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Análisis cuantitativo de las variables que influyen en el rendimiento universitario

Quantitative analysis of the variables which influence university performance

Análise quantitativa das variáveis que influenciam o desempenho universitário

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Resumen

Las tecnologías de la información y la comunicación (TIC) han sido una parte esencial en la educación, por lo que es importante determinar cuáles contribuyen a un mejor rendimiento académico. Por ende, el objetivo de esta investigación fue analizar el impacto de las TIC en el rendimiento académico (promedio de calificaciones) de estudiantes universitarios de una universidad pública mexicana. Para ello, se aplicó una encuesta semiestructurada a un grupo de 428 alumnos. En los resultados académicos se encontró que las variables *género femenino*, *beca* y *semestre* influyen de forma positiva en el aumento del promedio de calificaciones. De igual forma, en cuanto al uso de las TIC, se halló que el empleo de Google Académico, así como de blogs, herramientas para crear material multimedia (p. ej., Mindomo, NaikuDeck, Camtasia) y recursos sobre gestión de identidad y seguridad digital favorecen el rendimiento académico, especialmente NaikuDeck, la cual aumenta el promedio de calificaciones en 0.18 puntos.

Palabras clave: estudiantes universitarios, multimedia, rendimiento académico, TIC.

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Abstract

Information and Communication Technologies (ICT) have been an essential part of education, so it is important to determine which technologies help to achieve better academic performance; therefore, the objective of this research was to analyze the impact of academic and ICT factors on the Academic Performance (average grade) of university students, through a survey on the frequency of use of ICT. The research was conducted in a public university that has several academic programs. The investigation was exploratory, a cross-sectional study was used. This was carried out through the application of a semi-structured survey with general data and frequency of use of computer tools, to a sample of 428 students, from a population of 12 000 students, then with the data obtained, a model was estimated by the method of ordinary least squares. In the academic results it was found that the variables female gender, scholarship and semester positively influence the increase of the average of qualifications. Likewise, the results of ICT that favor academic performance were the use of academic google, the blog, tools to create multimedia material (Mindomo, NaikuDeck, Camtasia) and the tool on identity management and digital security. It is concluded that the ICT tool with the greatest impact is NaikuDeck, since it increases academic performance by 0.18 points.

Keywords: University students, Multimedia, Academic Performance, TIC.

Resumo

As tecnologias de informação e comunicação (TIC) têm sido uma parte essencial da educação, por isso é importante determinar quais contribuem para um melhor desempenho acadêmico. Portanto, o objetivo desta pesquisa foi analisar o impacto das TIC no desempenho acadêmico (nota média) de estudantes universitários de uma universidade pública mexicana. Para isso, uma pesquisa semiestruturada foi aplicada a um grupo de 428 alunos. Nos resultados acadêmicos, verificou-se que as variáveis gênero feminino, escolaridade e semestre influenciam positivamente no aumento da nota média. Da mesma forma, na utilização das TIC, verificou-se que o uso do Google Scholar, bem como blogs, ferramentas para a criação de multimídia de material (p. Ex., Mindomo, NaikuDeck, Camtasia) e recursos em gerenciamento de identidade e A segurança digital favorece

o desempenho acadêmico, especialmente o NaikuDeck, que aumenta a média de notas em 0,18 pontos.

Palavras-chave: estudantes universitários, multimídia, desempenho acadêmico, TIC.

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Introduction

The United Nations Organization for Forest Education, Science and Culture (Unesco) in the monitoring report on world education, states that one of the fundamental principles for providing quality education for all is found in the employment of the technologies (Unesco, 2016). This observation is consistent with what was stated in the National Development Plan of Mexico 2013-2018 (Presidency of the Republic, 2013), which indicates that in order to provide a quality education, new information and communication technologies must be incorporated (TIC) in the teaching and learning processes taking into consideration three essential lines of action: 1) To carry out and implement a Mexican policy or regulation of educational informatics aimed mainly at students to stimulate their abilities and their abilities to learn to learn by using and interaction of ICT, 2) carry out multiple donations of computer equipment and ensure connectivity in schools, and 3) introduce and encourage the use of ICT as an element of innovation in all educational levels of the country.

