

Student satisfaction about the online teaching of the Engineering in Business Management program of the Technological Institute of Toluca

Satisfacción Estudiantil sobre la enseñanza en línea del programa académico de Ingeniería en Gestión Empresarial del Instituto Tecnológico de Toluca

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Abstract

In the year 2020, educational institutions worldwide found it necessary to modify the way of teaching in response to the recommendations of health agencies to maintain social distancing to reduce the circulation of SAR-COV 2 and the development of COVID 19. The traditional way of teaching in which a classroom was attended in person, became staying at home and connecting to an electronic device that allowed the transmission of classes online. Given this new modality, this research aims to collect information through a student satisfaction survey of the academic program of Engineering in Business Management at the Technological Institute of Toluca of online classes during the semester of August-December 2020, period in which it was in pandemic. The variables to be considered were: Teaching, Academic Organization and Infrastructure and University Services. It is concluded from the results obtained that the students are satisfied with the performance of the teacher, however, there are also areas of opportunity in the management of digital platforms, as well as in the feedback and the time that is assigned to carry out conduct assessments online.

Student satisfaction, Teaching, Online education

Resumen

En el año 2020 las instituciones educativas a nivel mundial se vieron en la necesidad de modificar la forma de enseñanza ante las recomendaciones de los organismos de la salud por mantener un distanciamiento Social para reducir la circulación del SAR-COV 2 y el desarrollo de COVID 19. La forma de enseñanza tradicional en la cual se asistía a un aula de manera presencial se convirtió en permanecer en casa y conectarse a un dispositivo electrónico que permitiera la transmisión de clases en línea. Ante esta nueva modalidad, la presente investigación pretende recabar información mediante una encuesta de satisfacción estudiantil del programa académico de Ingeniería en Gestión Empresarial en el Instituto Tecnológico de Toluca de las clases en línea durante el semestre de Agosto-Diciembre 2020 periodo en el cual se estuvo en pandemia. Las variables por considerar fueron: la Enseñanza, Organización Académica e Infraestructura y Servicios Universitarios. Se concluye a partir de los resultados obtenidos, que los estudiantes se encuentran satisfechos con el desempeño del profesor, sin embargo, también existen áreas de oportunidad en el manejo de las plataformas digitales, así como en la retroalimentación y el tiempo que se asigna para llevar a cabo las evaluaciones en línea.

Satisfacción estudiantil, Enseñanza, Educación en línea

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Introduction

The Instituto Tecnológico de Toluca (ITTOL) is a higher education institution belonging to the Tecnológico Nacional de México (TECNM) that during the year 2020, like other educational institutions, was forced to implement the online education modality, due to the health contingency caused by the worldwide pandemic caused by the SAR-COV2 virus, in which the isolation of the population was the main way to combat it. Teaching strategies changed drastically, in the institutions, virtual classrooms were created by means of devices that allowed classes to be held synchronously as a way of substituting the classrooms in the school where students attended to attend their classes. The ITTOL has 9 educational programmes in the area of engineering, including the academic programme of Engineering in Business Management with an enrolment of 478 in the January-June semester and 557 in the August-December 2020 semester, according to the records of the Instituto Tecnológico de Toluca.

In the first section we consider the reference framework that shows the main aspects of the evolution of education until online education and its virtual environment are defined. The objective of the present research is to know the student satisfaction of the academic programme of Engineering in Business Management of ITTOL in relation to online education, which was presented in the year 2020 taking into account the following variables to measure it: Teaching, Academic Organisation and Infrastructure and University Services. The Teaching variable considers aspects where it is sought that the actions carried out by the teacher contribute to the assimilation of new knowledge, it groups aspects of methodology, mastery of the subject and evaluation techniques applied by the teacher; The variable of Academic Organisation brings together aspects of ease of communication with teachers, organisation of time, and the variable of infrastructure and university services, for the online modality that was studied, the technical resources to attend online classes were considered to be the computer and the internet, on the other hand, the infrastructure considered the conditions of the physical space such as lighting, ventilation and privacy.

In order to know the student satisfaction it was necessary to apply surveys to a representative sample of students of the academic programme of Engineering in Business Management of the Institution, whose procedure is shown in detail in the methodology.

The analysis of the results is shown graphically, which allows us to better identify the behaviour of the indicators of the variables. We end with the conclusions in which the values obtained in the survey are highlighted.

Frame of Reference

Human beings are constantly evolving, proof of which is their ability to adapt to the new conditions prevailing in the environment. Since the confinement by the Covid-19 pandemic, new scenarios have been generated where learning has been developed in virtual environments, according to (Aguilar Vargas & Otuyemi Rondero, 2020) the concept of "virtual environments" is associated with software or a computer application, space or medium in the network that facilitates communication. Their characteristics are collaboration, interactivity, flexibility, standardisation and scalability. They further conclude that there are different ways of defining "virtual learning environments" and, based on the results of their study and literature reviewed, they are presented as spaces, software or computer applications that are equipped with didactic materials and technological resources, where communication and interaction are essential, as they are intended to be as close as possible to a real space, a classroom in which face-to-face communication is handled, thus functioning in collaboration with pedagogical and learning processes.

(Abreu, 2020) points out that online education is conceptualised as electronically supported learning, which relies on the Internet for teacher/student interaction and the distribution of class materials. From this simple definition emerges an almost infinite number of ways of teaching and learning outside traditional classrooms and away from university campuses. With online education, students can participate in a virtual classroom from anywhere with Internet access and electricity.

It can include audio, video, text, animations, virtual training environments and chats with teachers. It is a rich learning environment, with much more flexibility than a traditional classroom. In the institution where the present work was carried out, online teaching was adopted to continue with the educational process, in this type of teaching students and teachers interact in their class schedules through the Teams platform, this Microsoft tool is an online communication and collaboration platform, It is a product focused on organising work groups in an efficient way, it is very useful because among the main functions it is possible to develop the topics with screen projection or share the blackboard where everyone can participate and solve doubts in real time, the communication is through video and active microphones, the students can expose in teams and interact with their classmates.

