in Remedial Courses

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**Gradient Lab**

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# Introduction

- Experiences in remedial courses
  - Remedial courses: reinforce student skills
  - Topics: physics, maths, chemistry
  - Number of students: from 100 to 300 per course



# Introduction

- Experiences in remedial courses
  - There is not a single platform which is according to all the requisites
  - Combination of KA and Moodle
  - The complexity of the authoring process
  - The need of adaptation of the gamification
  - Adjustment of the learning analytics functionality

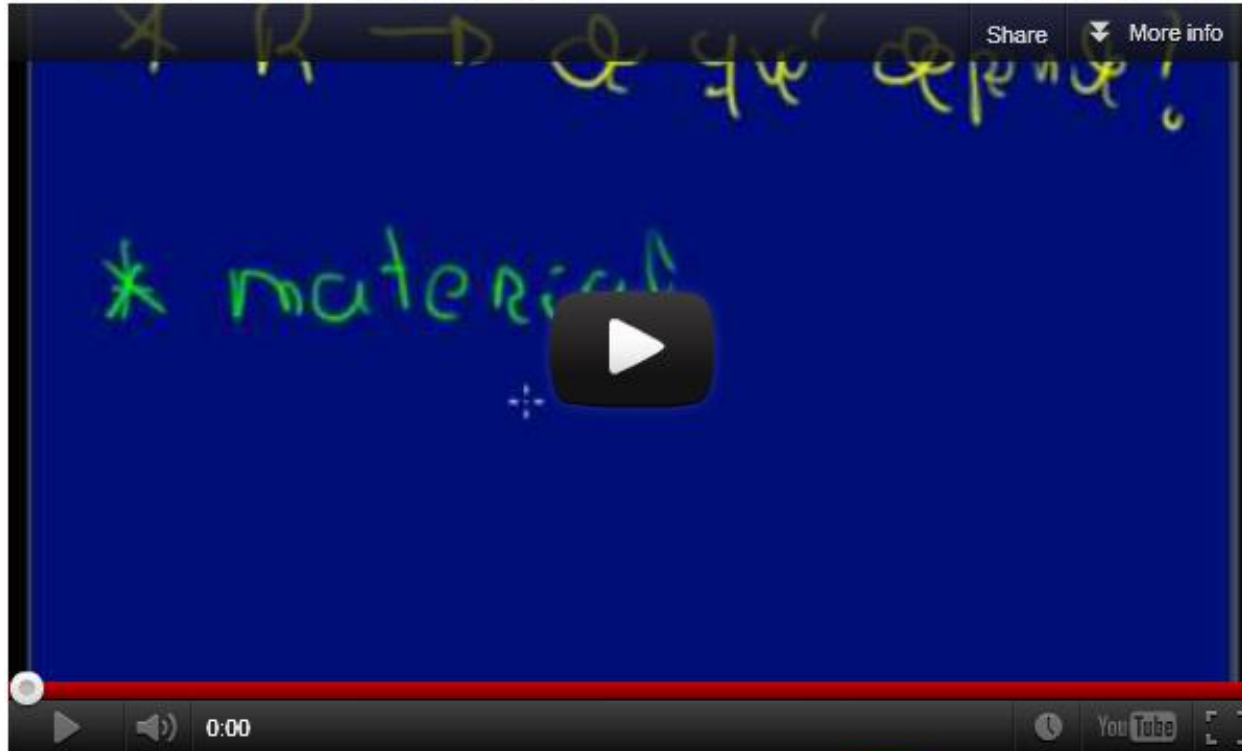
# Khan Academy: Videos

Ley de Ohm : Este video en una continuación de los de corriente eléctrica y generación de c...

Practice this concept

◀ Previous Topic: Generación de corriente y diferencia de potencial

Next Topic: Magnetismo ▶



Comments:

0 of 750

Video Subtitles

Share

Thank you, Sal!

-Example

Add a comment

Questions and answers about ley de ohm:

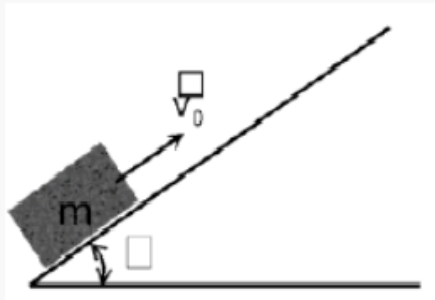
Most votes first

Ask a question about this video



# Khan Academy: Exercises

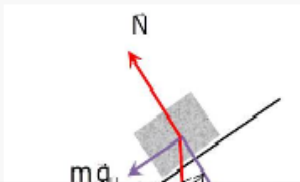
Se proporciona una velocidad inicial  $v_0 = 3 \text{ m/s}$  en dirección ascendente a un bloque que se encuentra sobre un plano inclinado un ángulo  $\alpha = 67^\circ$  con respecto a la horizontal, y que no presenta rozamiento.



¿Qué distancia en metros asciende el bloque por el plano inclinado antes de detenerse? Considere la aceleración de la gravedad  $g$  como  $9.8 \text{ m/s}^2$ . La solución final se redondeará a 1 cifra decimal

## Pista 1

- Dibuja las fuerzas que actúan sobre el cuerpo (peso y normal).
- Descompón las fuerzas en componentes perpendicular y paralela a la superficie del plano inclinado.



## Answer

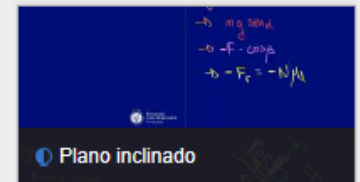
Acceptable formats

Check Answer

## Need help?

I'd like another hint (2 steps left)

## Stuck? Watch a video.



# Khan Academy: Exercises Format

```
<html data-require="math word-problems">
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
  <title>Ejercicio de trabajo y energia</title>
  <script src="../../khan-exercise.js"></script>
</head>
<body>
  <div class="exercise">
    <div class="vars">
      <var id="m">randRange(5, 50)</var>
      <var id="f">randRange(1, 10)</var>
      <var id="d">randRange(100, 300)</var>
    </div>

    <div class="problems">
      <div>
        <div class="problem">
          <p>Un bloque de masa <var>m</var> kg se mueve
sobre una superficie horizontal. En un instante dado, cuando la velocidad del bloque es <code>{v}_{{{0}}}</code> , empieza a actuar una fuerza de frenado uniforme cuyo módulo
es <var>f</var> N. Sabiendo que el bloque recorre una distancia de <var>d</var> m desde ese
instante hasta que se detiene:</p>
<p>Calcular el valor <code>{v}_{{{0}}}</code> de la velocidad inicial. (Utilizar para el cálculo el
teorema del trabajo y la energía cinética)</p><b>Solución aceptada:</b> <var>roundTo(1,sqrt
((2*f*d)/m))</var>
        </div>
        <div class="question">
          <p></p>
        </div>
        <div class="solution" data-type="decimal"><var>roundTo(1,sqrt
((2*f*d)/m))</var></div>
      </div>
    </div>

    <div class="hints">
```

# Khan Academy: Authoring Tool for Exercises





Ejercicio | Visualización previa | HTML

Crea un ejercicio

Volver a Ejercicios

Aquí podrás crear un ejercicio nuevo de Khan.


