

APPS FOR TEACHING MATHS OF FINANCE: AN EMPIRICAL APPROACH

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Abstract

There are many apps out there for students to learn Maths of Finance. In this sense, there exist different methodologies. Game-based learning platforms have appeared in our lives as a way to create, share and play fun learning trivia quizzes in minutes. In fact, we use modern e-learning technologies that support learning and provide a fun and engaging strategy for teachers. Indeed, students become active learners who thrive during the game. In this paper, we show the results of the use of Kahoot in the Faculty of Business and Economics at the University of Cantabria. In particular, it is used during the course Maths of Finance. This course is offered to the students of the Degree of Economics. We combine theoretical questions with practical ones. Also, different concepts about corporate social responsibility are introduced. The paper is structured as follows. Firstly, we review game-based learning platforms. Next, we propose a game that is used with students. In fact, students have to demonstrate their understanding by completing a quiz. Finally, we present our results. As a conclusion, we believe that these experiences could contribute to use of "social gamification".

FECIES. AREA TEMÁTICA INNOVACIÓN DOCENTE

1. INTRODUCTION

European universities are revolutionizing the quality and competitiveness of European higher education. In fact, all European countries are working to incorporate international aspects to studying, teaching, researching and making special policies. In this sense, European Commission has published the renewed EU agenda for higher education including four key goals for European cooperation in higher education (European Commission, 2017):

1. Tackling future skills mismatches and promoting excellence in skills development.
2. Building inclusive and connected higher education systems.
3. Ensuring higher education institutions contribute to innovation.
4. Supporting effective and efficient higher education systems.

The strategic framework for European cooperation in education and training (“ET 2020”) pursues the following four common EU objectives:

1. Make lifelong learning and mobility a reality.
2. Improve the quality and efficiency of education and training.
3. Promote equity, social cohesion, and active citizenship.
4. Enhance creativity and innovation, including entrepreneurship, at all levels of education and training.

In addition, and from another point of view, universities are very worried about teaching quality and learning opportunities for students. Thus, collaborative learning, critical thinking and application of learning to the real world have become new points of interest. As a result, new technologies for teaching and learning are changing higher education. In particular, new apps are very useful to create, share and play fun learning trivia quizzes in minutes.

Our analysis is twofold. Firstly, we describe different apps that can be used by teachers. Secondly, we show the results of the use of kahoot in the Faculty of Business and Economics at the University of Cantabria. In particular, it is used during the course Maths of Finance. This course is offered to the students of the Degree of Economics. We combine theoretical questions with practical ones. In addition, different concepts about corporate social responsibility are introduced.

2. APPS FOR TEACHING AND LEARNING

Educational technology is "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (Robinson et al. 2016). In fact, creating a digital learning environment is compulsory for modern societies.

The European Commission has adopted a Digital Education Action Plan in 2018 which includes 11 actions to support technology-use and digital competence development in education. The action plan has three priorities which are divided into different actions to help EU Member States meet the challenges and opportunities of education in the digital age:

- Making better use of digital technology for teaching and learning (Action 1 to 3)
 - Action 1 - Connectivity in Schools
 - Action 2 - SELFIE self-reflection tool & mentoring scheme for schools
 - Action 3 - Digitally-Signed Qualifications
- Developing digital competences and skills (Action 4 to 8)
 - Action 4 - Higher Education Hub
 - Action 5 - Open Science Skills
 - Action 6 - EU Code Week in schools
 - Action 7 - Cybersecurity in Education
 - Action 8 - Training in digital and entrepreneurial skills for girls

- Improving education through better data analysis and foresight (Action 9 to 11)
 - Action 9 - Studies on ICT in education
 - Action 10 - Artificial Intelligence and analytics
 - Action 11 - Strategic foresight

As a result, there are many apps out there for students to learn. In this sense, there exist different methodologies. Game-based learning platforms have appeared in our lives as a way to create, share and play fun learning trivia quizzes in minutes. In fact, we use modern e-learning technologies that support learning and provide a fun and engaging strategy for teachers. Indeed, students become active learners who thrive during the game.