Regarding the term online teaching (Abreu, Art. Cit.), many active members of the academic community have been hotly debating the terminology on social media, and "emergency remote teaching" has emerged as a common alternative term used by online education researchers and academics to establish a clear contrast with what many know as quality online education. Some readers may disagree with the use of the term "teaching" over options such as "learning" or "instruction". Rather than discuss all the details of those concepts, "teaching" was selected because of its simple definitions: "the act, practice or profession of a teacher" and "the concerted exchange of knowledge and experience", along with the fact that the first tasks performed during emergency shifts in delivery mode are those of a teacher/instructor/lecturer.

Covid-19 in education

The educational environment was affected by Covid-19, the change in the modality of traditional education where teachers and students converge in a classroom was abrupt, in the last week of March 2020, the indication was received that due to the health emergency, non-essential activities were suspended, education being one of them, classes would continue remotely - indefinitely - establishing a traffic light system by regions and clarifying that educational activities could be resumed until the traffic light was green.

For the follow-up of procedures and services, guards were set up among administrative and education support staff. Higher education institutions were forced to move to remote education. They did so at very different times, depending on the capacity of each one, or of each sub-system, to carry out the technological migration. The differences were significant: non-formal education was able to continue without interruption, as were some private universities. In general, universities and technological institutes interrupted classes for periods ranging from one to four months. All of them faced, to varying degrees, the difficulty of access to technology and the internet for their students.

Some of them facilitated students' access to electronic devices, mostly tablets or laptops. Many had to struggle with the lack of experience in the use of technology by teachers and students, and in all cases, with the lack of teacher training for distance education, which was also solved by each institution or sub-system according to its possibilities. There were no additional resources from the government for public higher education in this emergency, so institutions had to use their previously approved budgets to migrate to distance education (Schmelkes, 2020).

The lack of technological equipment and poor internet access at home becomes a major problem for students as they become indispensable tools to ensure the continuity of their studies, in addition to the preparation for the use of digital platforms, in this sense and with respect to digital (Lloyd, 2020) mentions that Mexico is quite bad off. In 2016, the country ranked 87th in the world and 8th in Latin America in access to ICTs, behind Uruguay, Argentina, Chile, Costa Rica, Brazil, Colombia and Venezuela, in that order, according to indicators from the International Telecommunications Union (ITU), based in Switzerland.

Mexico's position is worrying, and if we add to this scenario the economic inequality of the regions in our own country, the situation is becoming increasingly difficult. The present study measures student satisfaction in a public higher education institution.

With regard to the technological gaps at this academic level (Lloyd, Art. Cit.), he mentions that there are strong differences between the higher education subsystems: between the most established private universities, federal public universities and state universities, on the one hand, and the technological institutes and universities, teacher training colleges and recently created state universities, on the other. The case of the 11 intercultural universities (UI), which are part of the latter group, is particularly worrying.

These institutions, which serve indigenous students and members of other historically marginalised groups, have had to find creative solutions to continue the education of their students, many of whom do not have internet or computers at home. Even before the pandemic, UIs faced difficulties with ICT use, due to students' limited prior knowledge and the scarcity of available computers, according to an analysis by the Coordinación General de Educación Intercultural y Bilingüe (CGEIB), the federal body that coordinates the intercultural university subsystem.

(Schmelkes, Art. Cit) points out that in order to understand the magnitude of the immediate and long-term impact of the pandemic on higher education, it is necessary to take into account the confluence of three factors: 1) the economic problems derived from the decrease in productive and commercial activity during the pandemic and the consequent unemployment or loss of sources of income; 2) the enormous digital divide that goes hand in hand with socio-economic inequality and is superimposed on it; and 3) the difficulty for higher education institutions to face the educational crisis derived from the pandemic.

The actors in the teaching-learning process during the health contingency have had to adapt at a dizzying pace. In this sense (Gordón, 2020) carried out an essay whose objective was to reflect on the implications of the transition from learning in face-to-face scenarios to virtual learning in times of pandemic, concluding that there are students with special educational needs in which the learning process is incomplete due to inadequate curricular adaptation by teachers, who in turn have difficulty adapting to virtual reality.

From the above it can be concluded that the teaching-learning process has been an arduous path for both the teacher and the student, and this virtual learning process continues to be a challenge for the educational community.

In his article (Ordorika, 2020) he concludes that it will be necessary to establish a new agenda of transformations for Higher Education Institutions (HEIs) in general and for each one of them based on their particularities, a deep reflection on teaching-learning processes, pedagogical models and the use of technologies will be necessary. It also mentions that the COVID-19 pandemic has profoundly affected the institutions, actors and processes that take place in higher education. As in other spaces and activities in society, there have been effects and changes whose duration and transcendence are difficult to foresee. It seems appropriate, however, to move beyond a first stage of forced reactions, inevitably hasty and accelerated, to give way to careful reflections on the future of higher education.

Student satisfaction in online learning

(Álvarez Botello, Chaparro Salinas, & Reyes Pérez, 2017) consider that student satisfaction is determined by various factors that affect their university education, among these factors are the quality of the teachers and their teaching for the academic, professional and human training of the student, the services provided by the Institution, the Infrastructure that the University has, the student's own self-realisation and other factors that will ensure that the student's expectations and needs are met in the best way possible.

According to the case of customer satisfaction in an educational services institution presented by (Calderón Ríos, Zenteno Bonola, López Arista, Aguirre Brito, & Ordoñez Hernández, 2017), the main strengths detected in the higher education institution are: The recognition by students of the quality of teaching, mainly due to the preparation and updating of the teaching staff, as well as respect for the form of evaluation given by the professors; the sports facilities are adequate, as well as the security of the facilities.