- Variables


Acción	Nombre	Propiedades
	m	Número entero aleatorio (desde 5 hasta 50)
	f	Número entero aleatorio (desde 1 hasta 10)
	d	Número entero aleatorio (desde 100 hasta 300)
	<input type="text"/>	Número <input type="text" value="entero"/> aleatorio (desde <input type="text"/> hasta <input type="text"/> )


- Título


Ejercicio de trabajo y energia


- Enunciado





























































































































Paragraph


Font Family


Font Size



























































































































































































































































































































































































Variables











































































































Guardar  
título,  
enunciado y  
solución

- Source code
  - <https://github.com/kadaki01/Genghis>

7

# Khan Academy: Gamification

## ACCOMPLISHMENTS

### Achievements

✓ Goals (beta)

## VITAL STATISTICS

📊 Activity

📈 Focus

📊 Skill Progress

📈 Progress Over Time

## COMMUNITY

💬 Discussion

👤 Coaches



Medallas



Atocha Medallas



Neptuno Medallas



La Cibeles Medallas



Puerta de Alcalá Medallas x

1

Las medallas de la Cibeles son poco corrientes e implican que has invertido bastante en el aprendizaje.

## Possible Badges



Aprendiz de físico

+ 250

Achieve proficiency in Escalares y vectores, Sistemas de Unidades



Aprendiz de Gauss

+ 300

Achieve proficiency in Ley de Gauss 1, Ley de Gauss 2, Ley de Gauss 3



Aprendiz de Faraday

+ 300

Achieve proficiency in Ley de Faraday 1, Ley de Faraday 2, Ley de Faraday 3



Going Transonic

500

Quickly & correctly answer 10 skill problems in a row (time limit depends on skill difficulty)



Principiante en mecanica

+ 500

Achieve proficiency in Tiro parabólico, Movimiento circular, Fuerza de rozamiento, Plano inclinado A, Plano inclinado B, centripeta



Principiante en magnetismo

+ 500

Achieve proficiency in Magnetismo, Fuerza de Lorentz, Radio de Larmor



Going Supersonic

750

Quickly & correctly answer 20 skill problems in a row (time limit depends on skill difficulty)



Tecnico en mecanica

+ 1000

Achieve proficiency in Tiro parabólico, Movimiento circular, Fuerza de rozamiento, Plano inclinado A, Plano inclinado B, centripeta