Some of the most popular apps for teachers and educators are the following ones: Kahoot, Seesaw, Google Classroom, Teach Learn Lead, Remind, Classtree, Slack, Additio, Doceri, etc. All of them have advantages and disadvantages. In this paper, we are going to show the results we have obtained using Kahoot. Thus, in this case, we turn our class into a gameshow. Questions and answers are prepared into the site to create an instantly playable game with a web browser. In particular, as more students bring mobiles into the classroom, we are going to motivate them, just playing.

3. MATHS OF FINANCE

Mathematics of Finance is designed to prepare students for a wide range of careers in quantitative finance and risk management. This course is a subject that is both mathematically challenging and deployed by practical problems.

To achieve this, our modules are broad and cover both the necessary finance concepts and economics background. In particular it is divided into four modules:

- Module 1:
 - Simple Interest and Simple Discount
 - Compound Interest and Compound Discount
- Module 2:
 - Simple Annuities

- General and Other Annuities
- Module 3:
 - Amortization and Sinking Funds
 - Bonds
- Module 4:
 - Contingent Payments and Other contents

Thus, graduates are equipped with the skills needed to pursue careers in the field of quantitative finance and risk management.

Teaching methods are based on Lectures; Problem classes; Problem sheets and Tutorials. Also, Assessment methods include Coursework; Oral presentations and Written examinations

This course is recommended for students of Social Sciences and Applied Mathematics and Statistics who want a wide background in Maths of Finance. Some previous experience with statistics is recommended but not required.

Key points of this course are the following ones:

- **Technical Competence:**
Maths of finance equips the student with a wide range of statistical techniques. Mathematical Knowledge on Exponents, Logarithms and Progressions is required.
- **Methodological Competence:**
In particular, this course reinforces the student's ability to solve problems related with business and economics.
- **Social Competence:**
Students are expected to attend tutorials, seminars and write a term paper or a group project.
- **Personal Skills:**
Students are introduced to and gain experience in a variety of computational tools that are useful for economic analysis.

Finally, the Basic Bibliography and Texts for further Reading are the following ones: Tannous et al. (2013); Bonilla et al. (2006) and Brown and Zima (1996).

5. RESULTS

There are many apps out there for students to learn. In this sense, there exist different methodologies. Game-based learning platforms have appeared in our lives as a way to create, share and play fun learning trivia quizzes in minutes. In fact, we use modern e-learning technologies that support learning and provide a fun and engaging strategy for teachers. Indeed, students become active learners who thrive during the game.

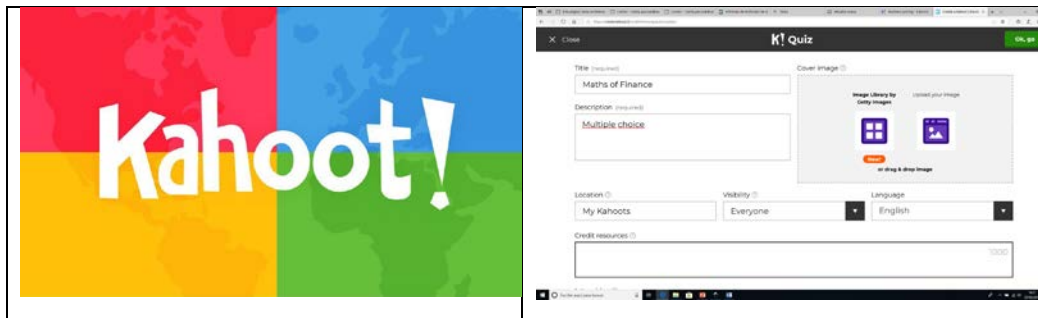


Figure 1: Using game-based learning platforms (<https://kahoot.com/b/>)

In this course, we have used Kahoot (see Figure 1) as a new way for teaching Maths of Finance. As teachers, we have proposed a Quiz and students have to choose from multiple answers. The questions of the Quiz cover some essential aspects of modules 1 to 3 and are designated to boost the student confidence in mathematics learning. They also help to improve the understanding of mathematical concepts and they are very useful for self-evaluation.

