

MEASUREMENT OF TECHNOLOGICAL FACTORS IN THE TEACHING-LEARNING PROCESS AT THE HIGHER EDUCATION LEVEL WITH THE USE OF SIX SIGMA

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Abstract -- This research is part of the teaching-learning process in the technological environment, which seeks to make it more efficient through six sigma, in order to know the impact of the use of ICT in the teaching-learning process at the higher level through six sigma. Seeking to achieve a quality equal to or better than the traditional face-to-face teaching. The information and communication technologies (ICT) seek a place in learning in a productive and high quality way, to favor a whole educational environment and give the optimal use that offers today the information and communication technologies (ICT) to all cybernauts, to adapt to a globalized environment to favor the teaching-learning process.

Keywords: ICT, students, teachers, quality.

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teaching-learning process at a higher level through six sigma. Seeking to achieve a quality equal to or better than the traditional one, such as on-site. Information and communication technologies (ICT) seek a place in learning in a productive and high-quality way, to favor an entire educational environment and give the optimal use that information and communication technologies (ICT) offer today.) to all netizens, to adapt to a globalized environment to favor the teaching-learning process.

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INTRODUCTION

It argues, as a general objective, that the current purpose of education includes preparing students to manage the challenges of sustainable development as an alternative to the current conception of development as growth of gross domestic product (GDP) [1].

But it is also important to mention that six sigma is a quality management tool that provides companies with the necessary tools to improve the capacity of their processes and standardize them [2].

That is why it is considered that students can enhance their academic and personal productivity. Remembering that quality is part of the actions of each individual.

DEVELOPMENT

Currently, unproductive episodes are seen high school students, which is caused by the lack of control over the use of ICTs, although adolescence is a risk group due to the use they make of new information and communication technologies (ICTs). The aim of the present study was to determine the patterns of use and to classify this use into non-problematic use and use with occasional problems [3].

Target

To understand the technological factors in the teaching-learning at the higher education level through six sigma.

Specific objectives

- To identify the factors inherent in the use of ICTs by students and teachers at the upper secondary level.
- Analyze the behavior of students and teachers in relation to ICTs.
- To understand the impact of the use of ICTs in the academic environment.

Advantages:

- Constant innovation.
- Self-taught learning.
- Paper is reduced.
- Productivity.
- Skills development.

Disadvantages:

- Distractions.
- Disorders associated a the new technologies.
- Codependence to ICT.
- Little interaction with humans.

In the so-called information, knowledge and/or communication society, the forms of social interaction between subjects of different generations are mediated by the use and consumption of information technology, particularly the Internet, and by the repeated validation of the incorporation of technologies into everyday life. New technologies are a new language that begins to mark differences between those who have access to the code of technology and artifacts, and those who begin to be relegated and excluded from these new forms of construction of meaning, which is called the digital divide [4].

Currently, society is facing several adversities which may limit the teaching-learning process, such as the misuse of ICT or the lack of updating.

Currently the inherent factors of ICT in young people are as follows:

- Internet use.
- Use of social networks.
- Use of some technological equipment.

It is important to mention that the behavior of the aforementioned factors is the lack of concentration to perform other activities such as academic ones, causing low performance and productivity in them.

In the case of teachers, they are still working with the traditionalist system of the old school and although it is usually good, it is necessary to get involved in this technological era to adapt to an environment that demands it, although dynamism fosters interest in students and generates a harmonious environment.

Table 1. Use of ICT.

Población	Total		Banda ancha		Banda estrecha		Otros	
	Absolutos	Por ciento	Absolutos	Por ciento	Absolutos	Por ciento	Absolutos	Por ciento
Nacional	20 131 852	100.0	20 070 846	99.7	2 726	0.0	77 673	0.4
Urbano	18 320 220	100.0	18 271 728	99.7	2 726	0.0	48 216	0.3
Rural	1 811 632	100.0	1 799 118	99.3	0	0.0	29 457	1.6
Nota: La suma de los porcentajes puede no corresponder con el 100% debido al redondeo. Cifras preliminares. Cifras correspondientes al mes de julio. Fuente: INEGI. Encuesta Nacional sobre Disponibilidad y Uso de TIC en Hogares, ENDUTIH 2019.								