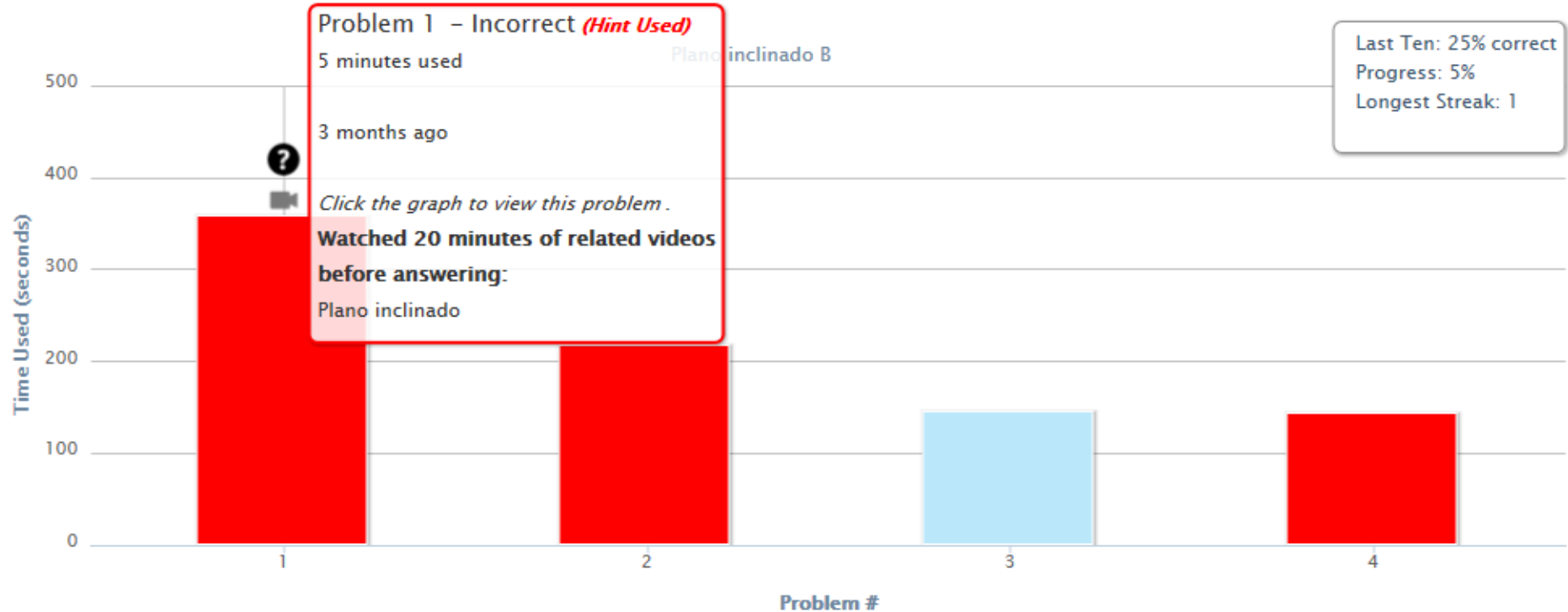


Tecnico en oscilaciones y

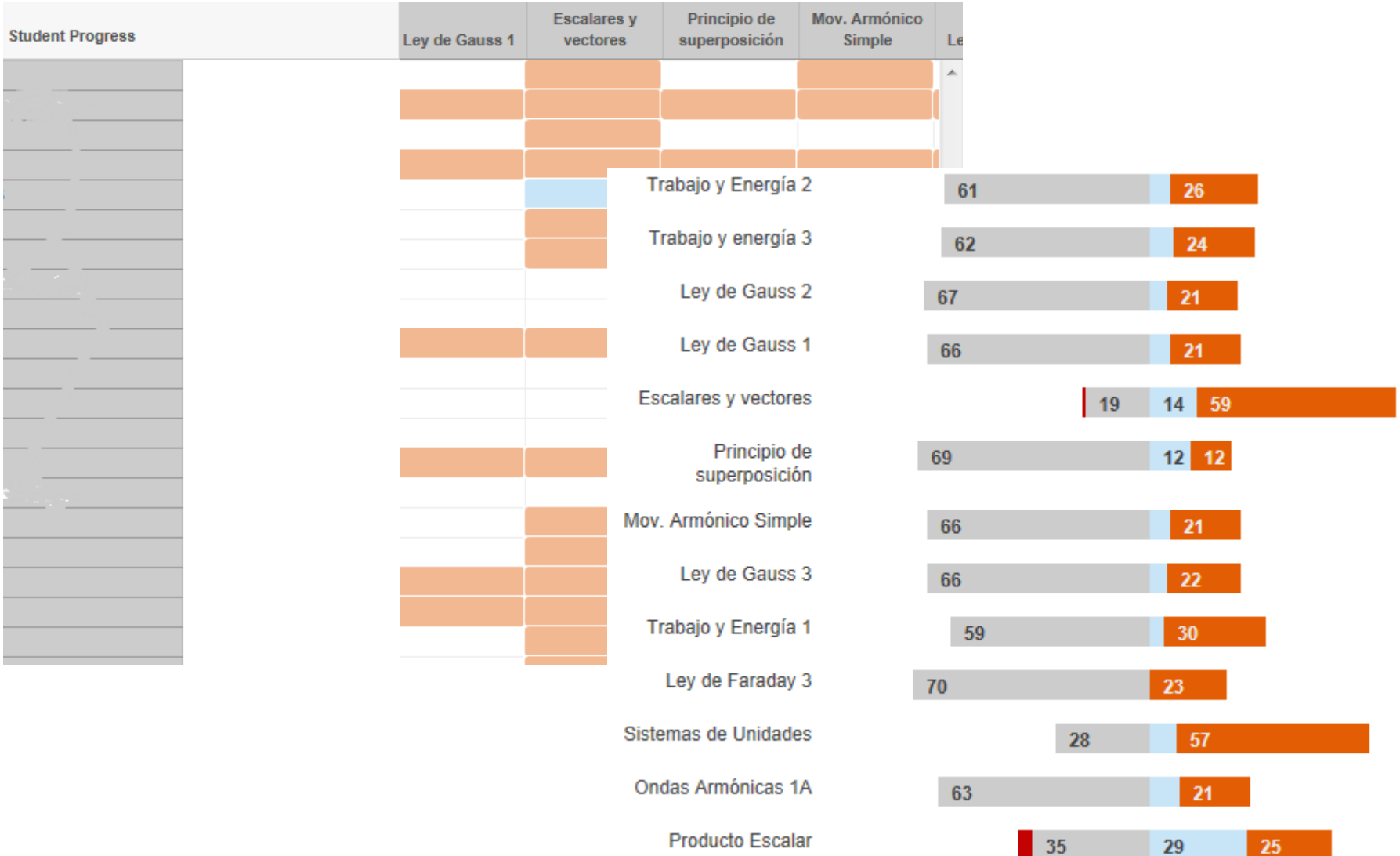
+ 1000

Achieve proficiency in Mov. Armónico Simple, Ondas Armónicas 1A, Ondas Armónicas 1B, Ondas Armónicas 1C, Ondas Armónicas 2A,

