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Online training for the strengthening of mathematical pre-knowledge mediated by Khan-Academy platform

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Abstract. The absence of mathematical skills makes part of the formative challenges currently facing Colombian Higher Education Institutions (HEIs) Being consequently Aware of the situation, denoting from the second academic semester of 2018 the Technological Units of Santander have consistently implemented the free course PREIN-UTS. This is an online training course mediated by the artificial learning web platform Khan-Academy, and it’s directed at the first semester students with the aim of strengthening their mathematical pre-knowledge before they are accessing the institution. Therefore, the object of study is to analyze the implementation of the course in his first stage and how the students does use it to improve their learning in mathematics. The methodological approach is quantitative of exploratory type with the proper use of descriptive statistics in the SPSS software. The random sample was made up of new first semester students (N=277). The results show implicitly the manner of solving exercises to increase the level of performance of the skills, in fact confirms and reveals that the activity students that dedicates the most time with average 340.97 minutes and Standard deviation (SD) 413.27. Finally, it was concluded that Khan-Academy enables the creation of free easy-access courses that can be used for the benefit of students who want to get into Higher Education to encourage their mathematical skills.

1. Introduction

Information and communication technologies have dabbled on a large scale in the educational field with the generation of several tools that will brought dynamism in front of learning and knowledge [1,2] by promoting the formative processes of students at all educational levels [3,4]. In the other hand, when the Colombian applicants try to get access to the higher Education they eventually present great shortcomings and difficulties in the development of mathematical competences [5,6], which generates high dropout and repetition rates around the first academic semesters [7], emphasizing within the current challenges that must be addressed by the different Colombian Institutions of Higher Education (HEIs) [8]. Precisely, the Technological Units of Santander ever since the initiative was consider in the second half of 2018 have launched the online training course called PREIN-UTS that pretends the strengthening of mathematical skills mediated by the Khan-Academy technology platform.

Khan Academy is a digital tool that offers different free courses in which the tutors have direct access to detailed information of the work carried out by their students in order to identify difficulties in time and implement improvement strategies to overcome the obstacles of learning [9]. The Khan-Academy training courses contain various methods and different support of aids that enable self-learning through videos, missions, clues and readings [10,11]. Besides, the platform rewards the achievements obtained through medals, avatar and energy points, which motivates the student to fulfill their goal [12]. In the
same way, Khan-Academy continuously assesses the level of skill development on a qualitative scale as follows: With difficulties, needs more practice, practiced, level 1, level 2 and Mastered.

Therefore, this study describes the experience of the implementation of the first phase of the PREIN virtual course mediated by the web platform Khan Academy conscientiously in students who were in fact admitted pursuing the first semester in to the different academic programs of (HEIs) of Bucaramanga, Colombia.

2. Methodology
The methodological approach is quantitative of exploratory kind with the use of descriptive statistics in the SPSS software. The random sample was shaped by new students of first semester (N=277). The research was actually separated in the following study phases:

2.1. First phase
A video tutorial was designed, and it was originally created the PREIN course by the Khan-Academy corresponding with the respective internal codices. The thematic axes assigned from the Khan-Academy were the primal bases of algebra according to: Unity 1 Fundamentals (31 skills), Unity 2 Algebraic expressions (10 skills), Unity 3 Linear equations and inequalities (14 skills) Unity 4 line graphs, and slope (13 skills), Unity 5 Systems of equations (6 skills), Unity 6 Expressions with exponents (11 skills) Unity 7 Quadratics and polynomials (12 skills), Unity 8 Geometry (6 skills). For a weighted total of 103 skills.

2.2. Second phase
From the stringent institutional documental base some reports were generated properly taken from the explicit listing of the students of first semester. Subsequently, the intention of create an invitation purpose was emitted via email and telephonically

2.3. Third phase
The preliminaries results were analyzed consider the following variables of study:

- Descriptive variables: gender, headquarters, academic program and faculty.
- Khan-academy Variables: skills, makes reference to the exercise practice inside the platform environment; activities, it does refer to the spender time within the platform; and gamification, these are the key points of energy and medals earned.