It also mentions that the Administrative Services variable was the best evaluated by students, both in terms of school services and in the re-enrolment and credentialing process. The areas of opportunity are present in practically all areas, since on average acceptance is less than 50%, the most worrying being the evaluation system in Mechatronics Engineering, as well as the computer centres where this degree course is provided.

The objective of the research carried out by (Talaveras Pichardo, Paz López, Silvestre, Montes Miranda, & Figueroa Gutiérrez, 2021) was to determine student satisfaction with the virtual modality and to find out the technical conditions for accessing virtual classes. Within the category of student satisfaction, the following factors were taken into account: teaching practices, students, communications and interactions, and finally, technical conditions and support for connectivity. Within the category of technical conditions of access to virtual classes, the following factors were studied: platforms, internet access, devices used.

The results obtained in the category of student satisfaction indicate that, in the factor of pedagogical practices, the variable that the students valued most positively was the accompaniment and monitoring carried out by the teachers. This result highlights the value of the teacher in educational processes, especially in contingency situations, their humanity, attention and guidance generates security and confidence in the student, on the other hand, students point out the excessive load of activities and materials as a factor that negatively affects their satisfaction, which could cause disinterest, stress and demotivation. It is advisable to think about the essentials and isolate the ancillary. An important task for universities is to train teachers in the definition of resources and activities that facilitate the development of the expected learning, giving priority to student autonomy.

He also mentions as a result of his article, that students show dissatisfaction with the communication spaces that are generated among them, and something that the authors suggest is that educational systems consider the social nature of learning, as insisted upon in the approaches of modern pedagogy.

Physical isolation in education should not represent distance in human relations, but rather the resources employed by educational institutions should facilitate this type of interaction.

In terms of the Connectivity category, three important variables are highlighted that deserve to be discussed: the inefficient institutional response when technical problems are reported, the prevalence of the use of mobile phones in their studies, and the limitations of the internet service they are using. What is impossible to deny is that there was no preparation for the "new normal"; that it has been necessary to prepare classes on previously unknown platforms, training for both students and teachers and access to the internet, as well as technological resources that may not have been available, however, the virtual classes were carried out, the present work refers to the student satisfaction of the degree in Business Management Engineering at the Instituto Tecnológico de Toluca, with respect to online teaching, according to (Mejías & Martínez, 2009) the customers are the students and their satisfaction is related to the way in which the educational institution meets their needs, expectations and interests; Thus, Student Satisfaction is defined as the level of mood that students have with respect to their institution, as a result of the perception they have with respect to the fulfilment of their needs, expectations and requirements.

(Chamizo González, Blázquez Resino, Gutiérrez Broncano, & Cano Montero, 2013), argue that, in order to know the effectiveness of internal university quality systems, it is necessary to identify the variables that students value most and, from these, establish relevant indicators in the quality of university life according to their perception, and thus allow us to identify the elements that significantly influence student satisfaction with respect to three aspects: resources and facilities, teaching aspects and social aspects. Thus, the results obtained show that both academic and social aspects are influential dimensions in student satisfaction. Teaching and academic reputation are considered to be the most influential academic variables.

In their study to develop an instrument to measure student satisfaction (Mejías & Martínez, Art. Cit.), they propose four conceptual dimensions of student satisfaction in higher education, the first one refers to teaching which is related to methodology, techniques and evaluation given by the teaching staff, the second one to academic organisation, the third one is related to university life as the participation of the school in expansion activities, skills and physical abilities and the last dimension refers to infrastructure and services.

Theoretical dimensions and indicators of student satisfaction variable		
Teaching	Methodology, techniques and evaluation provided by teaching staff	Preparation, updating and pedagogical conditions of teachers. Evaluation system used Teaching methodology Incorporation of new technologies in teaching
Academic Organisation	Student satisfaction with regard to the knowledge and attention shown. Hearing the administrative and teaching staff and their abilities to inspire credibility and trust, as well as the willingness and readiness to help the student and provide the service.	The content of the programmes The organisation of time Ease of communication with teachers Ease of communication with administrative staff Tutorial action Practical training and the link with future workplaces
University Life	School participation in physical expansion, skills and abilities activities	Access to a variety of cultural and recreational events. Formation of personal skills and traits
University Infrastructure and Services	Appearance of physical facilities, communication equipment and materials, and with the operation of student services.	Habitability of facilities Adequate teaching and study spaces Adequate sports facilities good library service Adequate functioning of cafeterias Adequate functioning of computer facilities Equal opportunities for participation in activities Safety and security of facilities Adequate attention in the enrolment and registration processes.

Figure 1 Theoretical dimensions and indicators of the student satisfaction variable

Source: (Mejías & Martínez, Art. Cit.)

Object of study

The Instituto Tecnológico de Toluca (ITToluca), is part of the 248 sister technological institutes and 6 Development and Research Centres (254) that make up the Tecnológico Nacional de México (TecNM), which were created to provide an educational offer linked to the needs of the productive sectors of the regions, at national and international level and with coverage throughout the country's territory, in its 32 federal entities, which under a vision of the development of Mexican engineering, contribute to the training of 41% of Mexico's engineers.

In the particular case of ITToluca, as part of the 126 federal technological institutes, it provides higher education services in the most populated state in the country, the State of Mexico, which, located in Metepec, is part of the Toluca Valley, where the most important industrial development poles of the Mexican territory and the capital of the state are located.

With 46 years of academic life, this institute currently offers 9 undergraduate programmes and 3 postgraduate programmes, and has delivered thousands of graduates to society, who in addition to raising the quality of life for their families, have been drivers of industrial development in the Toluca Valley and even beyond its borders; its high academic level has given great prestige to ITToluca, considered by various productive sectors and society, as the most important engineering school in the State of Mexico.

