

Use of technological tool for the consolidation of mathematical pre-knowledge in higher education

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Abstract: Currently, information and communication Technologies (ICT) have permeated the different educational, political, economic and sociocultural contexts, contributing to the inclusion and development of society by optimizing time, efforts and resources. On the other hand, (ICT) are considered powerful facilitators of the teaching-learning process at all training levels because they visibly improve the way of acquiring knowledge, becoming essential tools for educational transformation and innovation. Therefore, the purpose of this present study is to analyze the results of the first implementation of the PREIN - UTS virtual course developed in the web Khan- Academy tool. The sample was formed by new students who entered the first semester of the technological level in the academic period 2018-II of a higher education institution located in Bucaramanga Santander (N=801). The methodological approach was quantitative of exploratory type, with the use of descriptive statistics and SPSS software for data analysis. Among the research results it was evidenced that the PREIN course is an innovative and easily accessible strategy, that contributes to the assurance of mathematical skills of the upcoming students that will enter proximally.

Keywords: Mathematical competences, Higher Education, Khan–Academy

1. Introduction

Information and communication technologies (ICT) are important within the public policies of each country because they promote the accurate development of society through the improvement of the quality of life and reduction of large inequality gaps [1]. Precisely, in the educational field, (ICT) have become an essential facilitators tools and methods that boost knowledge since they allow the proper decentralization of knowledge and the creation of teaching methodologies in innovative learning spaces [2-3]. Nonetheless, the ICT incorporation within the formative process is limited due to the lack of training by teachers and it's also presented in several cases because of the high costs they generate [4].

Now, it can be appreciated and consider that despite the different alternatives offered by (ICT) to improve learning, the most clear results of the Report of the International Program for Student Evaluation or PISA Report reveal the assumption that the percentage of Colombian students who achieve high performance in the area of Mathematics is minimal with 1.8% [5]. Similarly, the State

tests Saber 11, implemented to measure the educational quality of Colombian people, show that students reach higher education with low levels of performance in the area of mathematics, implying high rates of desertion and repetition in the first academic semesters [6]. The above is one of the problems that Higher Education Institutions must address in order to train mathematically competent professionals, so that a possible way of tackling the problem is through the (ICT) incorporation in training processes, mainly in the area of mathematics, since they generate different ways of learning and several of them are freely accessible. For example, digital tools such as: Geogebra, Moodle, Mathway, Khan- Academy and others similar tools in between are able to benefit the learning of math's because they facilitate the making of didactics activities where the mathematical concepts are presented in a virtual and interactively way, allowing to relate the mathematics with real current living situations in accessible and attractive learning spaces that are used as support material to the development to the development of each student self learning.

Indeed, Khan-Academy is an innovative technological tool where different areas of knowledge can be learned online: mathematics, biology, chemistry, physics, computers, humanities, economics, finance and history. Khan-Academy courses are aimed at all educational levels and are offered free of charge

[8-9]. The formative process at Khan-Academy is based on an artificial learnign system that generates one unique training path for each student, depending from the results obtained in the diagnostic test, the system determinates the weaknesses, the strengths and skills in which the students are getting prepared to the learning process. While the students Works on the platform, Khan- Academy periodically evaluates them through "Domain Challenges " to ensure that the themes learned will be remained and retained over the time is passing through. Khan-Academy courses include several study material like videos, exercises, clues and instant feedback, which makes the different skills in the student to be formed and strengthened. Likewise, Khan-academy allows the student to go at their own pace and self-regulate their own learning resulting in people with extensive knowledge and excellent academic performance [10-11]. In Chile [12], the Khan- Academy massive incorporation results in the math classrooms highlight that the use of Khan-Academy improves the academic performance, it encourages the students participation, increases the collaborative learning and develops the self-learning, besides outstanding references has been said about what it is highly relevant to the Khan-academy and that is a universally adaptable tool for different types of teachers, students and countries.

Finally, assuming the primordial case in which the Technological Units of Santander, a Colombian Higher Education Institution, is involved; the previous problem is enlarged by the inclusionary component, where the Institution allows to receive all the students who are bachelor and who have presented the Saber 11 test without having Consider a minimum score to get admitted in the institution. Therefore, in the second semester of 2018, the PREIN-UTS course was implemented as a solution alternative in order to improve academic levels and favor student retention in the subjects of the area of mathematics. The PREIN-UTS course is an online training, of free use, implemented in the Khan-academy technology platform. The course addresses the thematic axes of: fundamentals of algebra, algebraic expressions, quadratics and polynomials, linear equations and inequalities, geometry and equations, line and slope graphs, systems of equations and expressions with exponents.