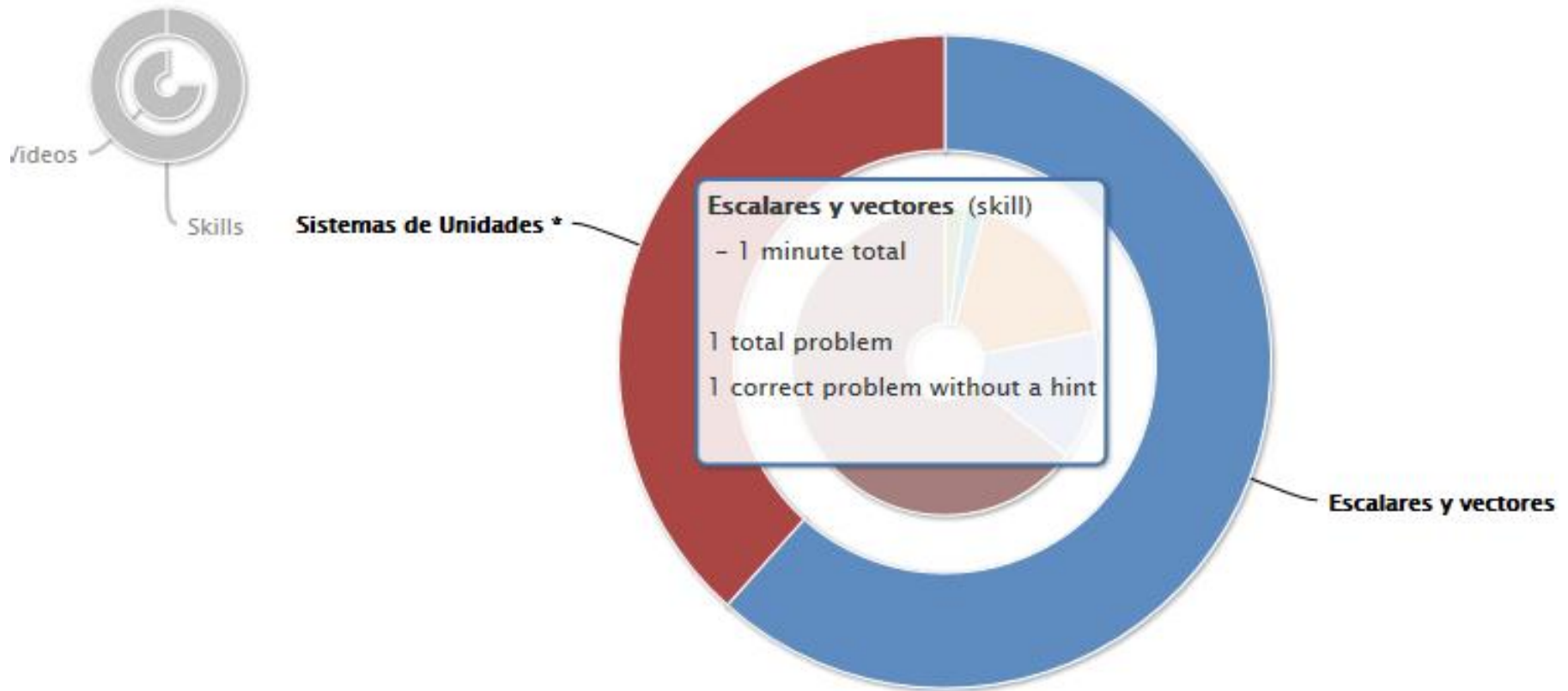
# KA: Report by details on exercises



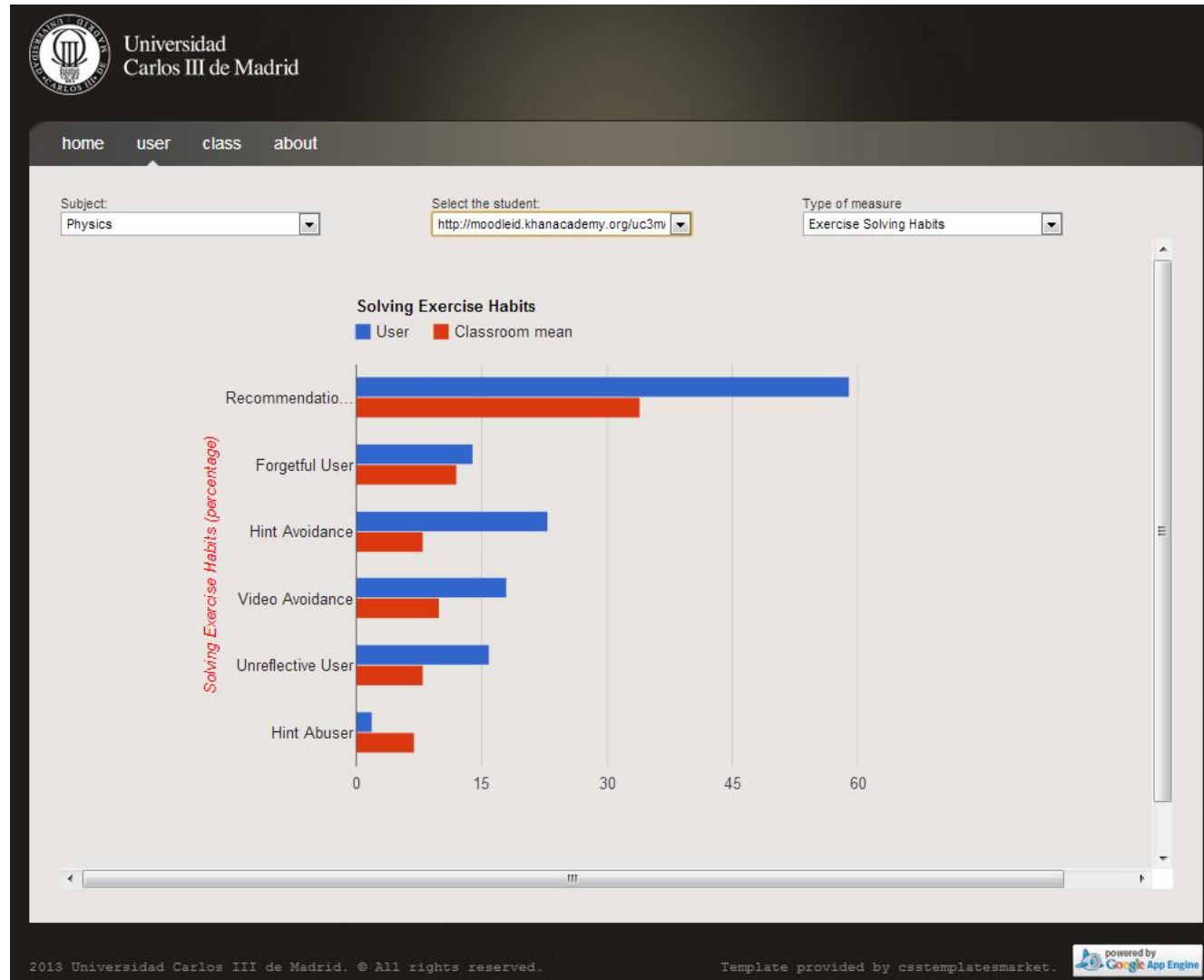
# KA: Report by Skills



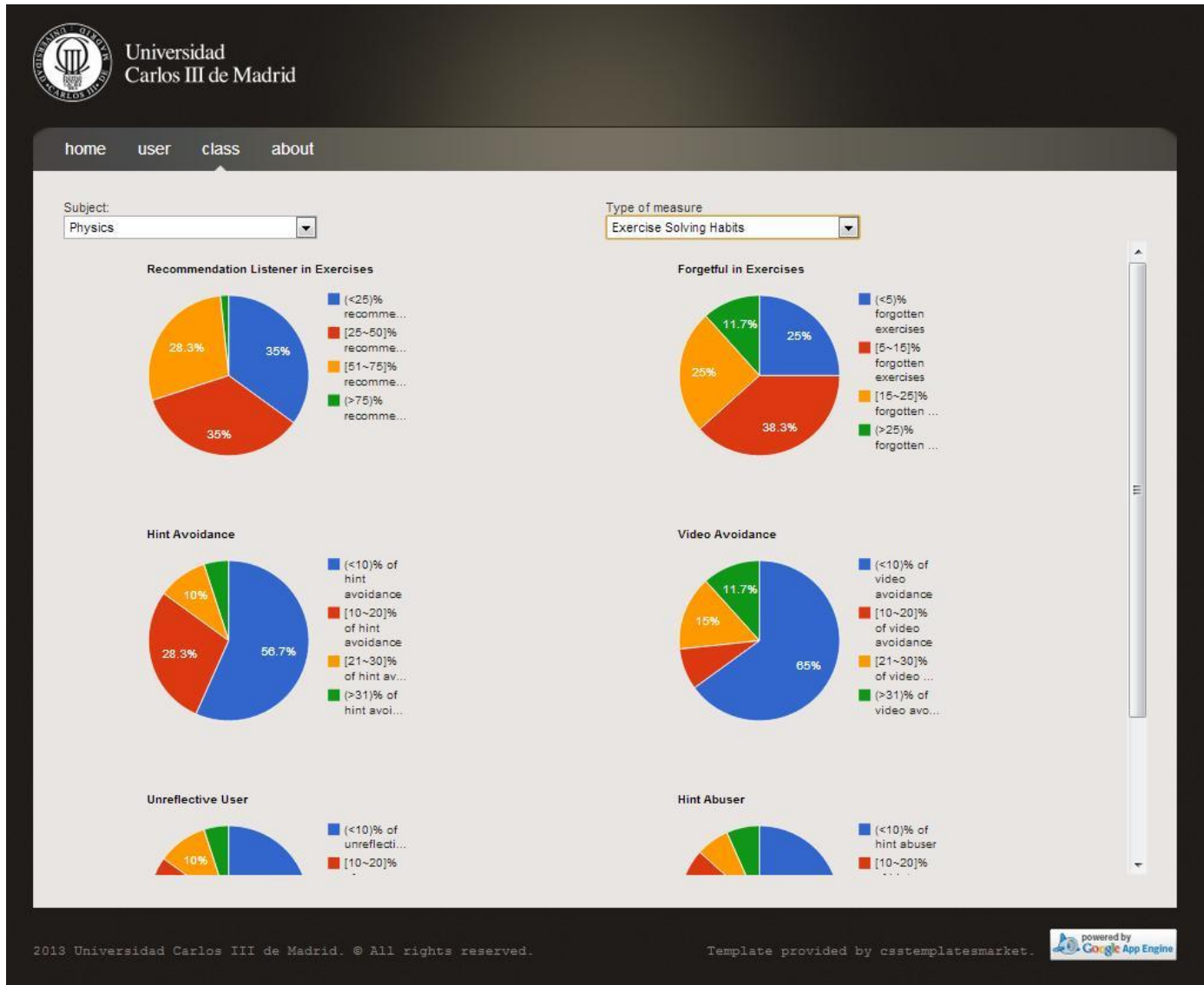
# Khan Academy: Report by time in topics