In order to continue with its positioning and to be a reference of technological higher education in the local, national and international sphere, institutional planning is fundamental, which allows to outline the most appropriate lines of action for the efficient and effective construction of the institution to meet the challenges that the nation and the world demand. (Instituto Tecnológico de Toluca, n.d.).

The academic programme of Engineering in Business Management (IGE) is part of the degree programmes offered by the ITToluca, its objective is to train professionals who contribute to business management and process innovation.

As well as to the design, implementation and development of strategic business systems, optimising resources in a global environment, with ethics and social responsibility.

The competences that GSE graduates have, among others, are: Management and engineering skills in the design, management, strengthening and innovation of organisations for effective decision-making, with a systemic and sustainable orientation; Applies quantitative and qualitative methods in the analysis and interpretation of data and systems modelling in organisational processes, for continuous improvement in accordance with world-class standards; Designs and undertakes new businesses and sustainable business projects in competitive markets, to promote development; Interprets financial information to detect opportunities for improvement and investment in a global world, to promote business profitability.

Uses new information and communication technologies in the organisation to optimise processes and effective decision-making; Promotes the development of human capital to achieve organisational objectives, within an ethical framework and a multicultural context; Applies research methods to develop and innovate models, systems, processes and products in the different dimensions of the organisation; Manages the supply chain to develop and innovate models, systems, processes and products in the different dimensions of the organisation. Manages the supply chain of organisations with a process-oriented approach to increase productivity; Etc. (Instituto Tecnológico de Toluca, n.d.).

According to the definition of the Royal Spanish Academy, student refers to "The one who studies" as an adjective, and "Person who studies in an educational establishment". As the object of study of the present work, it will be understood that the student is the person who has a relationship with ITToluca as an educational institution, where their correspondence is limited within the academic environment, in which ITToluca is committed to the student to achieve the following educational objectives, among others:

To promote the integral and harmonious development of the student in relation to others, to himself and to his environment, through an intellectual formation that trains him in the handling of methods and languages, sustained in the principles of national identity, justice, democracy, independence, sovereignty and solidarity; and in recreation, sport and culture that allows him a healthy mind and body.

To offer professional profiles that integrate the specific regional needs so that the graduate contributes satisfactorily to the development of the community, especially the productive plant.

These objectives are aligned with the institution's mission to offer quality, equitable and pertinent Higher Technological Education services, oriented towards the integral formation of the human being by offering accredited educational programmes that promote sustainable development for the creation of a just and humane society.

Problem Statement

Due to the change in the teaching-learning process from a face-to-face form to a scenario where classes are online using the Teams platform, it is extremely important to know how the sessions have been developed, the support given by the teachers, the fulfilment of the academic programmes and their evaluation, as well as the technical resources available to the students, Therefore, the objective of this work is to know the degree of satisfaction of the students about the online teaching of the academic programme of Engineering in Business Management of the Instituto Tecnológico de Toluca. Based on the results obtained, it will be possible to implement actions oriented to increase student satisfaction. For the present study, student satisfaction is understood as "The perception that students have of the degree to which their needs and expectations have been fulfilled. According to (Calderon Rios, Aguirre Brito, Zenteno Bonola, & Ordoñez Hernández, 2019), one of the consequences of student dissatisfaction is dropping out of school, understood as the voluntary departure of students before completing their studies because the educational institution failed to meet one or more of the needs established by them.

They also conclude that the results obtained highlight the areas that require immediate attention from the client's (students') perception, and that this information constitutes the basis for developing strategies for continuous improvement.

It is clear that the teaching-learning processes in the virtual modality are in constant evolution, which implies that both teachers and students are in a position to use the available resources, which are being innovated day by day to promote learning and ensure student satisfaction, which means that it is necessary to start from a solid and sustained basis of those variables that increase satisfaction and those that need to be taken into account for their adaptation.

Methodology

The type of research approached was descriptive research, as it seeks to systematically refer to the characteristics of a population, situation or area of interest; in this case, the characteristics that influence student satisfaction.

With respect to the determination of student satisfaction with the online teaching of the Business Management Engineering programme at the Instituto Tecnológico de Toluca, in the present work the conceptual dimensions Teaching, Academic Organisation and University Infrastructure and Services proposed by (Mejías & Martínez, Art. Cit.) will be taken up again in order to develop the variables that allow us to conclude the degree of student satisfaction.

It is important to clarify that the dimension University life is not taken into account, as this refers to the institution's participation in expansion activities, skills and physical abilities, which have not been implemented in online education; as for university infrastructure and services, we will study those aspects related to the resources that students have at their disposal to take classes, as well as the habitability and lighting of the study spaces.

The variables analysed are opinion variables, as the focus is on the level of satisfaction that students have with online teaching. The evaluation instrument is a questionnaire consisting of 12 questions.

A 5-level Likert scale was used, the levels used being: very satisfied, slightly satisfied, indifferent, slightly dissatisfied and very dissatisfied. The questionnaire was designed and subsequently tested; the questionnaire was applied to a small group of students, and the measuring instrument was validated as there were no observations. Given the circumstances of the health contingency, it was decided to apply surveys virtually through the Teams platform, the enrolment data by programme for the June-December 2020 semester was 557 students, this figure was taken from Table 19 "Enrolment by gender at undergraduate level Semester August-December 2021 and 2020" of the Accountability Report 2021, published on the official website of the Instituto Tecnológico y del (Instituto Tecnológico de Toluca, n.d.).

