

Mitigating deficiencies of generation Z through new educational methodologies in a business statistic course

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Abstract

Nowadays, most of the students in first course at University are from the so-called Generation Z. Since a young age, these students have been used digital technology such as internet, mobile phones, tablets and laptops developing certain skills. But a large majority of these students have some deficiencies such as low knowledge of mathematics, scarce levels of motivation, concentration or logical reasoning and little patience (they want to understand everything quickly). These characteristics must be improved being a hard work to do by teachers. New educational methodologies are being adapted taking into account these digital skills and mitigating the deficiencies observed in some students. This paper presents an analysis of the impact of using new methodological techniques in a business statistics course. The work focuses on the problem of increase the student's motivation through the use of new digital tools such as video-lessons, screencasts and flipped classroom combined with neuroeducation techniques. Our hypothesis is mitigating the deficiencies of students through increasing their motivation. A multiple linear regression model to a set of students is carried out. Empirical results show, in general, that females take advantage of this methodology implemented better than males. Moreover, students with "good" performance reach better outputs (higher final score and a deeper knowledge of the subject) if additional methodological tools are implemented in the traditional class. While, there is not improvement for "bad" students.

Keywords: Educational Innovation, Generation Z, video-lecture, screencast.

1. Introduction

Generation Z students behave, think and learn in a different way than students of the 20th century did. For this reason, the last didactic techniques and methodologies used by teachers in 20th century are not effective nowadays generating the need to break the gap

between the current student and the learning method used. The literature collects an intense discussion about it (Winguist and Carlson, 2014). Two types of methodologies have been confronted: the traditional and the innovative (flipped classroom). The traditional methodology is based on master classes, repetition and memorization. The innovative methodology is based on new available technologies such as gamification, collaborative learning, flipped classrooms. In Morales (2019) is proposed a hybrid model that combines the best of both methods and the advances in the field of neuroscience (neuroeducation).

A high proportion of current students show difficulty in reaching the concentration level necessary for a correct learning process due mainly to the lack of motivation and commitment to the subject. As noted in Enkvist (2011) “the student has lost the respect for knowledge”. Of course, there are a proportion of very good students in terms of motivation and commitment (taken into account in our model), but the main objective is to recover the set of less motivated student.

The last OECD's Programme for International Student Assessment (PISA report 2018) is disturbing for Spain, noting that 48% of teenagers do not like to study, warning of the growing school discomfort due to the gap between traditional education (with rules, limits and tasks) and the digital world they live (no rules, no limits and no tasks to do).

The research of this paper is based in a population of students between the ages of 18 and 20, born between 2000 and 2002 (Generation Z). According to Matesanz (2015) from Forbes journal, this generation is mainly characterized by:

1. Be self-taught. 33% of students use online tutorials. More than 20% read on tablets and other devices. 32% do all their tasks and work online.
2. Their average usage time of an application is less than eight seconds.
3. They spend more than three hours a day in the computer for activities not related to their learning.

The students of generation Z use compulsively mobile phones or tablets to obtain information, in fact, most students do not use the basic book of the subject as the main way to obtain knowledge of the subject. This compulsive use of mobile phones and screens is causing a change in the adolescent's brain structure (Hutton et al., 2020). During the first six years of life executive functions are developed in the prefrontal cortex of the brain. This part of the brain is responsible for concentration, operational memory, planning or emotional self-regulation among other tasks (Corel, J.L., 1975). The study presented by Blakemore and Choudhury (2006) observed, during class development, a decrease in the brain's ability to perform these executive functions. Especially worrying is the lack of concentration (a necessary skill for proper learning) of the Z generation. It is practically impossible for the learning process to succeed without minimum levels of concentration. In Christakis (2009) and Christakis & Garrison (2009) the relationship between screen abuse

and concentration levels (the so-called screen effect) is shown. The greater the numbers of hours in front of a screen, the greater the likelihood that the child will have greater concentration problems in the future. Concentration is a process that requires voluntariness, awareness and perseverance. The concentration is an internal and active process while the use of mobile phones, tablets, ... are external and passive processes, i.e. today's teenagers train their brain with passive mechanisms while learning requires active processes. The thinker José Antonio Marina (Marina, 2019) affirms that "technology is creating a dangerous passivity" and predicts "an absolute and dramatic intellectual impoverishment" due to "a destructive idea: what am I going to learn if I can find it on the internet? ". As some experts point out, when students have a mobile device they stop reading. This lack of reading produces a lexical crisis, i.e., they stop understanding what they read and if they do not understand, they lose interest and motivation. It should not be forgotten, that until the age of seven or eight, the child's brain is extraordinarily plastic, establishing neuronal connections (Corel, J.L., 1975). Recent advances in the field of neurology establish a second golden age of learning, between the ages of 13 and 18 (Blakemore and Choudhury,2006), where a new type of neuroplasticity has been found. In this phase, the anatomy of the brain changes, great habits are implanted (such as the ability to concentrate) and in addition, educational failures can be corrected. In conclusion, teachers of this generation Z must face a type of student who, due to the psychological and social characteristics of the moment, is totally different from the previous generation. Note that the aforementioned occurs in all types of subjects but is especially problematic in quantitative subjects (Dillon, K.M., 1982). Therefore, new tools to stimulate and motivate the student must be used. In this sense, this paper presents the use of different digital tools.

