On the Gamification of a Graduate Course on Cloud Computing

Alexandru Iosup and Dick Epema
(Delft University of Technology, the Netherlands)
A.Iosup@tudelft.nl

The need for a new approach in higher education

- **A new generation of students**: they doubt the need for technical studies, have short attention spans, lack coaching, etc.
- **A new wave of students**: international and multi-cultural, used to job-hopping and train-spotting, without much in common, etc.
- **The blame game educator—student:** most faculty consider their teaching *above* average [1], research vs teaching in career, etc.
- **The social cost of technical sciences is high**: enrolment in technical sciences is low, especially among women; course and curriculum completion rates are low in Western Europe; etc.

The promise of gamification

Gamification = using *social* gaming elements to non-game environments

- **Social gaming** = gaming activity for which social interaction helps improve the gameplay experience.
- **Three kinds of elements:** mechanics, dynamics, actual content.
- **The Promise**: "science and scholarship are much like games" [2], gamification can help in education [3], (our experience for the past five years:) gamification caters to all student types [4]

IN4392 Cloud Computing: A Gamified Graduate Course in HPC

Why Cloud Computing?

- Appealing topic in disitrbuted HPC
- Typical computer systems topic: experience gained through discussion and practice is important, but difficult to achieve with traditional methods

Course Goals

- Explain basic concepts, objectives, and functions of cloud computing (through Lectures)
- Implement complex applications using cloud computing (through Lab exercises)
- Analyze state-of-the-art in cloud computing (through team and personal self-study, followed by team Presentations and individual Reviews)

Course Topics

1. Overview of cloud computing
2. Scheduling and resource management
3. Data centers and energy efficiency
4. Multi-tenancy concepts, including virtualization
5. Cloud programming models
6. Case studies
7. Guest lecturer

Gamification =

Design for the Perfect Student + Stimulating Scoring System + Many Other Elements

- Provide alternative paths for **four student types**: achiever, explorer, socializer, killer (the Bartle taxonomy)
- Provide mechanics, dynamics, and actual content for both **Cooperative *and* Adversarial**
- Create a **path for the perfect course grade** but *not* for the barely passing grade

Course Points	Access Tokens
10,000 for straight 10	Discuss w Lecturer about MSc topics
4,000 for large exercise	
3,500 for reviews	Recommendation Letter
2,500 for presentations	
≤1,000 for improvements	
+50 activity in Lab/Lecture/Presentation	Unlocked content
+25/Q end-lecture quiz	
+500 entry quiz	

- **Onboarding**: entry quiz, story every lecture, etc.
- ***Social* Learning**: in-class teams, self-study as team effort, keep top students in the classroom, involve both achievement and exploration-oriented students in team assignments
- **Support different player types**: ladders, ranking, end-lecture quiz for top students and self-testing; content unlocking for explorers; etc.

Results of Gamification

- **Macro**:
  - Large enrolment (50 MSc students), good completion (>60%)
  - Students able to discuss advanced topics at research level
  - Students able to complete projects at industry-hiring level
- **Student Survey:**
  - (Yes-No-Don't care questions) (>90% 75-90% 50-75%)
  - I understand how this course was gamified
  - Gamification made me more motivated
  - Gamification made me think more carefully about what I like to do (where I can get bonus points)
  - I enjoyed the interactive part of the lectures
  - I enjoyed the exercises at the end of the lectures

Future Challenges for Gamification

- **Macro**: Does gamification lead to sustained improvement? Which gamification element is responsible for the largest improvement? Which type of learning goal gains most from gamification? Which type of student gains most from gamification? Which level of student gains most from gamification? How to measure? Long-term studies, etc.
- **Micro**: tuning gamification elements, esp. scoring; etc.

References

[1] (Blackburg & Lawrence, 1995)(Bok, 2006)(Gillespie et al., 2010), etc.
[2] (Mayra, 2009)
[3] (Randel, 1992), (Vogel et al., 2006), (Sitzman, 2011), (Kapp, 2012), etc.
[4] A. Iosup, Gamification: Playful Teaching for Generation-X/-Y/-Z/..., Lectures at TU Delft, Delft, the Netherlands, and Technion, Haifa, Israel.

http://www.pds.ewi.tudelft.nl/~iosup/Presentations/2013/2013_AIosup_gamification-primer13technion.pptx