Determination of the sample

Since the student population is known, the formula was used to determine the sample size of a finite population (Münch G. & Ángeles E. 1995)

$$n = \frac{z^2 pq * N}{e^2(n-1) + z^2 pq} \quad (1)$$

Where:

z= confidence level

n= sample size

p= probability at factor

q= probability against

N= population or universe

e= estimation error (precision in the results)

A confidence level of 95% with a margin of error of 5% will be used, then the formula will be as follows:

$$N = 557$$

$$Z = 95\% .95 - 1 = 1.96$$

$$e = 0.05$$

$$p = 0.5$$

$$q = 0.5$$

$$n = \frac{557 * 1.96^2 * 0.5 * 0.5}{0.5^2(557-1) + 1.96^2 * 0.5 * 0.5}$$

$$\text{Result} = 176$$

Thus the sample will be 176 students currently studying for a degree in business management engineering.

Collection of information

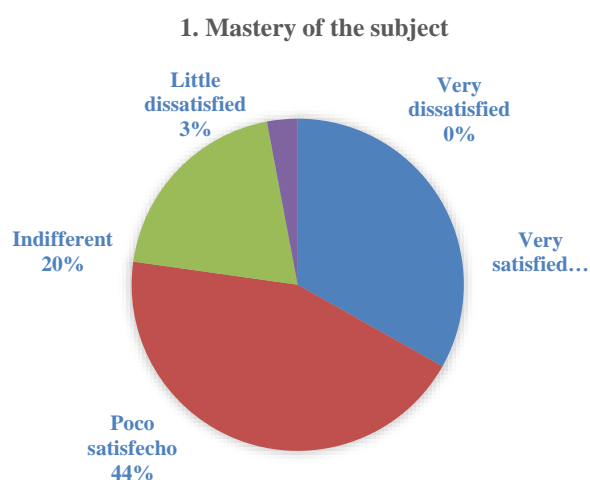
The direct survey technique was used, for which a questionnaire was designed consisting of a set of structured questions regarding the variables to be measured (Hernández, Fernández, & Baptista, 2010). The questionnaires were applied through the Teams platform, obtaining 202 responses to the instrument sent, it is important to mention that, although the result of the sample is 176 elements for a confidence level of 95%, there was a greater participation of the student community.

Results

The graphs presented in this section describe the behaviour of the variables of: Teaching, Academic Organisation and Infrastructure and University Services that are considered most relevant in student satisfaction for this research of the students of the ITTOL Business Management Engineering degree course.

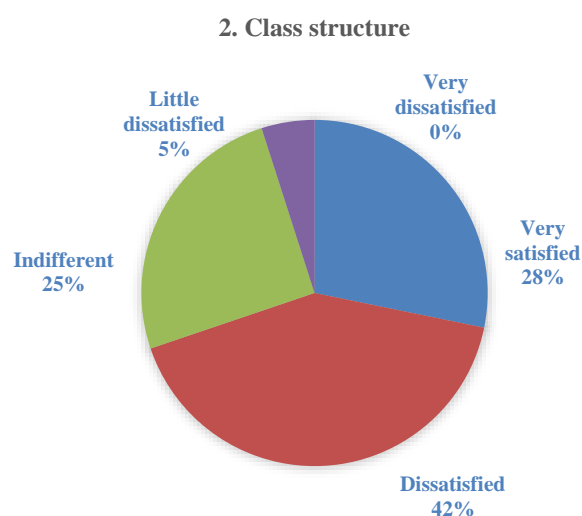
These results are the product of the information obtained through the direct survey.

With regard to the Teaching variable, which seeks to ensure that the actions carried out by the teacher contribute to the assimilation of new knowledge, it groups together aspects of methodology, mastery of the subject and evaluation techniques applied by the teacher, with the following results being obtained:



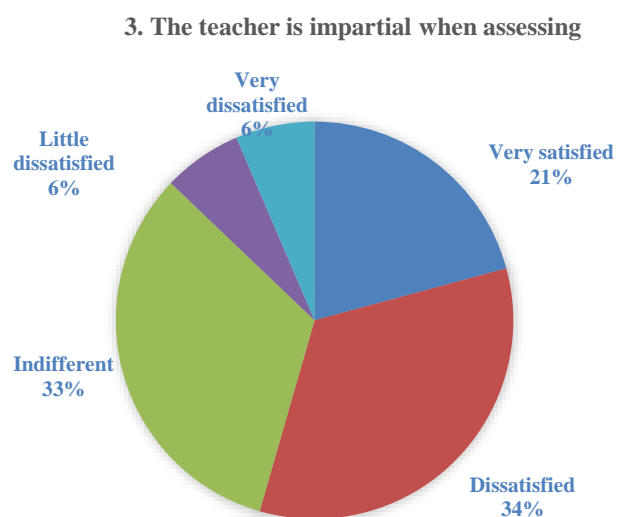
Graph 1 Subject Mastery
Source: Own Elaboration

Graph 1 indicates the students' appreciation of the teacher's mastery of the subject, as can be seen, a high percentage of students, represented by 77%, were satisfied, of which 44% are not very satisfied and 33% very satisfied, which shows that teachers at the institution are prepared in the subject they teach.



Graph 2. Class structure (Introduction, Development, Conclusion)
Source: Own Elaboration

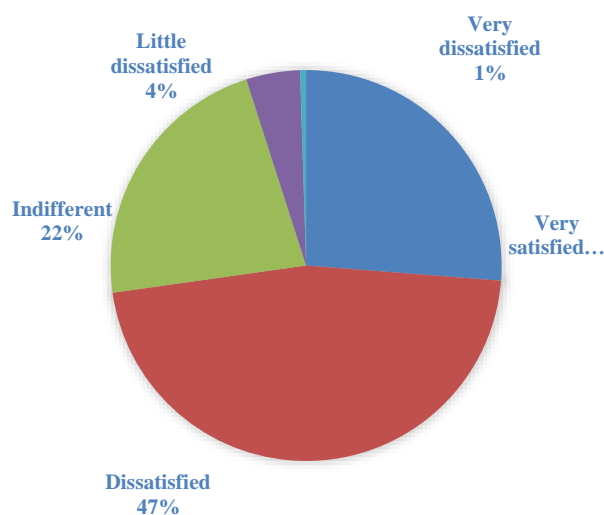
Graph 2 shows that the teacher structures his lessons with an introduction, development and conclusion, 42% were not very satisfied and 28% were very satisfied with the structure of his lessons. On the other hand, a minority of 5% were not very dissatisfied with the structure of their lessons.