Source: INEGI (2012).

Today society is facing a virus better known as COVID 19. It has made all activities of a society change.

Academically speaking, it has struggled to satisfy the educational service in every possible way, but it is also true that it is still not sufficiently prepared and deficiencies have been emerging, which for many are areas of opportunity.

Thus, this new society has placed much of trust in technological development, linked to communication and information.

The emergence of information and communication technologies (ICT) has had an impact on the functions of the education system and allowed innovation in the transmission of new knowledge. Educational institutions, possessors and distributors of knowledge, are no longer the only sources of knowledge. Much knowledge that used to be the exclusive patrimony of schools can now be found in different places.

ICTs are providing students with access to unlimited sources of knowledge, multimedia tools that allow them to expand their knowledge, and the ability to

information literacy. ICT has undoubtedly transformed the learning environment.

The current situation has changed from a traditional teacher-centered one to a student-centered one, since the former has ceased to be the main source of information and the main transmitter of knowledge to become a guide or driver of learning, and the student has gone from being a passive recipient of information to an element that actively participates in his or her own learning [5].

Statistically, the population that mostly uses ICTs (INEGI, 2011) are adolescents between 12 and 24 years of age and, at the same time, they are the generations that, on average, consume more symbolic goods produced National Institute of Statistics and Geography [6].

While INEGI (2012) mentions households that have Internet in rural urban areas, according to means of connection in 2019 [7].

It is important to mention that the figures presented are at the national level.

As already mentioned, we assume that the introduction of technology in education has implied adjustments to the role played by the actors in this process.

Indicators on availability and use of ICTs.

Indicadores sobre Disponibilidad y Uso de TIC	2015	2016	2017	2018	2019
Hogares con computadora como proporción del total de hogares	44.9	45.6	45.4	44.9	44.3
Hogares con conexión a Internet como proporción del total de hogares	39.2	47.0	50.9	52.9	56.4
Hogares con televisión como proporción del total de hogares	93.5	93.1	93.2	92.9	92.5
Hogares con televisión de paga como proporción del total de hogares	43.7	52.1	49.5	47.3	45.9
Usuarios de computadora como proporción de la población de seis años o más de edad	51.3	47.0	45.3	45.0	43.0
Usuarios de Internet como proporción de la población de seis años o más de edad	57.4	59.5	63.9	65.8	70.1
Usuarios de computadora que la usan como herramienta de apoyo escolar como proporción del total de usuarios de computadora	51.3	52.2	46.8	46.7	44.6
Usuarios de Internet que han realizado transacciones vía Internet como proporción del total de usuarios de Internet	12.8	14.7	20.4	23.7	27.2
Usuarios de Internet que acceden desde fuera del hogar como proporción del total de usuarios de Internet	29.1	20.5	16.7	13.4	10.7
Usuarios de teléfono celular como proporción de la población de seis años o más de edad	71.5	73.6	72.2	73.5	75.1

Source: INEGI (2012).

This is due to the dynamism with which technology is inserted into the teaching-learning processes and which requires students to develop the skills that will allow them to move into a future full of uncertainties.

The learner, unlike his role in traditional education, is now fully active, an autonomous agent, responsible for his own learning process and able to plan and be active during the learning process [8].

Young people of the new generations grew up with a technology that has defined them by their familiarity and confidence in ICTs. Echenique [9] refers to them as young people who have grown up in a digital world and expect to use these tools for their advanced learning environments, as part of their daily lives, their hobbies and their form of interaction; they surround themselves with the use of video games, music players, cameras, instant messaging and multimedia, which has given them the possibility of developing skills around information processing [9].

Availability and use of ICTs

Although it is well known that, although ICTs have been booming in recent years and have come to revolutionize all processes in the whole environment, it has been seen that the knowledge of ICTs in education is very deficient. It has been seen at the academic level that the knowledge of ICT in education is very deficient. On the other hand, it is known that young people have become masters with the use of technology, however, it is true to mention that in productive matters they lack knowledge of technology for their training. This implies that students have gaps that limit their training, existing a codependence with the teacher, it is very evident that in this contingency it can be difficult for them to adapt, it is also evident that as a teacher we lack the influence of the use of ICT.