2. Methodology

As noted above, in order to approach the adolescent's brain and as a way to ignite the flame of curiosity in the student and as a result, there is an increase in their intrinsic motivation. It is proposed a combined or hybrid approach with two main objectives (Morales, 2019):

1. Take advantage of the best of the traditional teaching with the incorporation of new pedagogical techniques and technological means that allows to develop a more efficient and effective learning process.
2. To adapt the learning process to the new psychological and sociological characteristics of the new students.

For this purpose, the class structure carried out is presented in Table 1.1. The final objective is to create a more effective learning that allows the student to obtain a deep learning of the subject avoiding the so-called bulimic student.

Table 1.1. Class Structure

Number of sessions per week			
	Session1	Session2	Session3
Duration	1h30'	1h	1h30'
Type	Traditional	Flipped	Flipped
Method	Theoretical classes + resolution of numerical exercises on whiteboard.	Practical classes with computer (with R and Excel)	Gamification of tests with Socrative or Kahoot, Real-world exercises. Elaboration of mind maps.
Requirements	Visualization of video-lectures and readings.	Visualization of screencast, videos-lectures and readings.	Study of the material of Session1 and Session2.
Work type	Individual	In group	In group

2.1. Breaking the gap between the digital world and traditional learning

We are currently living in a world where technology plays a central role. The use and consumption of videos on channels and tools such as YouTube, Coursera or edx courses are replacing the classic channels and means of information and learning. This new context or environment in which we move produces significant changes in the cognitive characteristics of current students. The current student learns everything in a more visual way. Using for it the back part of the brain more than the front part. This kind of learning require less effort but is slower therefore a more effective university education adapted to the new framework must be designed (Taylor, 2010).

A set of different multimedia tools and visual learning strategies have been made available to the students. Table 1.2 shows the objectives and activities developed in the course.

Table 1.2. Objectives and Activities in class

Objectives	Measures implemented in the classroom
Engage the unmotivated students	Short videos covering the whole subject (apowersoft).
Consolidate the knowledge of students with medium and high motivation	Screencast for practical work (apowersoft)
Cover the possible lack of assistance	Full use of Moodle or CANVAS: tests, forums, practices, etc
	Kahoot, Socrative, Perusall, etc.
	Exercises on graphical tablet, etc.

During the experiment emphasis has been placed on the video-lectures being complementarity to traditional materials (not a substitute) and flexible (Woolfitt, 2015). This videos satisfy the SEA characteristics (Short, Easy and Applied).

The main objective of the videos-lessons is to engage (short term), motivate and maintain interest (medium term) and consolidate (long term). The idea is that students watch the video-lecturer online prior the class in order to minimize the lecture time in class Wilson (2013) and Winqvist & Carlson, (2014). Additionally, the students have a set of screencast

videos to carry out practices with computer using for that, free software like R (RStudio) or RCommander, and Excel. Students also have tutorials and a set of self-directed training exercises.

2.2. Applying New Methodological Techniques

Neuroeducation. Neuroscience provides us with knowledge of how the human brain works. The objective of using the concepts of neuroscience applied to the academic world is to break the dynamics generated by the lack of motivation. Because one of the principles of neurodidactics is that you can't learn without emotion. And this is where our emotional brain begins to run as neurotransmitters involved to link the prefrontal area of the brain, where executive functions, essential for proper learning, are allocated. Therefore, the emotional and cognitive brain are inseparable. A combination of neuro-education plus pedagogical techniques could improve the learning process.

The concepts of neuroscience applied to the classroom have focused on three points:

- i. Light the spark of curiosity: A good exordium, spill the theoretical explanations and the resolution of exercises with notes and historical anecdotes and motivate with real data.
- ii. New slides, more concise and more visual.
- iii. Gamification that helps them consolidates knowledge in a fun way. Socrative and Kahoot have been used to carry out different tests during the course.

Additionally, teachers have tried to improve the relationship with students (we are a team) and to emotionally involve the student during the class (Bain, 2004).