Graph 3 Impartiality at the time of assessment by the teacher
Source: Own Elaboration

Teacher impartiality is very important in teaching, as it represents fairness among young students when they are assessed. Figure 3 shows the student perception of teacher impartiality when assessing, where 54% of the students are not very satisfied and 54% are very satisfied. It should be noted that 33% were indifferent.

4. Mastery of the platform by the teacher

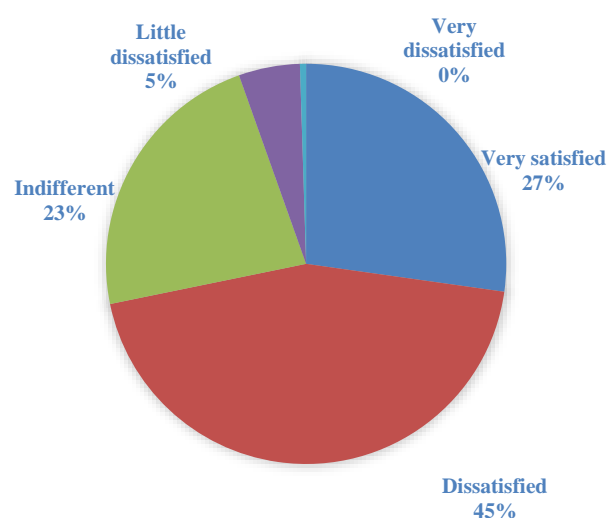


Graph 4 Mastery of the platform by the teacher

Source: Own Elaboration

In graph 4 concerning the mastery of the platform, in this case the Teams tool was used, 73% of the students recognise mastery of the platform by choosing the two most satisfactory options. It is important to mention that the above results reflect the intensive courses that the teachers received to prepare them to respond to the online modality.

5. E-learning tools and materials

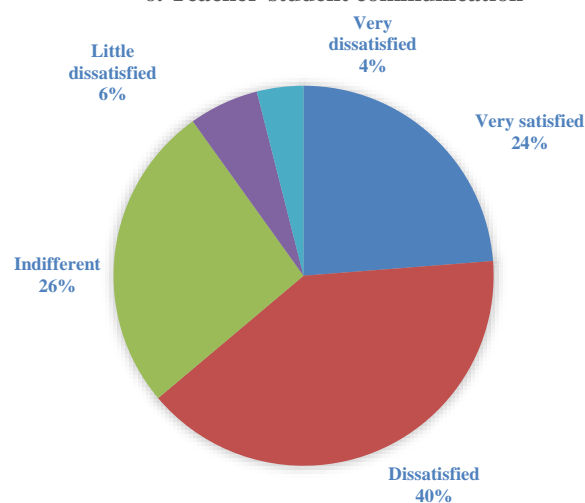


Graph 5 Learning tolos

Source: Own Elaboration

In order to identify the use of virtual learning tools and materials such as platforms, videos, chats, etc., students were asked about the use of these by the teacher, 72% were slightly dissatisfied and very satisfied with the use of these in the teaching-learning process. The variable of Academic Organisation concentrates on aspects of ease of communication with teachers, organisation of time, and in this respect the following questions were considered:

6. Teacher-student communication

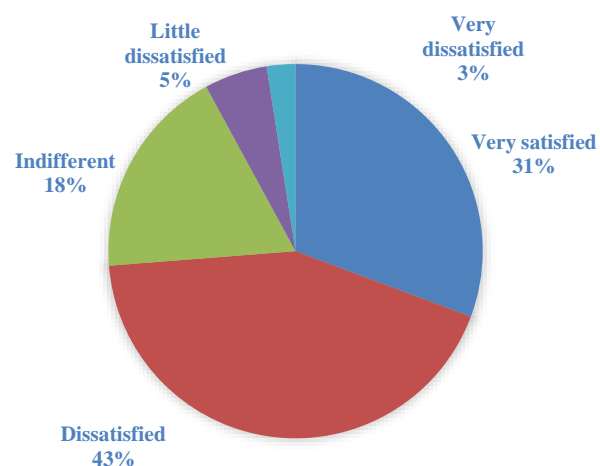


Graph 6 Teacher-student communication through the platform

Source: Own Elaboration

In graph 6, regarding teacher-student communication through the platform, 40% of the students consider it not very satisfactory and 24% very satisfactory, however, it is important to highlight that 26% of the students are indifferent, which represents an area of opportunity.

7. Resolution of doubts

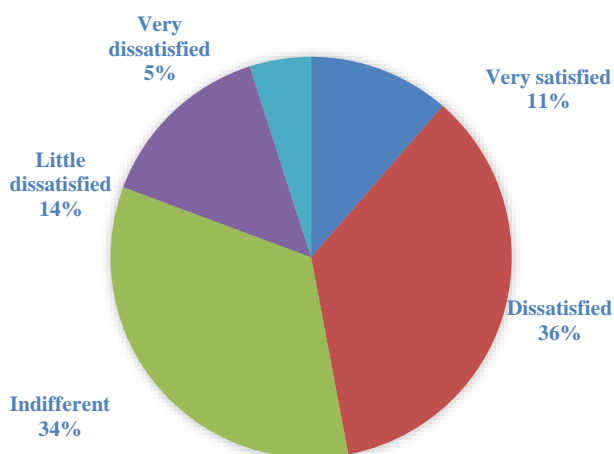


Graph 7 Resolution of doubts presented by the students

Source: Own Elaboration

With regard to the resolution of doubts, 74% of the students who responded to the survey perceived that teacher-student communication in the virtual environment was satisfactorily answered by the teachers, as shown in graph 7; however, 8% were dissatisfied with the communication obtained from the teachers.