Information and Communication Technologies (ICT) have been entering the and today they are a reality, although on many occasions they are not well used due to the lack of knowledge about their didactic possibilities. The school must be able to offer a response tailored to the needs of the students.

students who come to the classroom today, digital natives, who find in these tools a higher level of motivation. However, the integration of ICT in the classroom requires teachers trained in the technical use of technologies, but, above all, in their pedagogical use [10].

Information and communication technologies (ICT) represent a step towards the creation of new forms of communication, since they are dynamic synchronous and asynchronous tools that facilitate the emission, access and processing of information. The incorporation of these technologies in teaching leads to a new modality of the teaching-learning process.

In this sense, the University of Guadalajara has proposed the incorporation of new educational technologies and to this end initiated a process of investment-modernization in ICT, in order to shape the institution towards a new culture of quality and increase academic competitiveness.

To this end, it has modified its nature and work in planning, academic organization and evaluation processes, with the purpose of adapting to the challenges brought about by the current knowledge society, where ICTs are now keeping pace with the continuous scientific advances in a framework of economic and cultural globalization [11].

The integration of ICT in the teaching-learning process is not easy and requires a period of sensitization in which teachers are motivated by the experiences of others.

Then, it is necessary to involve the teacher in technological training courses so that he/she knows and uses each of the ICT tools and incorporates them into his/her learning activities. It should be clear that these tools are only a support for teaching practice and applying them consciously can be reflected in higher educational quality [12].

The incorporation of technologies in education is a call made by society and arises from the growing need for the use of information.

Some outstanding characteristics of ICTs are thus established, which allow them to be selected as a means of instruction and sometimes even as ideal environment for the development of the educational act, depending on the type of technology used.

Finally, reference is made to the advantages and limitations that they present, where the ultimate goal of any means, strategy or environment must respond to the formation of individuals with the necessary competencies for life, for work and for the world; based on communicative skills, increasing the active, critical and reflective participation of the subject [13].



Figure 1. Inverted Classroom in Distance Education

METHODOLOGY

For this purpose, the DMAIC methodology will be applied, a methodology developed by Motorola at the beginning of the 90's. The first letter "D" was

added by General Electric, which comprises a structured 5-step strategy of general applications [14].

- D -- Define
- M -- Measure
- A -- Analyze
- M -- Improve
- C -- Control

Client:

- Students.

Prerequisite:

- To offer a solid teaching-learning .

Table 3: DMAIC methodology.

Etapas	Objetivos	Herramientas
Definir	Identificar aspectos claves de la organización, definir clientes, sus requisitos y los procesos claves que pueden afectar a los clientes, es decir identificar posibles proyectos de mejora.	Diagrama Pareto, diagrama de flujo de proceso, histograma, oz del cliente, lluvia de ideas, árbol crítico de la calidad, entre otras.
Medir	Identificar las causas claves del problema para la recogida de datos en el proceso objeto de estudio.	Diagrama entrada-proceso-salida, análisis de capacidad de proceso, gráfico Pareto, gráficos de control.
Analizar	Analizar los datos (procesarlos) recogidos, para determinar cuáles son las causas del mal funcionamiento de los procesos.	Diagrama de causa efecto, matriz de relación, correlación y regresión, análisis de varianza, muestreo.
Mejorar	Generar posibles soluciones al problema detectado e implementar las más convenientes.	Técnicas analíticas, pruebas piloto
Controlar	Establecer un plan de controles que garanticen que la mejora alcanzará el nivel deseado.	Planes de control, gráficos de control, capacidad de proceso.

Source: Garza, González, & Rodríguez, Hernández (2016).

Step: 1 Define:

Activities that may affect students.

Objective: To determine the impact of the use of ICT in high school students through six sigmas.

Poor scheduling of activities, no internet, no equipment or the platform has technical failures.