Flipped Classroom and Cooperative Learning. A more dynamic class structure has been adopted where the student participates actively in the learning of the subject by solving practical group exercises, as well as the development of debates that promote the ability of analysis and collaborative learning (Winqvist & Carlson, 2014 and Reidsema, C., et. al., 2017). In order to encourage cooperative learning, the resolution of exercises and tests in group in platforms such as Socrative, Kahoot, Perusall or Canvas were used. Free online sources to create mind maps in group for the different lessons of the subject as well as for the whole subject were employed. The aim is to ensure that the student gets a clear idea about the structure as well as about the key concepts of the subject.

3. Results

The population under study consists of first and second year students at University for the subject Business Statistics with compulsory attendance. It is a population of students

between 18 and 20 years. The experiment consisted in applying two types of teaching methodologies to two different classes: Class T for traditional methodology with 57 students (47.06% female) and Class H for the hybrid model methodology with 42 students (65.38% female). Subsequently, a simple random sample of 30 students (31 females, 29 males) was selected in each of the classes. Class T plays the role of control group while Class H plays the role of experimental group.

A simple linear regression model has been used to determine and quantify the relationship between the explained variable and the explanatory variables of the model:

- Explained variable: *FinalScore* = Final score obtained in the ordinary examination.
- Explanatory variables:
 - 1) *Gender* = dummy variable (Female =1, Male = 0). Male is the benchmark.
 - 2) *Type of student* = dummy variable for performance of the student (Good [score between 8-10], medium [score between 5-7] and bad [between 0-4]. Medium is the benchmark.
 - 3) *Videos* = dummy variable about the methodology used in the classroom (if the class is with teaching innovation techniques it takes the value 1, 0 in otherwise). Traditional methodology is the benchmark.
 - 4) *Midterm* = quantitative variable referring to the intermediate exam.

The proportion of the variable *type of student*, depending on their performance, in the sample was as follows:

- Bad (31; 51.67%), medium (18, 30%) and good (11, 18.33%).

There has been a substantial increase in the proportion of bad type students during the last academic years.

In order to estimate the quantitative relationships between the explained and the explanatory variables, the following multiple regression model was adjusted:

$$FinalScore = \beta_0 + \beta_1 Bad + \beta_2 Female + \beta_3 Good + \beta_4 Midterm + \beta_5 Videos + e_i$$

where: $e_i \equiv \text{error term}$, $e_i \sim N(0, \sigma^2)$.

The coefficients are calculated using the R statistical package. The final model is:

$$FinalScore = 4.147 - 2.319Bad + 0.884Female + 1.816Good + 0.122Midterm + 1.415Videos + e_i$$

The adjusted coefficient of determination (measure the accuracy of the model) is 0.791, that is, the model is able to explain 79.1% of the total variability of the explained variable *FinalScore*. To ensure that the hypotheses of the linear regression model are met, it was verified that the residuals follow a normal distribution and that the variability of the residuals is homogeneous throughout the entire range of the variable. The results of this

analysis allow us to consider that the model is suitable, that is, the estimated parameters are valid.

All the parameters of the model were statistically significant except the one corresponding to the Midterm variable. This result was as expected, since the objective of the intermediate exam is to evaluate basic concepts and motivate the student.

The average score obtained in the final exam of statistics of a female student is higher about 0.88 points as compared to the average score obtained of a male student.

The average score obtained in the final exam of statistics of a bad student is lower about 2.31 points as compared to the average score obtained of a medium student.

The average score obtained in the final exam of statistics of a good student is lower about 1.81 points as compared to the average score obtained of a medium student.

The average score obtained in the final exam of statistics applying innovation techniques is higher about 1.41 points as compared to the average score obtained in a traditional class.

With regard of bad students in Class H, 12% improve the final score using videos and screencasts, 64% of the bad students obtained similar final scores and finally 24% de bad students got worse final grades.

4. Conclusions

Students from Generation Z have been used digital technology such as internet, mobile phones, tablets and laptops developing certain skills. But a large majority of new students have some deficiencies such as low knowledge of mathematics, scarce levels of motivation, concentration or logical reasoning, little patience with very high self-esteem and unreasonable behaviours for the good development of the class. New educational methodologies must be adapted taking into account these digital skills and mitigating the deficiencies observed in some students. This paper presents an analysis of the impact of using new methodological techniques in a business statistics. The paper focuses on the problem of increase the student's motivation through the use of new digital tools such as video-lessons, screencasts and flipped classroom combined with neuroeducation techniques. The empirical results indicate that the inclusion of digital tools in the classroom improves the performance of good students obtaining better final grades and a deeper knowledge of the subject (better results for females). For the least motivated students the effect is the opposite. Therefore, research should continue in this line to further improve the learning process especially for students who need it most, the least motivated.

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