The questions are the following ones:

1. Which variable represents the nominal rate of interest compounded monthly?
 - a. r_{12}
 - b. d_{12}
 - c. j_{12}
 - d. j

2. You make a deposit of €1,000 in a savings account that pays simple interest. At the end of 10 years, you have accumulated €1,100. What is the rate of interest payable every 6 months in this account?
- 10%
 - 1%
 - 0.5%
 - 0.05%
3. What is the annual effective rate of compounded interest equivalent to the nominal rate of interest of 12% compounded monthly?
- 12%
 - 6%
 - 24%
 - 12.68%
4. The term of an ordinary simple annuity is 2 years and its accumulated value at an annual rate of interest of 1% is €1,200. How much will be the accumulated value at the same point of time if we decide that the previous annuity is due (payments are made at the beginning of each period)?
- €1,200
 - €1,212
 - €1,188.1
 - €600
5. Today, the discounted value of an ordinary simple annuity at an annual rate of interest of 1% is €1,200. How much will be the discounted value today if the payments of the previous annuity are deferred a full year?
- €1,200
 - €1,212
 - €1,188.1
 - €600

6. Today, the discounted value of an ordinary simple perpetuity at an annual rate of interest of 1% is €1,200. How much will be the discounted value today if the previous perpetuity is due (payments are made at the beginning of each period)?
- €1,200
 - €1,212
 - €1,188.1
 - €600
7. A loan of €50,000 is amortized annually over a 6-year period at $j=0'01$. At the end of the first year, it will be paid only the annual interest portion due and during the next 5 years, the payments will be equal and annual. How much is the annual interest portion of the first year?
- $I_1 = \text{€}$
 - $I_1 = \text{€}10,000$
 - $I_1 = \text{€}5,000$
 - $I_1 = \text{€}500$
8. In the previous loan, the principal repaid of year 6th will be $A_6 = \text{€}10,200$. How much will be the outstanding principal of year 5th?
- $P_5 = \text{€}$
 - $P_5 = \text{€}1,020$
 - $P_5 = \text{€}10,200$
 - It cannot be obtained with that information.
9. A bond is redeemable at 105%. If the face value of the bond is €500, which variable represents the redemption value of the bond?
- $r = \text{€}25$
 - $C = \text{€}25$
 - $P = \text{€}25$
 - $F = \text{€}25$

10. What is a callable bond?
- a. A bond that can't be redeemed by the issuer prior to its maturity
 - b. A bond that has to be redeemed by the issuer prior to its maturity
 - c. A bond that can be redeemed by the issuer prior to its maturity.
 - d. A perpetual bond.

5. CONCLUSIONS

This paper shows the results of the use of Kahoot in the Faculty of Business and Economics at the University of Cantabria. In particular, it is used during the course Maths of Finance. This course is offered to the students of the Degree of Economics. We combine theoretical questions with practical ones. Also, different concepts about corporate social responsibility are introduced.

The quiz is create by the teachers and the students make use of devices such as their laptops or smartphones to respond the quiz. The questions are displayed on teacher's screen and students have to reply using their devices. At the end of the quiz, it generates a detail report about response to each question. It is a useful analysis tool for the teachers. It is helpful in adding fun and excitement to a boring lesson and what is more important: Students reinforce the taught concepts and knowledge learned.

In this way, the apps are all free to use and have been carefully chosen because they do not require the students to enter any personal information to use them. Students can access the apps on laptops or mobile devices and have the option to access the app through a web page or to download the app from the apps store or the play store. All of the apps require the students to be either on their own mobile network or using the University WiFi.

Finally, as main conclusions of this experience, we can point out the following ones.

- Game-based learning platforms add fun to a boring lesson and increase class participation.
- It helps the teachers understand the weak areas of students.
- It is a helpful tool for self-evaluation.
- It is an exciting tool for engaging students.
- It is an interesting way for improving teaching and learning.

The European Commission has adopted on 17 January 2018 the Communication on the Digital Education Action Plan. The Action Plan outlines how the EU can help individuals, educational institutions and education systems to better adapt for life and work in an age of rapid digital change by:

- Making better use of digital technology for teaching and learning;
- Developing relevant digital competences and skills for the digital transformation;
- Improving education through better data analysis and foresight.

New initiatives as the proposed in this paper are very useful for teachers and students. As Educators, we have to consider the possibilities for embedding technology into teaching. They develop digital competences and improve higher education.

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