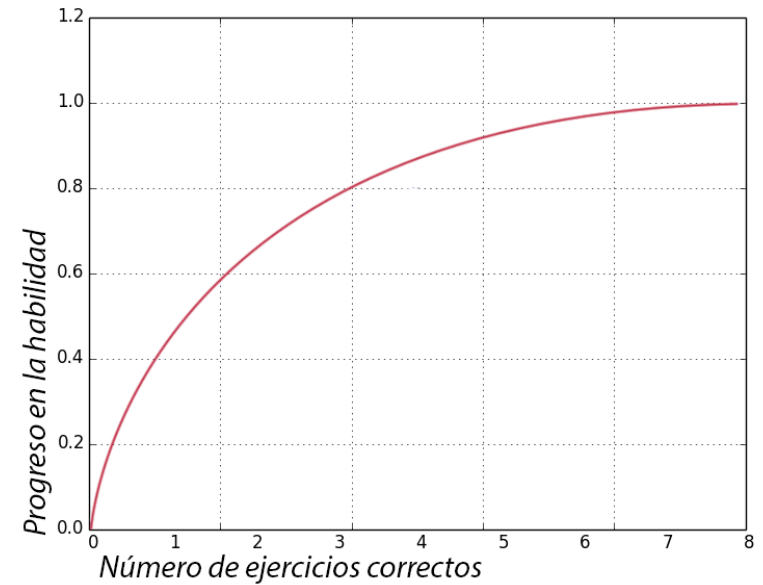
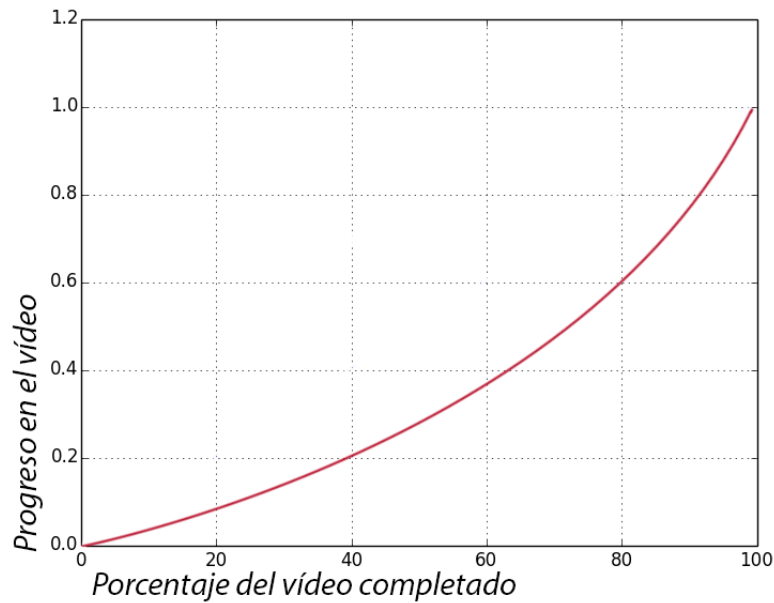
# KA: Individual reports: self-reflection



# KA: Evaluation of the whole class

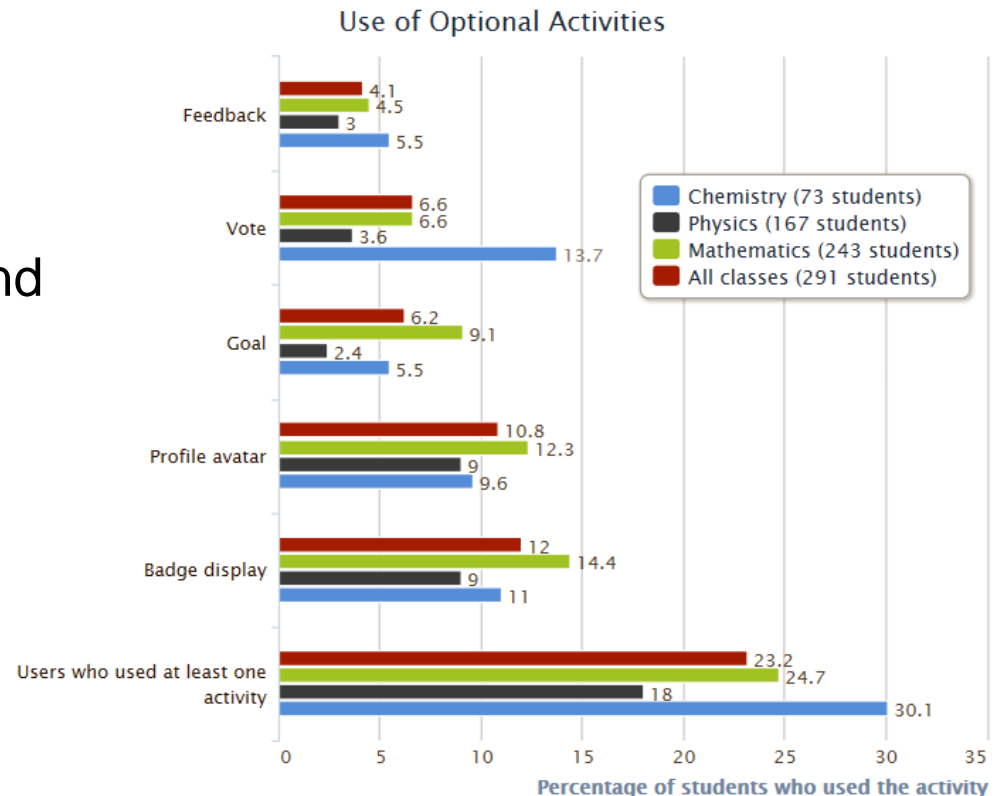


# KA extensions: Effectiveness



# KA extensions: Analysis of optional activities

- 76.81% of students who accessed, did not use any optional activities
- Difference of use per course and depending on type of optional activities
- 55 goals (50.9% completed)
- 40 votes (26 positive, 13 indifferent, 1 negative)



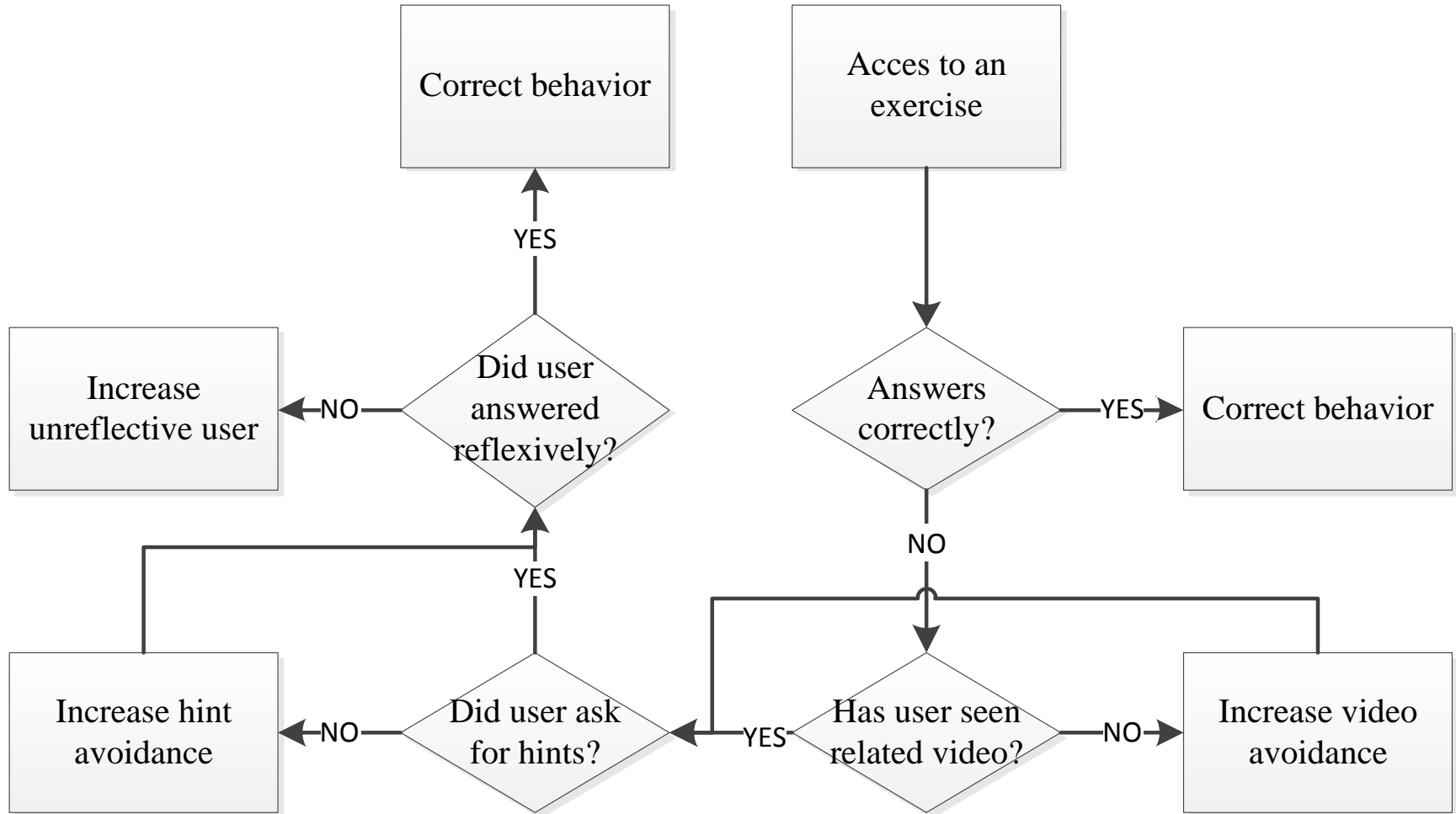
Type of activity	Percentage of activities accessed				
	0%	1-33 %	34-66%	67-99%	100%
Regular learning activities	2.48%	51.55%	23.19%	18.84%	3.93%
Optional activities	76.81%	18.43%	4.14%	0.41%	0.21%