8. Time allocated to online evaluation

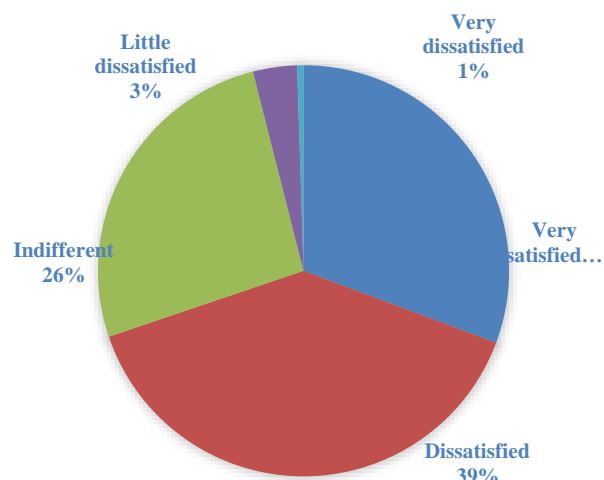


Graph 8 Time allocated to online evaluation
Source: Own Elaboration

Graph 8 shows information about the time allocated for the assessment; out of the 202 students 72 students are satisfied, it is important to highlight that 68 students were indifferent to the question, which represents 34% of the surveyed population. 19% do not agree with the time allocated to online assessment.

In the variable of infrastructure and university services, for the online modality that was studied, the technical resources to attend the online classes were considered to be the computer and the internet, on the other hand, the infrastructure was considered to be the conditions of the physical space such as lighting, ventilation and privacy that each student creates at home.

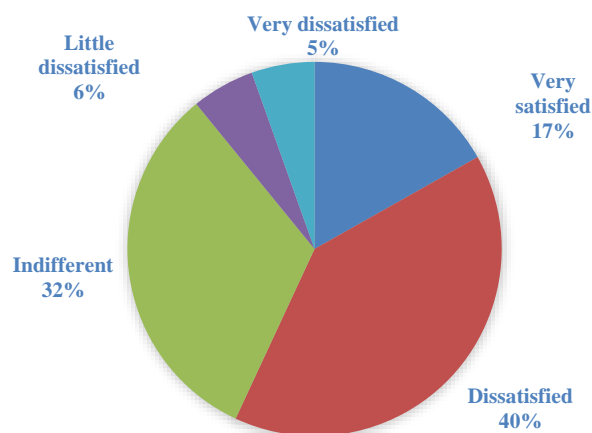
9. Technical resources for online classes



Graph 9 Technical resources such as computer and internet to attend online classes
Source: Own Elaboration

It is very important to consider that without the technical resources the students could not have attended the online classes, for this reason in graph 9 shows that 70% of the students were satisfied and very satisfied with the necessary resources to take their classes online, and for 26% they are indifferent to the means used to attend the online classes.

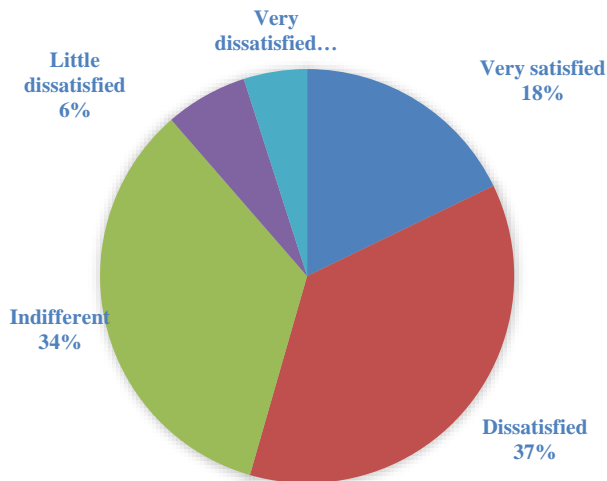
10. Lighting in the study area



Graph 10 Lighting in the study area
Source: Own Elaboration

Graph 10 represents the students' appreciation of the lighting in the study area, most of them were satisfied with the lighting in their study area and those who were not satisfied with improving it because it is directly related to their performance, only 11% showed little satisfaction with it.

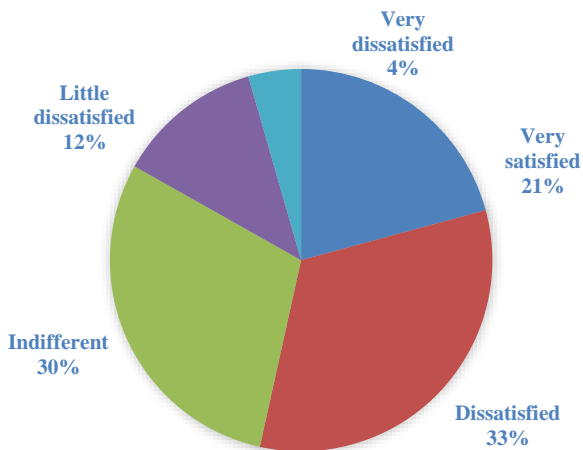
11. Ventilación en la zona de estudio



Graph 11 Ventilation of the study área
Source: Own Elaboration

Graph 11 shows how they evaluate the ventilation, they were asked how they considered this element in their space and 6% of the students were not very dissatisfied and 5% were very dissatisfied with the ventilation in their study area, 89% answered that they were satisfied.

12. Privacy you have in your study area



Graph 12 Privacy in the study área
Source: Own Elaboration

In graph 12, compared to the results of the previous questions, the privacy they have in their study area presents a lower percentage than the one represented in this question, around 17% of the 34 students feel little dissatisfied and very dissatisfied with the privacy they had in their study area, and it is understandable since they take classes in spaces they share with their family or in environments where they cannot have complete control over the environment where they took the classes.