Now, although all the previous purposes are based on noble intentions, reality often shows that such objectives are not usually achieved in all their dimensions. For this reason, the objective of the present research was to determine how ICT and computer tools impact the performance (grade point average) of university students. For this, the following working hypothesis has been proposed: the use of Google Scholar, blogs, tools to create multimedia material (eg, Mindomo, NaikuDeck, Camtasia) and resources on identity management and digital security have a positive influence in academic performance.

Similarly, the research questions posed were: does the female gender help to achieve higher academic performance? Does having a scholarship help increase academic performance? Does the

student's semester help increase their academic performance? Which ICTs help increase academic performance?

ICT and academic performance

Currently, ICTs have had a significant impact in all spheres of human development and, especially, in the educational process due to the many didactic possibilities offered to work with students of any level and in any modality (face-to-face, blended learning and distance learning) (García Martínez , Guerrero Proenza and Granados Romero, 2015; Hernández and Jiménez, 2016).

These resources, however, require a series of changes, which include deep modifications in the most traditional paradigms, as well as transformations around the role and attitude of the teacher (García et al., 2015), who must teach the students the way in which ICT can be used to enhance their learning processes and, consequently, their academic performance (Borao and Palau, 2016). This has been evidenced in different investigations where the results have shown that ICT have served not only to help increase the levels of motivation, interest and commitment of students for the topics explained in class (Golbach, Mena, Rodriguez Areal, Abraham and Fernández, 2015), but also so that the qualifications of them increase considerably, in comparison with other students who are taught with traditional methods and resources.

An example of this is the work done with students from educational centers in Catalonia (Rosero, 2016), who were exposed to an experiment through the use of ICT. This investigation consisted in explaining the same contents to two groups of students (an experimental group consisting of 18 students and a control group made up of 9 students) using technological and traditional resources, respectively. The results of this work showed that the first group, unlike the second group, obtained better grades, which can be justified because they were the ones who felt more motivated to perform a greater number of exercises, tasks and review activities.

In fact, according to Prats and Ojando (2015), students obtain a high academic performance when they are taught with more dynamic activities and resources with which they are more familiar. For this reason, in other European countries (eg, Italy) some web pages that were created mainly as a source of entertainment have been used for educational purposes. This has happened, for

example, with portals such as Youtube, which, according to Manca and Ranieri (2016), is the most used in the Italian educational sphere (with 39%), followed by blogs and wikis (with 29%) . These technologies have allowed teachers to create, supervise and maintain online learning communities, which are based on multimedia environments to allow students to have the same information available in other Web sites available, but this once in audiovisual format (Calhoun and Green, 2015).

In Latin America, of course, this type of research has also been carried out. In this regard, we can mention the case of the Faculty of Industrial Engineering and Systems of the Universidad Privada del Norte (Lima, Peru), where the blog was used to present the contents of the subjects to students through texts that were accompanied by images, audios and videos (Cubas, 2016). This strengthened the students' understanding, which resulted in a considerable increase in their grades. The reason for this lies in the fact that introducing other stimuli (eg, images) in the teaching-learning process creates the possibility of activating cognitive skills that in many cases are often marginalized. In fact, using multimedia content stimulates the curiosity, imagination and expressive communication of the student, which favors it in its dynamism (Marrero Pérez, Santana Machado, Águila Rivalta and Pérez de León, 2016).

These explanations serve as support to encourage teachers to use technological resources to support their pedagogical practices, although it should be noted that these by themselves can not solve educational problems if they are not applied with well-structured planning (Santiago Benítez, Caballero Álvarez, Gómez Mayén, and Domínguez Cuevas, 2013). Likewise, it should be foreseen that the amount of these could be overwhelming, hence the following section describes some of the most used.

ICT tools in the classroom

An ideal tool to be used in the classroom is Mindomo, since it serves for the multimedia creation of mental maps. This techno-pedagogical instrument favors the ability to represent data in a conceptualized way and stimulates retention and visual perception, which facilitates understanding (Blayone, van Oostveen, Mykhailenko and Barber, 2017, Fernández-Márquez, Vázquez-Cano and López-Meneses , 2016). Mindomo also allows students to communicate and

work online, which is ideal to encourage collaborative work and the exchange of information on a specific topic (Delić-Zimić and Gadžo, 2017).