# Prediction models

Learning gains=  $25.489 - 0.604 * \text{pre\_test} + 6.112 * \text{avg\_attempts} + 0.017 * \text{total\_time} + 0.084 * \text{proficient\_exercises}$

- Hierarchical regresion
- Can explain more than 50% of variability
- New model with higher level indicators improve the model

# ALASKA: exercise solving habits

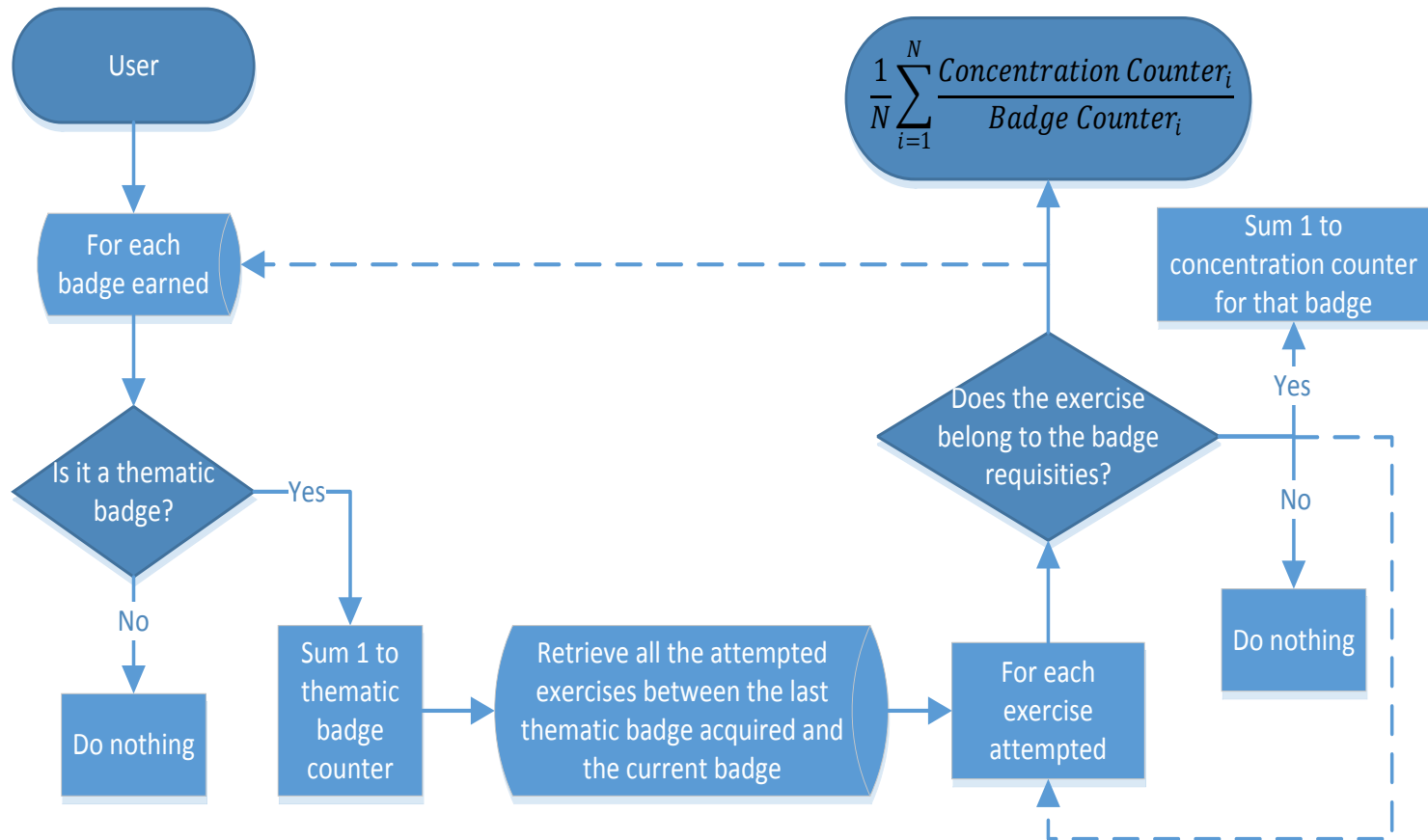


# KA extension: exercise solving habits

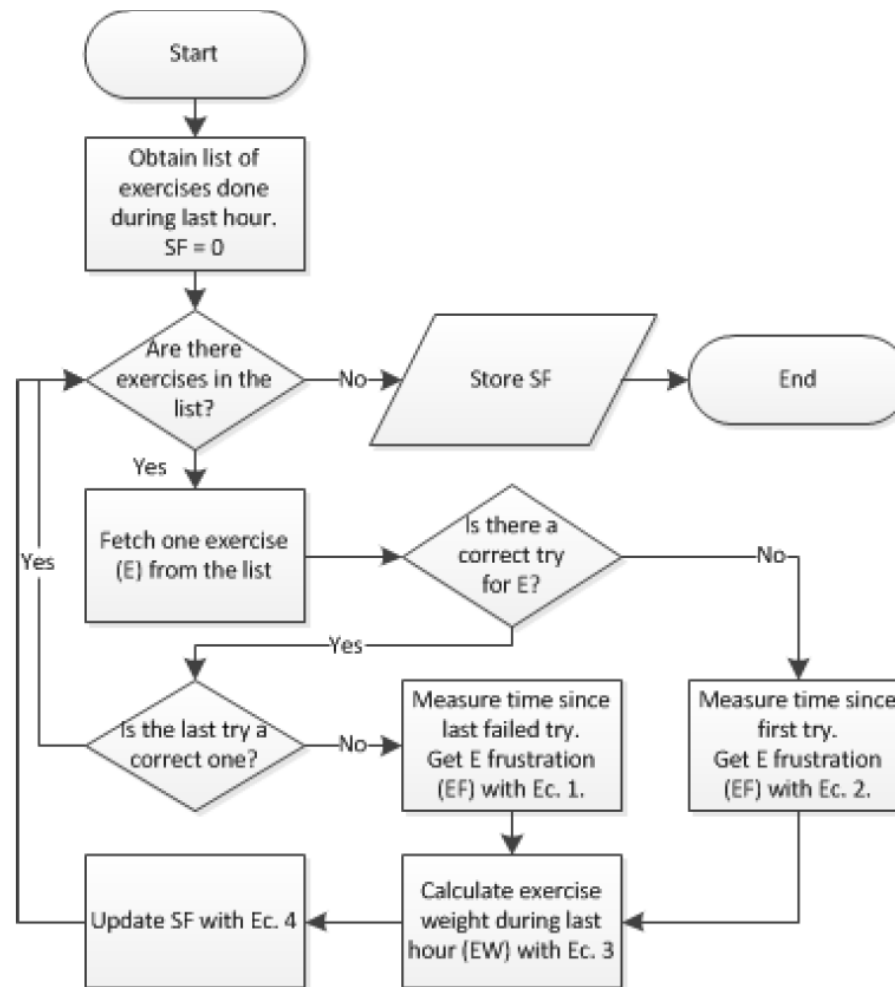
- Some statistics with a level of 25%
  - 30.3 % hint avoider
  - 25.8 % video avoider
  - 40.9 % unreflective user
  - 12.1% of hint abuser