3. Partial Results

3.1. Descriptive results
Of the 1624 students enrolled in the first academic semester 277 were registered on the PREIN course. Whom which the 53.36% were man ant the el 46.64% were woman. The Figure 1 show the percentage distribution of PREIN students by headquarters where it gets a great appreciation of a major participation of the principal headquarters students of the institution with a 91.18%.

![Figure 1. Bar graph of PREIN students by headquarters.](image-url)
By a side, the Figure 2 sights the distribution of the percentage of students per academic program: Tourism, Geotechnics, Agroindustry engineering, Topography, Fashion, Electronics, Telecommunications, Banking and finance, Electricity, Sports, Environmental engineering, Marketing, Systems, Electromechanical engineering, Business management, accounting career; highlighting the participation of students coming all the programs offered by the institution.

![Figure 2. Line graphic of PREIN students by academic program.](image)

In the other hand, the sectoral graphic from the Figure 3 evidence a considerable increase of participation from the belonging students that attend at the Faculty of socioeconomic and business sciences in reference to the students of the Faculty of Natural Sciences and Engineering.

![Figure 3. Sectoral graphic of PREIN students per faculty.](image)

3.2. Khan-Academy results

3.2.1. Abilities. After a month of the implementation in use of the PREIN course its absorbs that the 40% of the student to have a reliable progress major or equal to the 50 % in the exercise practice (See Figure 4).
3.2.2. Activity. Respect to the invested time it is planed that the students have, on average, spent 444.08 min on the platform, distributed as follows: 103.11 min watching video tutorials and 340.97 min to practice missions (See Table 1) From the above we can conclude and affirm certainly that students prefer to invest notoriously their time in solving exercises than observing videos.

![Figure 4. Radial Graphic of the global advance of the students in PREIN.](image)

Table 1. Descriptive statistics.

|                            | Total minutes | Minutes of videos | Minutes of skills |
|-----------------------------|---------------|-------------------|-------------------|
| Mean                        | 444.08        | 103.11            | 340.97            |
| Median                      | 279.63        | 38.57             | 229.07            |
| Mode                        | #N/A          | 0.00              | #N/A              |
| Standard deviation          | 553.41        | 199.41            | 413.27            |
| Sample variance             | 306262.08     | 39762.85          | 170789.68         |
| Kurtosis                    | 26.80         | 25.82             | 32.91             |
| Asymmetry coefficient       | 4.49          | 4.60              | 4.88              |
| Minimum                     | 60.05         | 0.00              | 50.13             |
| Maximum                     | 4306.92       | 1461.67           | 3416.28           |
| Confidence level (95.0%)    | 113.35        | 40.84             | 84.65             |

Right Next, Figure 5 demonstrate the Box Plot of the total amount of minutes students have invested in the platform, where we absolutely can objectively appreciate the asymmetry inside the distribution of the variable, maximum value of 4306.92 min, minimum value of 60.05 min and median of 279.63 min.

3.2.3. Gamification. In fact, so far at this moment the average energy points obtained by students on the Khan-Academy platform is 44250 with a Standard Deviation (SD) 39671.53 while the number of medals won is 17 (SD) 9.40.
4. Conclusions
The accurate technology has entirely made it possible for the different location students, their permeable access to the PREIN course presetting without the prevailing need of moving to the main Headquarters and actually incur in different mobility expenses, allowing access to the platform from the comfort of their homes or making use of any site that counts with a viable computer and a good internet connection. The matter fact being implicit that Khan-Academy is a free software does incurred prioritizing in the minimum expenses generated for the institution and clearly does it make that the current implementation of the PREIN course be enormously significant, contributing to the valuable creation of teaching innovative strategies that promote the mathematical pre-knowledge of the students that will get in to first semester of any academic program. Even though the PREIN is a voluntary course, in this first stage of implementation it had a great acceptance by the students of the two faculties. Finally, in the next implementations is recommended extend the invitation to the students repeaters of the first semester subjects related to the area of mathematics.

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