Camtasia, on the other hand, is an effective tool for most students because it provides a visual and flexible aspect for learning through the use of video clips that can then be entered into different computer programs, such as Prezzi (Fitzgerald and Li, 2015) or Power Point (Hajhashemi and Caltabiano, 2018). For teachers, likewise, this resource can be very useful, since it serves to produce and edit educational videos that can then be published on a group website or on YouTube (Gómez, 2014; Romney, 2016). In this way, teachers can assign to the home the revision of a certain topic, so that most of the time in the class is devoted to answering questions or doing exercises (Baharum et al., 2017; Roshan, 2015).

Another useful resource in these times is social networks (eg, Facebook, Twitter and LinkedIn), since the students are very familiar with them (O'Connell and Dyment, 2016, Prieto, 2016, Prieto-Velasco and Fuentes-Luque, 2016). These can be used to exchange information or to generate debates around a specific topic (Banda-Sierra, Reinoso and Reichardt, 2015). Even, according to a study by Kim and Yoo (2016), these offer several benefits, among which the following can be mentioned: 1) information acquisition and communication, 2) efficiency in work, and 3) relationship building. However, some disadvantages that underlie the use of these should also be taken into account, for example: 1) insecurity, 2) desertion from the study, and 3) negative emotion.

Materials and methods

The present investigation was exploratory and transversal, and was carried out in 2016 at a public university in Mexico City to determine the impact that the use of technological tools had on the academic performance of higher education students. The sample consisted of 428 students from a population of 12,000 students. The following were taken as independent variables: frequency of use of ICT, gender, scholarship, semester and failed subjects (figure 1). Likewise, in table 1 a description of the variables used in the model is made. The instrument and the proposed model are described in the following sections.

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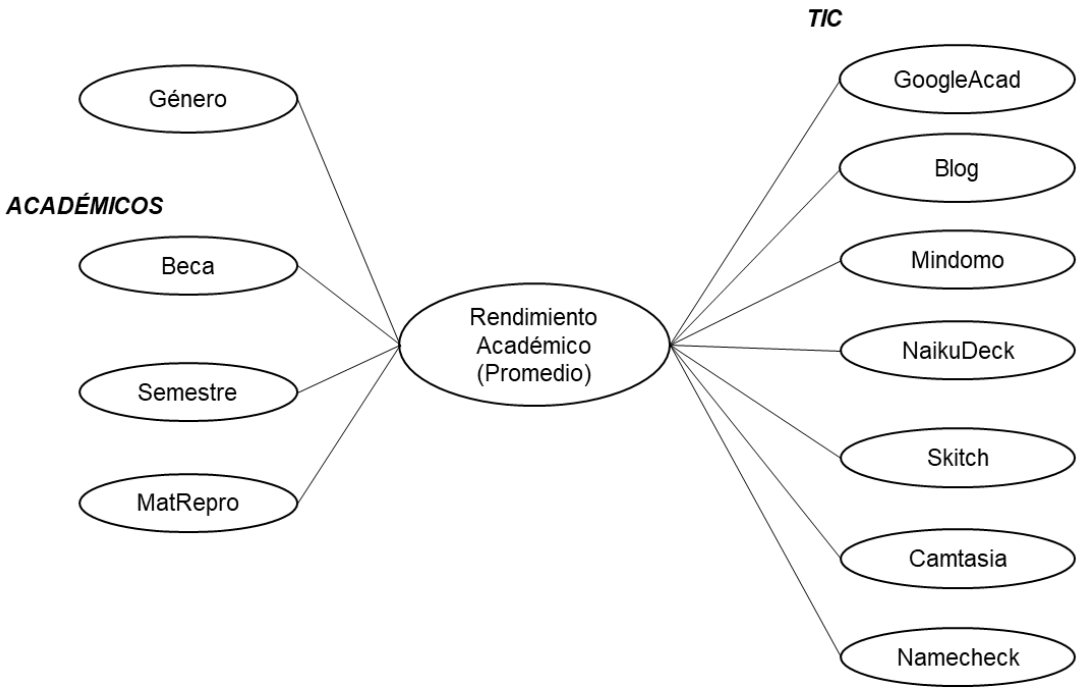
Figura 1. Variables del modelo (se incluyen variables TIC y variables de aspectos académicos)



Fuente: Elaboración propia

Instrument

A semi-structured survey was applied that included questions related to the academic variables considered (ie, scholarship, semester in which he was enrolled and failed subjects) and with the use of ICT (that is, they were asked about some pages or programs). computer scientists, such as Google Scholar, blogs, Mindomo, NaikuDeck, Skitch, Cantasia and Namecheck).