	Hint avoid.	Video avoid.	Unrefl. User	Hint abuser
Hint avoidance	1	0.382	0.607	-0.186
Video avoid.	0.382	1	0.289	0.096
Unrefl. user	0.607	0.289	1	0.317

# KA extension: gamification habits



# KA extensions: Detection of emotions



# KA: Selected Publications and video

- Publications

- Muñoz-Merino, P. J., Ruipérez-Valiente, J. A., Alario-Hoyos, C., Pérez-Sanagustín, M., & Kloos, C. D. (2015). Precise Effectiveness Strategy for analyzing the effectiveness of students with educational resources and activities in MOOCs. *Computers in Human Behavior*, 47, 108-118.
- Ruipérez-Valiente, J. A., Muñoz-Merino, P. J., Leony, D., & Kloos, C. D. (2015). ALAS-KA: A learning analytics extension for better understanding the learning process in the Khan Academy platform. *Computers in Human Behavior*, 47, 139-148.
- Muñoz-Merino, P. J., Valiente, J. A. R., & Kloos, C. D. (2013, April). Inferring higher level learning information from low level data for the Khan Academy platform. In *Proceedings of the third international conference on learning analytics and knowledge* (pp. 112-116). ACM.

# KA: Selected Publications and video

- Publications

- Ruiperez-Valiente, J., Munoz-Merino, P., Kloos, C. D., Niemann, K., Scheffel, M., & Wolpers, M. (2016). Analyzing the Impact of Using Optional Activities in Self-Regulated Learning, IEEE Transactions on Learning Technologies
- Leony, D., Muñoz-Merino, P. J., Ruipérez-Valiente, J. A., Pardo, A., & Kloos, C. D. (2015). Detection and evaluation of emotions in massive open online courses. Journal of Universal Computer Science, 21(5), 638-655.

- Video

- <http://www.youtube.com/watch?v=nQ-80sZOfT8>

# Open edX

- We made a new release which includes:
  - Better color usage to transmit information along all the interface
  - Visualizations scaling to massive amount of students and high variety in the number of educational resources
  - Improves the processing design making a relative-computation of only new events (tracking logs)
  - Adapted to newer releases of Open edX (tested in Cypress and Dogwood)
  - GitHub <https://github.com/analyseuc3m/ANALYSE-v1>
  - Video <https://www.youtube.com/watch?v=3fpIIITON1bs>

# Interface of ANALYSE

## Problem Time Distribution

This visualization shows the percentage of time invested in minutes in each one of the problems of the course. You can filter by all the students or each student individually.

### Options

All students ▼

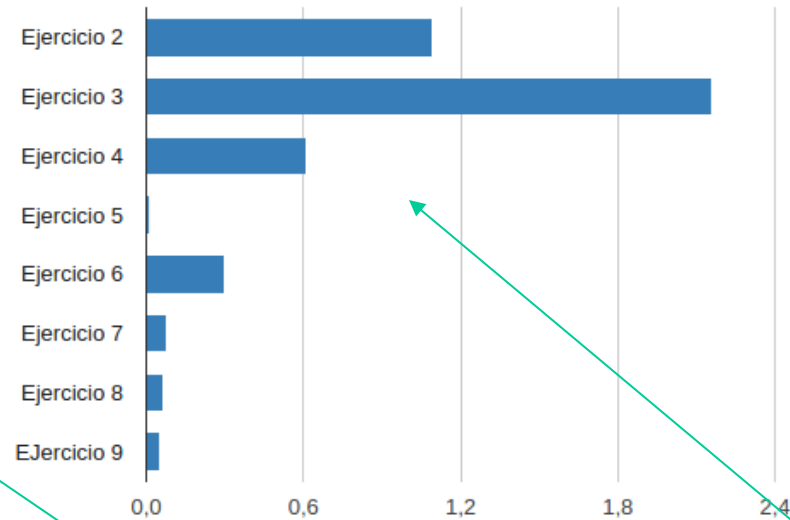
### Range of problems

Ejercicio 1  
Ejercicio 2  
Ejercicio 3  
Ejercicio 4  
Ejercicio 5  
Ejercicio 6  
Ejercicio 7  
Ejercicio 8

Draw again

Reset

Hold down the Ctrl (windows) / Command (Mac) button to select multiple videos.



Problem time



Percentage of time

# Students Grades

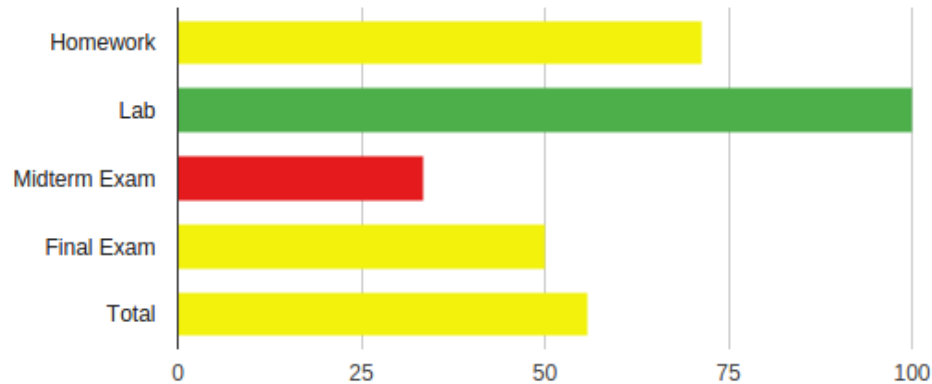
## Students Grades

This visualization shows the average grade in each category of resource in the course. You can filter by all the students, each student individually or by students' groups (by grades). Click on a bar in order to see the results decomposed in each item within the category.

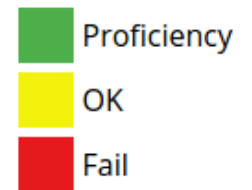
### Options

Select student ▼

paloma ▼



## Grade categories



# Video Time Watched

## Video Time Watched

This visualization shows in light orange the percentage of different video watched (it does not count if the same parts are watched several times, the max. is the 100% of the video) and in dark orange the percentage of total video watched (total amount of time spent compared to the length of the video in percentage). You can filter by all the students or each student individually.