2. Methodology

The methodological approach was quantitative of exploratory type. For the analysis of data, descriptive statisticians were used in the SPSS software. The random sample was made up of students from all the academic programs, previously inscribed in the actual modality,

admitted or enrolled in the Technological Units of Santander during the second academic period of 2018. The research was divided into the following phases:

2.1 First Phase Implementation of the PREIN-UTS course. Via e-mail and through the institutional Contact Center, the invitation to the first semester students was extended to carry out the free virtual course PREIN-UTS, in order to level the mathematical pre-knowledge. The activities to be executed on the platform were the thematic axes of "Fundamentals of Algebra", which collect on a large scale the competences of the educational levels of basic and secondary education according to the curricular guidelines of the Ministry of National Education MEN.

2.2 Second Phase. Collection of performance reports in the PREIN course generated by the Khan-Academy platform. After the first implementation of the PREIN course, continuously in this stage it gets proceeded where reports were generated from the Khan-Academy platform regarding the thematic axes of the "Fundamentals of Algebra" course, composed of 104 skills.

2.3 Third Phase. Data analysis. The results obtained were analyzed considering the following study variables:

- Descriptive variables: gender, headquarters, academic program, faculty and group.
- Khan-Academy Variables: skills, activities and gamification.

The classification of the Skills variable was calculated using the qualitative scale: with difficulty, it needs practice, practiced, level 1, level 2 and dominated. While the variable Activity was assessed taking into perspective the total minutes, minutes of videos and skills minutes. Finally, as the evidence for the Gamification variable, the energy points and the won medals have been taken into account.

3. Results

In the second academic semester of 2018, the first implementation of the PREIN course was taking form properly alluding with the considerable participation of 801 students distributed as follows: 5.9% corresponding to students inscribed or admitted, but in fact not enrolled in the Institution, which are considered within the extension factor that the Institution contributes to society. 94.1% corresponding to students enrolled in the Institution and who attended the first academic semester in 2018-II, (see Figure 1).

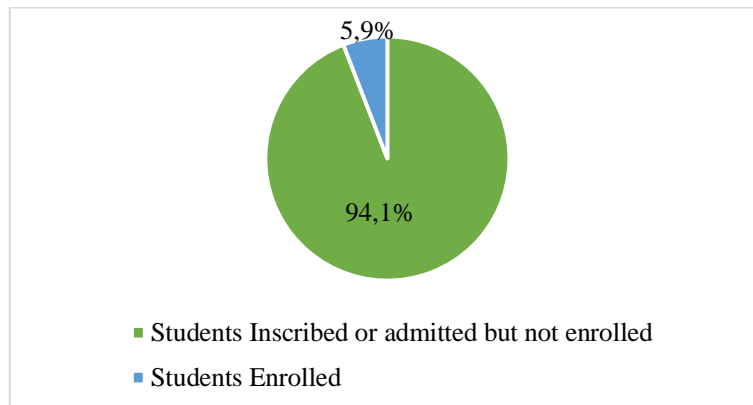


Figure 1. Sector graph of percentage distribution of students PREIN-2018-II according to their state

On the other side, 94.1% of the students enrolled in the PREIN2018-II course, equivalent to 754 students, obtained the following results: of the 1786 new students who entered the Institution to attend the first academic semester in 2018 -II, 42% completed the PREIN course. On the other hand, Figure 2 shows the percentage of students per headquarters, standing out a greater participation of students from the main campus. However, in spite of evidencing a minimum percentage of participation of the students of the regional headquarters, the accessibility of the course is highlighted since it made possible the decentralization of the institutional academic processes.

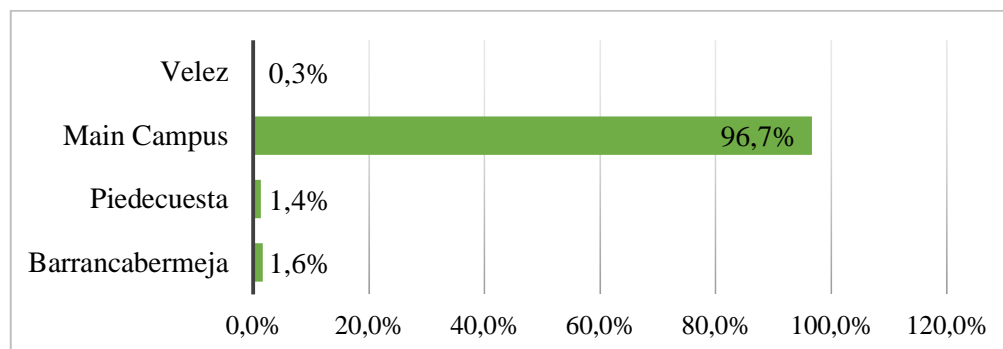


Figure 2. Bar graph of the percentage distribution of PREIN students by headquarter

Likewise, Figure 3 shows the percentage of participation of PREIN students by academic faculties, evidencing greater participation by students of the Faculty of Socioeconomic and Business Sciences with 61%.