Respondents were asked to indicate how often they used ICT tools for academic activities, that is, between 0 and 7 days a week. Regarding the reliability of the instrument, it was very good, since a Cronbach's alpha of 0.864 was obtained for the total questionnaire, while for each of the questions it was obtained between 0.86 and 0.89. This means that there is an internal consistency between all the elements.

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Model

With the variables that correlated with academic performance, a model was developed, which was estimated using the ordinary minimum method with the MCO procedure of SAS software (SAS InsituteInc, 2002) (version 9.0). The model was generated by multiple linear regression. The analysis was based on the use of a statistic called p-value, which corresponds to the probability of accepting the null hypothesis, compared to the level of significance α (α = 0.01 was used). Next, the work is specified under the function indicated in equation 1.

(1)

$$Rendimiento\ Académico = f(Genero, Beca, Semestre, MatRepro, GoogleAcad, Blog, Mindomo, NaikuDeck, \text{Skitch}, \text{Camtasia}, \text{Nam}$$

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Tabla 1. Explicación de las variables del modelo

Variable	Descripción	Tipo y relación
Rendimiento académico (Y)	Rendimiento académico de los alumnos o promedio de las calificaciones generales.	Dependiente: Variable principal
Género	Género de los participantes: 1 = femenino; 0 = masculino.	Independientes: Se relacionan con la variable *rendimiento académico* por vincularse de forma directa en el promedio de las calificaciones.
Beca	Variable dicotómica: 1 = beca; 0 = sin beca.	
Semestre	Número de semestre en el que se encuentran inscritos los alumnos participantes.	
MatRepro	Cantidad de materias reprobadas por los alumnos.	
GoogleAcad	Frecuencia de uso del Google Académico (medida en días a la semana).	Independientes: Se relacionan con la variable *rendimiento académico* por ser parte de la tecnología, basado en el uso de las TIC para una educación de calidad.
Blog	Frecuencia de uso al consultar blogs (medida en días a la semana).	
Mindomo	Frecuencia de uso de la herramienta de creación multimedia de mapas mentales Mindomo (medida en días a la semana).	
NaikuD	Frecuencia de uso de la herramienta de creación multimedia NaikuDeck (medida en días a la semana).	
Skitch	Frecuencia de uso de la herramienta de edición de imágenes Skitch (medida en días a la semana).	
Camtasia	Frecuencia de uso de la herramienta de creación multimedia o reproductor de videos Camtasia (medida en días a la semana).	
Namecheck	Frecuencia de uso de la herramienta sobre gestión de identidad y seguridad digital.	

Fuente: Elaboración propia

In equation 2 we present the theoretical model proposed to analyze the academic performance and the technological tools already mentioned.

(2)

$$Y = \beta_0 + \beta_1 Género + \beta_2 Beca + \beta_3 Semestre + \beta_4 MatRepro + \beta_5 GoogleAcad + \beta_6 Blog + \beta_7 Mindomo + \beta_8 NaikuD + \beta_9 Skitch + \beta_{10} Camtasia + \beta_{11} Namecheck + u_1$$

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Results

The estimates of the estimation by the ordinary least squares method of the multiple linear regression model are those shown in table 2.

Tabla 2. Estimación de los parámetros de regresión

Parámetro	Coeficiente de estimación	Desv. Típica	Estadístico *t*	*valor p*	
Const	7.5423	0.0808	93.2308	< 0.00001	***
Género	0.0906	0.0528	1.7157	0.08696	*
Beca	0.4680	0.0544	8.6014	< 0.00001	***
Semestre	0.04068	0.0130	3.1092	0.00201	***
MatRepro	-0.2320	0.0206	-11.2624	< 0.00001	***
GoogleAcad	0.0261	0.0128	2.0344	0.04254	**
Blog	0.0290	0.0142	2.0392	0.04206	**
Mindomo	0.1143	0.0381	2.9958	0.0029	***
NaikuDeck	0.1895	0.0503	3.7644	0.00019	***
Skitch	0.0673	0.0290	2.3202	0.02081	**
Camtasia	0.0484	0.0202	2.397	0.01697	**
Namecheck	0.0889	0.0350	2.5385	0.0115	**
R^2 : 43.88 % Ra^2: 42.40 %; error estándar de la estimación: 117.47;					
F: 29.47 < 0.0001					

