

International Conference in Innovative Teaching: Improving the University for Future Generations



HARVARD

# Let's Play Gamification to Mitigate Demotivation and Unevenness in Engineering Courses

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# Outline

- 1. Motivation
- 2. Gamification in Engineering
- 3. Methodology
- 4. Results
- 5. Perception of Gamification
- 6. Conclusions and Future Work



#### Let's Play. Gamification to Mitigate Demotivation and Unevenness in Engineering Courses

### 1. Motivation

PIE-17-122. GAMONING: Gamification for the motivation and leveling of students at engineering schools

- Computer Science and Computer Engineering
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  - Daniel Hector Stolfi
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# 1. Motivation

 Uneven skill levels and knowledge -Low cut-off mark in Engineering (between 5 and 6 over 10) • Student's **lack of motivation** for theoretical lectures



This makes it hard for the lecturer to keep everyone focused during the lessons

### **Gamification** main idea

*if you can make something funnier, and include notions of play, you can get people to do things they otherwise might not want to do* 

# 2. Gamification in Engineering

- The average video game player has been playing games for over **12 years**. The majority of our students grew up playing video games
  - They are **extremely optimistic**. They believe that everyone can succeed by working hard enough and long enough
  - They are good a teamwork, often gaming in groups. They learn from each other, not a coach or a teacher
  - They like to be **good at things** (and have others see how good)
  - They like to see **how we measure up** against others
  - They like to win (and have others see)





# 2. Gamification in Engineering

- Our main goal is to address the lack of engagement and background unevenness by fostering health competition through games
  - Increase the motivation
  - Encourage continuous effort
  - Improve the cooperation
  - Promote loyalty of the students to the subject
- Implementation of gamification:
  - Games performed in groups
  - Initial test to set balanced groups
  - **Rewards** for the participants (for each activity and the whole semester)





- **Preparation phase:** Designing and generating the artifacts to perform the activity
  - Google Forms for follow-up and satisfaction surveys
  - Slides and Socrative or Kahoot for games
  - Defining the rewards



- Execution phase:
  - Games are applied after finishing a thematic block
  - **Dynamic quizzes** that includes questions (multiple answer, multiple choice, and short answer) and bounded problems to be quickly solved
  - All team members should be involved in the answer, since the teacher randomly chooses a given member to justify the answer
  - The wining team is **rewarded in public**
  - The students have to answer short **follow-up surveys** (appreciated difficulty and learning levels)





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• Execution phase:

Two game variations:

- Limited time to answer the questions
  - It **increases the dynamism** of the games
  - Similar results in terms of correct answers
  - Less discussion among the team members  $\rightarrow$  less knowledge sharing
- Winner/loser team can **steal a member** from other teams
  - The activity could be **annoying**  $\rightarrow$  team members moving thorough the class
  - Funnier for our students
  - It needs to be applied with enough teams and team members
    - Low number of team members  $\rightarrow$  Teams likely to disappear
    - Low teams  $\rightarrow$  Unbalanced teams







- Monitoring phase: Gathering information and evaluation of the methodology
  - Creation of a list with the highest difficult questions to be reviewed in class
  - Evaluate student's appreciation



Encuesta Seguimiento PIE

¿Has aprendi	do algo d	e tus com	pañeros c	le grupo?	
	1	2	3	4	
Nada	0	0	0	0	Basta
¿Has enseña	do algo a	tus comp	añeros de	grupo?	
	1	2	3	4	
Nada	0	0	0	0	Basta
Valora la con	nplejidad	del juego			
	1	2	3	4	
Muy fácil	0	0	0	0	Muy di
Valora la rele	vancia de	l juego re	specto a la	a materia	imparti
	1	2	3	4	
Nada relevante	0	0	0	0	Muy rele
En 140 carac	teres, ¿qu	é cambia	rías en est	te juego?	
Your answer					

• Evidences found in the Monitoring phase may provoke changes (in the preparation of future activities) that will be applied during the Preparation phase

### 4. Results

- Knowledge sharing: There are share of knowledge intra-teams (discussion before answering) and extra-teams (when justifying the answers)
  - Almost all of students have learned something during the games
  - More than the half of the players have taught something to the other team members

Better establishment Heterogene of the knowledge Works				
Game	Percentage of students that have learned something	Percentage of students that have taught something		
Game 1	90.5	52.4		
Game 2	80.0	66.7		
Game 3	89.3	76.8		
Game 4	96.3	92.6		
Game 5	96.0	63.2		

### 4. Results

### • Level of difficult:

- The difficulty rate is assessed using the **difficulty index**. The questions are divided into quintiles according to the overall students have correctly answered the question
  - **D1**:  $D \ge 80\%$  very easy **D2**:  $80\% > D \ge 60\%$  - easy **D3**:  $60\% > D \ge 40\%$  - average difficulty **D4**:  $40\% > D \ge 20\%$  - difficult

**D5**: 20% > D - very difficult



- First game was difficult  $\rightarrow$  it had more problems than questions
  - The students expressed their discontent and loss of interest
- Second game was re-designed according to the results of the first one (quizzes and surveys)



### 4. Results

- Correlation between learning and perceived difficulty:
  - Learning and perceived difficulty is obtained by means of surveys (from 1 to 4)
  - There is an **invers correlation** between the average degree of learning and the average perceived complexity





#### No more difficult quizzes help to learn more



# 5. Perception of Gamification

- Help us in our research
  - Short survey about gamification
- Browse with your portable device to <u>www.kahhot.it</u>

• Enter the Game PIN and your Nickname





# 5. Perception of Gamification

 Surveys to asses the experience, expectations, and perception about gamification strategies in Engineering degrees by lecturers



# 5. Perception of Gamification

 Surveys to asses the experience, expectations, and perception about gamification strategies in Engineering degrees by students



# 6. Conclusions and Future Work

### Conclusions

- The implementation of gamification is not as simple as introducing games in the course
- A **bad design** of the games or the reward system can lead to a **loss of interest**
- The capability of **adapting the games** improves the probability of **success**
- Gamification requires time (lecturers know about its benefits but they do not apply it !!!)
- Gamification can improve the **engagement** of the students in the lectures
- Gamification fostered **cooperation** between students (group activities are preferred)

#### Future work:

- Involve more lecturers in our gamification activities
- Gather more evidences about the benefits/drawbacks of applying gamification

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# **Comments?**

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