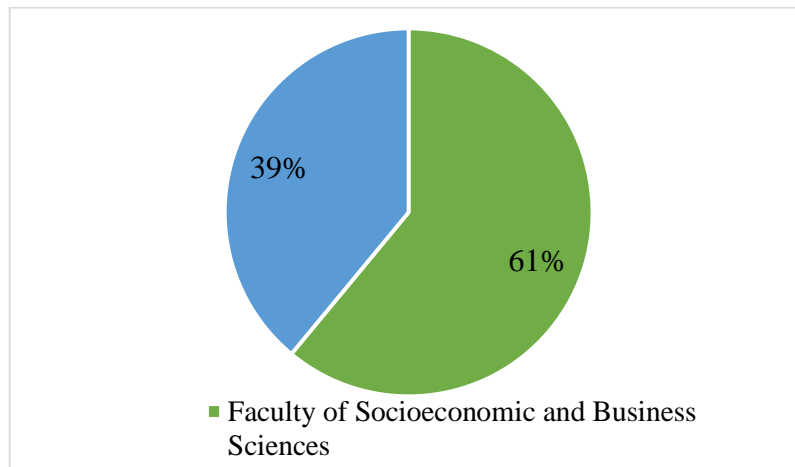


Figure 3. Sector graph of the percentage distribution of PREIN students by Faculties

Now looking at the participation of students by academic programs, Figure 4 shows that Technological program in Financial Accounting (N = 137), Technological program in Business Management (N = 104) and Technological program in Sports (N = 93), programs belonging to the Faculty of Socioeconomic and Business Sciences, they obtained a greater number of participants in the course.

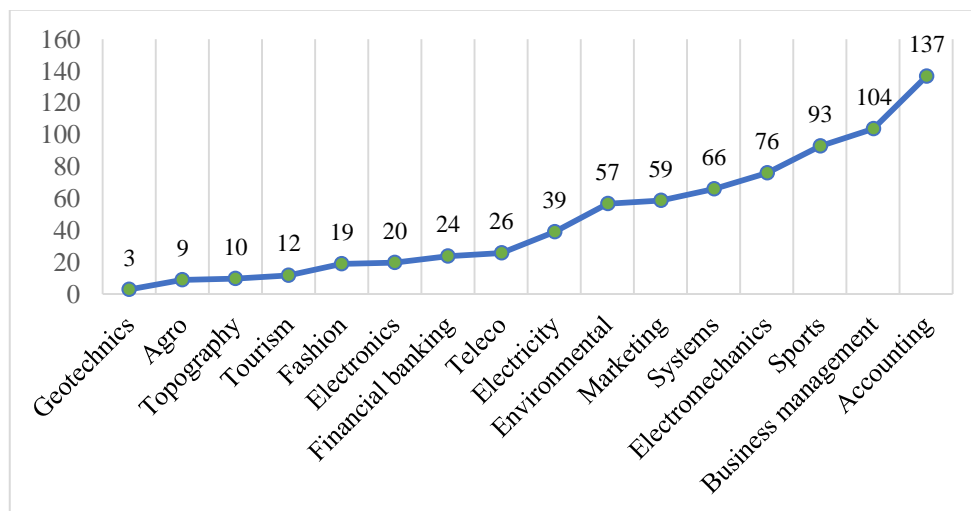


Figure 4. Line graph of the distribution of the number of PREIN students by academic programs

Regarding the time invested in the development of the PREIN course, it is evident that the students spent an average of 468.53 minutes on the platform, distributed as follows: 51.24 minutes watching video tutorials and 417.29 minutes to practice missions (see Figure 5). From the above, it is concluded that students prefer to spend time solving exercises than observing videos.