Analysis of the results

The objective of this research was to determine student satisfaction in the online modality during the August-December 2020 semester of the Business Management Engineering academic programme at the Instituto Tecnológico de Toluca, with an enrolment of 557 students.

To measure the above, indicators were used in the behaviour of the variables of: Teaching, Academic Organisation and Infrastructure and University Services that are considered most relevant in student satisfaction and by means of the structured survey technique according to the Likert scale with the following levels: very satisfied; slightly satisfied; indifferent, slightly dissatisfied and very dissatisfied. This measurement instrument was applied virtually through the Teams platform, with a response of 202 students, which exceeded the sample in accordance with the procedure described, due to the desire to participate.

The results of the evaluation of the Teaching variable were as follows, as shown in the graphs:

In the question whether the teacher has mastery of the subject, 77% of the students were very satisfied and not very satisfied, with satisfaction prevailing in this indicator.

In the question of whether the teacher structures his classes, i.e. starts with an introduction, presents a development and ends his class with the conclusion, 141 students, representing 70%, were slightly and very satisfied, considering the two options satisfactory, 25% of the students were indifferent.

Fairness at the time of evaluation is very important in teaching, 54% of the students were very satisfied and not very satisfied, it is worth noting that 33% of the students showed indifference in this indicator while only 12% showed their dissatisfaction.

As for the mastery of the platform, students were asked if the teacher had this indicator, 157 students representing 73% of the sample answered both options satisfactorily, while 22% were indifferent.

On this issue, it is worth highlighting the training provided to teachers during the first semester of 2020 for the continuity of online classes.

In the use of virtual learning tools and materials by the teacher, 72% of the students were very satisfied and slightly dissatisfied with the teaching-learning process, which shows that they have a certain degree of satisfaction.

In the Academic Organisation variable, the following aspects were grouped together: ease of communication with teachers, resolution of doubts and the time allocated to online assessment.

With regard to teacher-student communication through the Teams platform, 129 students, representing 64%, are satisfied to a certain degree, 40% of the students consider it not very satisfactory and 24% very satisfactory. It is important to highlight that 26% of the students are indifferent with 53 students, which indicates an area of opportunity.

With respect to the resolution of doubts, 74% of the students who responded to the survey perceived that the communication between teacher and student in the virtual environment was satisfactory; however, 8% were dissatisfied with the communication obtained from the teachers.

The last indicator of the Academic Organisation variable refers to the time allocated for online assessment; of the 202 students, 72, representing 47% of those surveyed, were satisfied. It is important to note that 68 students were indifferent to the question, representing 34% of the population surveyed, and 19% disagreed with the time allocated.

It is very important to consider that without the technical resources the students could not have attended the online classes, for this reason 70% of the students were satisfied and very satisfied with the resources necessary to take their classes online, and 26% were indifferent to the means used to attend the online classes.

The following indicators that measure this variable of university infrastructure and services were adapted to the conditions of each student in their home or work area from where they connected to attend online classes, as they were carried out in a synchronous manner.

Most of the students were satisfied with the lighting in the study area, and it was up to them to improve it; only 11% showed little satisfaction in this respect.

In relation to ventilation, they were asked how they considered this element in their space. 13 students (6%) were slightly dissatisfied and 5% were very dissatisfied with the ventilation of their study area, while 107 students (89%) answered that they were satisfied.

The last indicator of the University Infrastructure and Services variable, compared to the results of the previous questions, shows a lower percentage than the one represented in this question, around 17% feel slightly dissatisfied and very dissatisfied with the privacy they had in their study area and it is understandable since they take classes in spaces they share with their family or in environments where they cannot have complete control over the environment where they take classes, even so 108 students representing almost 54% have a certain degree of satisfaction when evaluating the privacy they have in their study area.

Conclusions

Based on the results obtained, the following strategies are proposed:

Regarding the variable Teaching, where the mastery of the subject by the teacher, the structure of the classes, and the impartiality at the time of evaluating the students were measured, in these indicators the highest satisfaction was reflected in the mastery of the classes, so it is a strength of the teaching staff; On the other hand, the indicator with the lowest degree of satisfaction is that of impartiality when assessing, one of the strategies to be followed by the teacher is to establish assessment rubrics and make them known on the first days of classes so that students are aware of them in detail and can clarify any doubts they may have regarding the integration of their qualification.

In terms of the ease of handling technology such as mastery of the platform and virtual learning tools and materials, the assessment was not very satisfactory, due to the haste of entering virtual environments, despite the fact that intensive courses were given on virtual platforms, constant practice in these digital environments is essential to achieve skill in their use and handling.

With regard to the variable of academic organisation, which was evaluated with the aspects of teacher-student communication and the resolution of doubts, the students are not very satisfied, which indicates an area of opportunity for improvement and the implementation of new strategies that allow for adequate communication between them.

On the other hand, the time allocated to online assessment presents an important area for improvement, as the majority of students are dissatisfied and dissatisfied, so it would be advisable to carry out an in-depth analysis of the subject and type of assessment in order to remedy this problem.

In the variable of infrastructure and university services for the online modality studied, the technical resources to attend online classes were considered, such as computer equipment, i.e. computer, tablet and internet service.

The infrastructure took into account the conditions of the physical space such as lighting, ventilation and privacy that each student creates at home. It is important to note that without having the optimal conditions that exist in the classrooms, there was a commitment to create the necessary conditions to attend online classes.

Finally, given this situation, which is not foreseen in any educational institution in the world, the commitment of the institution to carry out teacher training, contracted resources such as digital platforms and the responsibility of students to adapt their areas of study and be able to attend online classes, which have the characteristic of being synchronous from their homes or work areas, is highlighted.

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