Fuente: Elaboración propia

The theoretical model proposed in equation 2, where the general specification is established to estimate the regression parameters to calculate the intercept and the independent variables (as shown in the values -p in table 2), allows to establish the estimation of the model , as defined in equation 3:

(3)

$$\boldsymbol{Y} = 7.5423 + 0.0906Género + 0.4680Beca + 0.04068Semestre - 0.2320MatRepro + 0.0261GoogleAcad + 0.0290Blog + 0.1143Mindomo + 0.1895NaikuDeck + 0.0673Skitch + 0.0484Camtasia + 0.0889Namecheck$$

The test of F indicates that the model works properly and rejects the null hypothesis, with a reliability level of 0.0001, that the coefficients of the model have a value of zero.

Since p-values are less than 0.01, the null hypothesis is rejected and it is concluded that there is statistical evidence that academic performance increases when there is a change in some independent variable, keeping others constant. For example, the yield rises by 0.09 points when the participants are female, by 0.46 points when they have a scholarship and by 0.04 points when they go to another semester.

It also happens with the frequency of use of ICT. For example, the use of Google Scholar increases academic performance by 0.02 points, while multimedia tools (Mindomo, NaikuDeck, Camtasia) increase it by 0.11, 0.18 and 0.04 points, respectively. Likewise, the image editing tool Skitch increases it by 0.06 points, while the use of the Namecheck tool on identity management and digital security increases it by 0.08 points.

Finally, the variable failing subjects negatively affects the academic performance of students. In addition, values t greater or closer to the value 2 ensure that the regression coefficients obtained in the model that influence academic performance statistically contribute to the explanation of the model in an appropriate way.

Discussion

The use of ICT facilitates the teaching-learning process (Delić-Zimić and Gadžo, 2017; Rosero, 2016), fosters an attitude of autonomy and motivation in participants and helps develop their cognitive abilities (Blayone et al., 2017 Golbach et al., 2015; Hajhashemi and Caltabiano, 2018; Marrero et al., 2016). In fact, and taking as support the results of this work, it can be affirmed that the use of ICT improves the academic performance of the students, especially with the use of computer tools, which are very useful for the training of students. professionals (Venkatesh et al., 2016).

However, it should also be noted that these should be implemented in a manner planned by the decent, who should educate students about the opportunities they offer. In this way, a quality and inclusive education can be achieved, which also serves to reduce the rates of educational lag.

In the near future, therefore, it will be absolutely necessary to encourage the learning process of people through the use of ICT.

On the other hand, it is worth mentioning that tools such as Mindomo are not usually used in Mexico (Carrasco, Sánchez and Carro, 2015), although several researchers have pointed out that this favors retention skills (Calhoun and Green, 2015; Fernández et al., 2016; Cubas, 2016).

Regarding the limitations of this research, finally, it can be mentioned that an application could have been designed to measure the exact amount of access of the participants to the web pages and programs taken as independent variables. Likewise, other variables that have a direct correlation with academic performance should have been included.

Conclusions

From the results taught in this paper it can be concluded that variables such as semester and scholarship help to increase the academic performance of students, which also happens when using different web pages or informant programs, such as Google Scholar, Mindomo, Camtasia, Skitch or Namecheck. In fact, it should be noted that the ICT tool that most helps the academic performance of students is NaikuDeck, specifically, at 0.18 points.

On the other hand, it can be indicated that these results suggest that future research could monitor the impact that ICTs have on students, although this time to establish educational policies that boost the quality of teaching, which will surely impact the Significant form in the formation of more competitive students and better prepared to enter the labor field.

Finally, it should be emphasized that these technologies require certain digital skills from teachers, as well as a pedagogical approach that adjusts to the innovations that these resources demand (Valbuena, Ortiz and Agudelo, 2015). Otherwise, all the effort and time spent could yield unfavorable results. In short, in order to implement ICT in the school environment, it must be ensured that both the teaching and administrative staff and students have knowledge about the use of these tools to implement them in the best way possible. (Badilla y Sandoval, 2016).

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