### Options

All students ▼

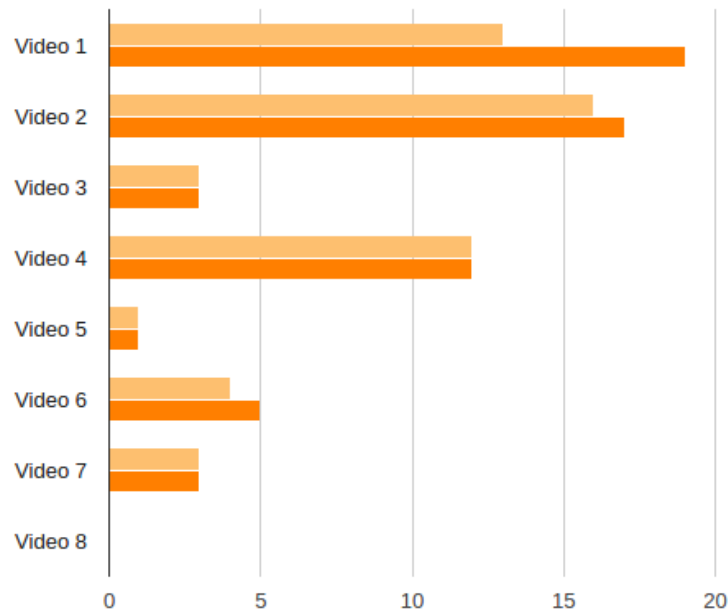
### Range of videos

Video 1  
Video 2  
Video 3  
Video 4  
Video 5  
Video 6  
Video 7  
Video 8

Draw again

Reset

Hold down the Ctrl (windows) / Command (Mac) button to select multiple videos.



## Video Time Watched

Different Video Time  
Total Video Time

# Repetition of Video Intervals

## Repetitions of Video Intervals

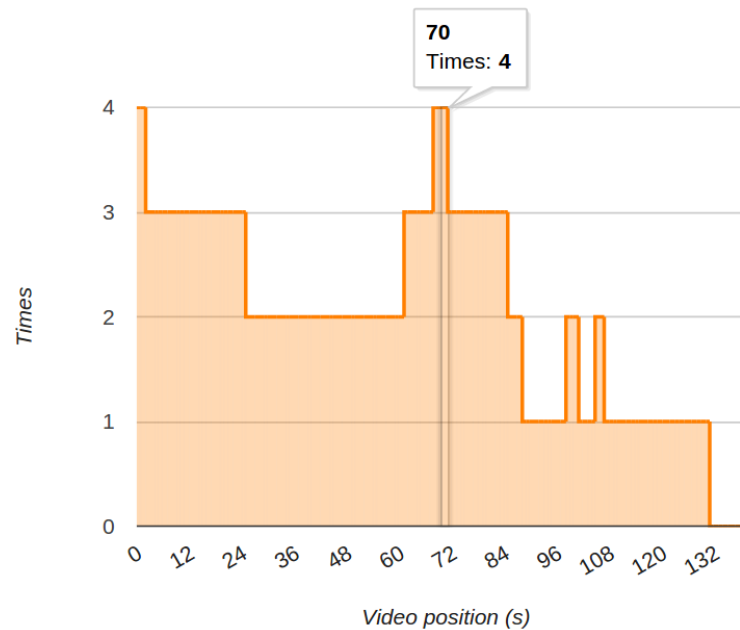
This visualization shows the number of different times that each second of a video have been watched by all the class. You can select two different options; either each student can count only 1 time, or each student can count up to the number of times that he/she has watched that video second. You can also pick students individually.

### Options

Class: total times ▼

### Videos

Video 1 ▼

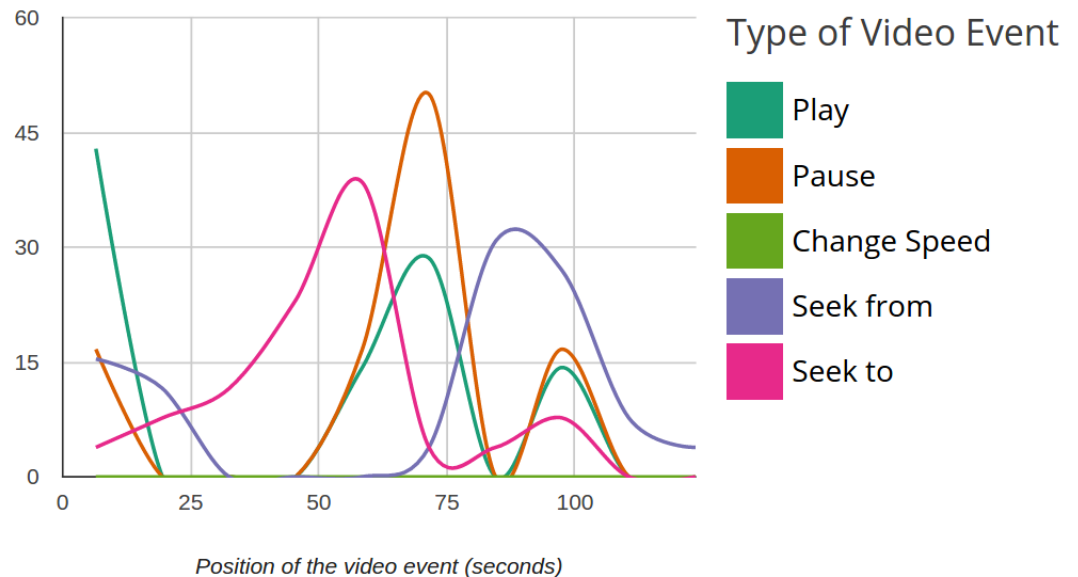
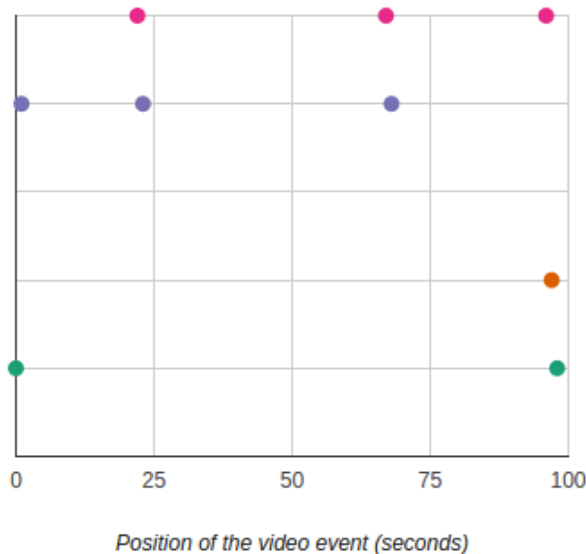


## Repetitions

Number of Times

# Video event distribution

- Video events (play, pause, change speed, seek from, seek to)
- Possible use related to detection of problems in resources
- We can see many 'seek from' events around second 85 and 'seek to' around second 55 → Seeking backwards



# People involved in the development of ANALYSE

- José A. Gascón Pinedo
- José A. Ruipérez Valiente
- Héctor Pijeira Díaz
- Javier Santofimia
- Jaime Alzola
- Javier Orcoyen
- Carlos Delgado Kloos
- Pedro J. Muñoz-Merino

# Use of Learning Analytics in Remedial Courses

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**Gradient Lab**

**Universidad Carlos III de Madrid**