Specific objectives:

- * To identify the factors inherent in the use of ICTs by students and teachers at the upper secondary level.
- * To analyze the behavior of students and teachers in relation to ICTs.
- * To understand the impact of the use of ICTs in the academic environment.

Step 2 Measure

This step seeks to identify the causes and effects of the teaching process with the use of ICT, presented throughout these 10 weeks.

Of the main outstanding causes during the teaching-learning process in the technological environment are the following:

- There is no internet access.

- They do not have equipment.
- There is no solid platform.

Figure 1 shows the result found after performing the aforementioned analysis.



Figure: 2 causes and possible effects of the impact of ICT on the teaching-learning process.

Source: own elaboration (2020).

In Step 3: Analyze

For this purpose, our variables are analyzed as failures and opportunities considered during the teaching-learning process.

Failures and opportunities during the teaching-learning process.

Table 5. Failures and opportunities of the teaching-learning in education.

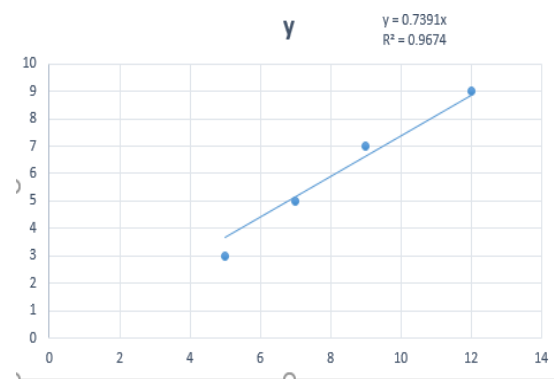
Faults	Opportunities
x	y
7	5
12	9
9	7
5	3

Source; own elaboration (2020).

In order to verify the relationship between the variables mentioned, a correlation study was carried out. Microsoft Excel 2016 software was used for this purpose, in order to facilitate the study. It is shown

Linear correlation

r: 0.99437671



Graph 1. Linear correlation.

Source: own elaboration (2020).

Step: 4 Improve:

Generate possible solutions to the detected problem and implement the most convenient ones.

However, and regarding the causes of a teaching-learning process, it is necessary to first have internet, computer or mobile equipment, a virtual platform and a program for the subject.

Factors involved in the teaching-learning process in the technological environment.

Description	Faults/ deficiencies	Opportunities
Internet	7 failures	5
Team	12 failures	9
Platform/ virtual	9 failures	7
Programming	5 failures	3
Total	33	24

Source: Own elaboration (2020).

On average, a teacher works 4 hours per day, that is, 20 hours per week. Taking into account 10 weeks after the weeks of classroom work, due to the contingency, with an accumulated total of 200 hours per week.

Once the working hours were defined, defects per million opportunity (DPMO) were calculated.

of hrs processed: 200.
of total failures: 33.
opportunities: 24:

DPO: defect per million opportunity. D: Defects.
O: Opportunities.
N: Number of hrs processed.

$$DPO = \frac{D}{N \cdot O} = \frac{33}{200 \cdot 24} = .006875$$

$$DPMO = .006875 \cdot 1000,000 = 208.33$$

Once the measurement table was shown, we looked for the DPMO, which is 9800, and we took the closest value, obtaining a 3.8 defects per million, i.e., failures during the process of

teaching-learning in the technological environment with a performance of 98.9%.

CONCLUSIONS

Thanks to the use of ICTs in the teaching-learning process, productivity is increased and self-taught learning is promoted, in addition to favoring the environment and taking advantage of the use of ICTs, a prosperous and quality virtual environment is generated, and after everything relevant to COVID-19, it should be taken as an area of opportunity to update teachers.

RECOMMENDATIONS

Once the sigma level and performance is known, it is important to standardize the teaching-learning process, which should only have 3.8 failures before, during and after, as this indicates a level of virtual educational quality, and is part of a philosophy and culture that shapes an entire educational system.

It is important to choose a good platform that is accessible to both the students and the teacher in order to achieve efficiency.

Likewise, technological tools are fundamental since they complement the entire environment, such as the use of Meet, Zoom, YouTube, Facebook, WhatsApp, etc.

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