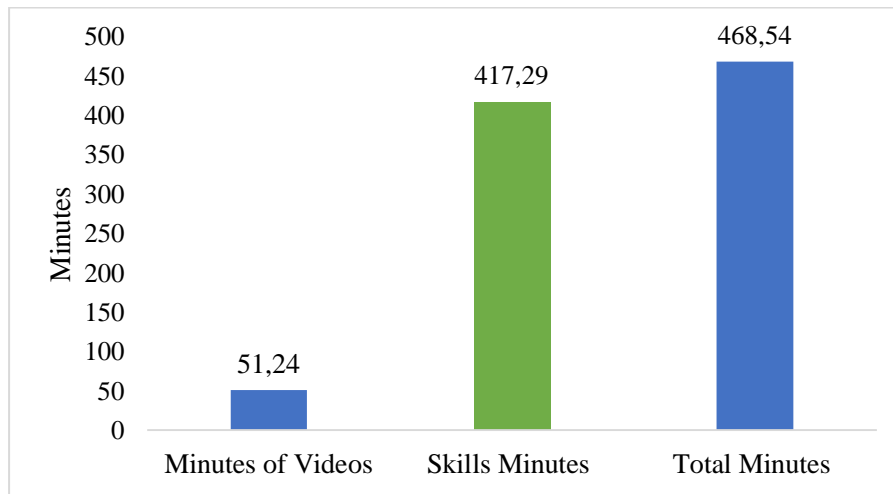


Figure 5. Histogram of the average time spent by students according to PREIN activities.

From referential point in the PREIN course of 104 skills measured in the qualitative scale: With difficulty, needs practice, practiced, level 1, level 2 and dominated, it is evident that 66.46% of students managed to position in the levels: practiced, level 1, level 2 and mastered more than 40 skills (see Figure 6).

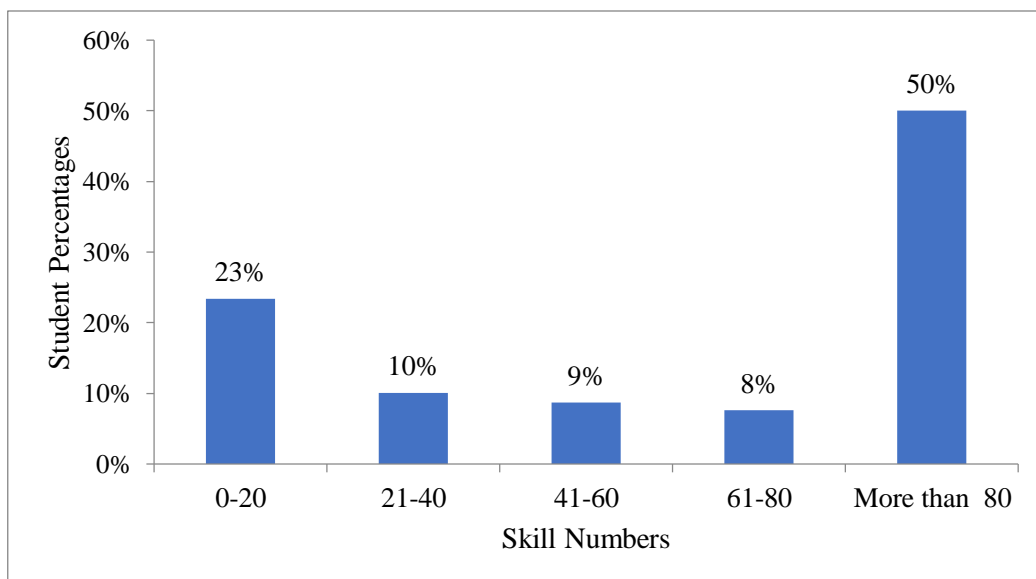


Figure 6. Percentage histogram of the number of skills: practiced, level 1, level 2 and mastered in the PREIN course.

Regarding the academic performance of the first cut in the subjects of the area of mathematics, the results show that the students who made the PREIN course obtained a higher percentage of approval of the subjects with 60%, compared to the students who did not Take the course, which obtained an approval percentage of 42%. In the same way, the average of the grades was higher for the students who took the PREIN course 3.26, unlike those who did not complete the course, which was 2.64. Finally, we will see that during the first academic cut none of the students who made the PREIN course defected from the subjects of the area of mathematics.

The technological tools may affect the math's learning, however, Khan- Academy has a ultimate adding value in referent to the others technological tools due by the fact that maintains the usage of an artificial learning system, the high quality training process that conform the different courses and the easily adaptability in different teachers methodology type, students variable and countries.

4. Conclusions

The primary fact that Khan-Academy is a free software makes the implementation of the PREIN-UTS course generate minimal costs to the institution contributing to the use of (ICT) in improving student learning in the area of mathematics and implementation of didactic and innovative strategies easily accessible in higher education. The PREIN-UTS course contributes to the promotion of educational quality by strengthening and ensuring the mathematical pre-knowledge of new students, thus helping to mitigate the decline and repetition in the first academic levels with respect to the subjects of the area of mathematics.

Accordingly to several studies made in Chile [12] we positively can conclude that the Khan-Academy Platform is an easy implementation system and can be really usefull to start the most profounds pedagogical proces in the students mathematical competences contributing to mitigate the academic challenges that The Colombian HEIs are facing.

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