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Diagnosis of the competitiveness in the technological skills of high schools of macuspana, tabasco, for the generation of a proposal for improvement

Karina Jiménez Rojas[1]
karyjiro_86@hotmail.com
https://orcid.org/0000-0001-8705-3401
Tecnológico Nacional de México/Instituto Tecnológico de Villahermosa

M.A. Carlos Mario Martínez Izquierdo
carlos.mi@villahermosa.tecnm.mx
https://orcid.org/0000-0001-9630-6714
Tecnológico Nacional de México/Instituto Tecnológico de Villahermosa

M.C. Leticia López Valdivieso
leticia.lv@villahermosa.tecnm.mx
https://orcid.org/0000-0001-6288-3636
Tecnológico Nacional de México/Instituto Tecnológico de Villahermosa

Mtro. Norma de lós Angeles Rojas Rodriguez
narrkvnf.12@gmail.com
https://orcid.org/0009-0001-1149-7134
Tecnológico Nacional de México/Instituto Tecnológico de Villahermosa.

Dra. Juana María Morejón Sánchez
juana.ms@villahermosa.tecnm.mx
https://orcid.org/0000-0002-9930-181x

ABSTRACT

Competitiveness is considered an important aspect that is determined in an individual, community or country. This refers to the ability to remain and adapt to local, national and international markets. In the case of the education system, the competences of those involved in the teaching-learning process (teachers, students, administrators, etc.) are taken into account to define and evaluate their performance. For education it is of major importance to be competitive in order to improve human development, so it is an essential factor that requires the planning of strategies that exceed expectations and allow to develop inclusion in all areas. In order to be competitive, it is necessary to constantly update and acquire skills in order to carry out any diligence in an appropriate manner, considering the emerging needs of today's globalized society, given that this entails an evolution in technological innovations and thus a change in all social systems, including education. Therefore, this article seeks to reflect on the competitiveness of technological skills as part of the education sector where the necessary skills are required in any social, economic, political or technological field, which affects the quality of the academic community, for which the context in terms of technological competitiveness and education is briefly presented and subsequently the link between technological skills and study techniques is indicated, as is currently assumed. This diagnosis is part of a research project focused on determining the competitiveness of technological skills of high schools in Macuspana, Tabasco, Mexico.

Keywords: *technological skills; competitiveness; education.*

[1] Autor principal
Correspondencia: karyjiro_86@hotmail.com

Diagnóstico de la competitividad en las competencias tecnológicas de los colegios de macuspana, tabasco, para la generación de una propuesta de mejora

RESUMEN

La competitividad se considera un aspecto importante que se determina en un individuo, comunidad o país. Esta se refiere a la capacidad para permanecer y adaptarse al mercado local, nacional e internacional. En el caso del sistema educativo, se toman en cuenta las competencias de los involucrados en el proceso enseñanza-aprendizaje (docentes, alumnos, administrativos, etc.) para definir y evaluar su rendimiento. Para la educación es de gran importancia ser competitivo con el fin de mejorar el desarrollo humano, por lo que es un factor imprescindible que requiere de una planificación de estrategias que superen las expectativas y permitan desarrollar la inclusión en todas las áreas. Para ser competitivo se necesita de la actualización y adquisición constante de habilidades para desempeñar de forma adecuada cualquier diligencia, considerando las necesidades emergentes de la sociedad globalizada actual, dado que este hecho conlleva una evolución en las innovaciones tecnológicas y con ello un cambio en todos los sistemas sociales, incluyendo el educativo. Por ello, en este artículo se busca reflexionar acerca de la competitividad de las habilidades tecnológica como parte del sector educativo en donde se requiere de las destrezas necesarias en todo ámbito social, económico, político o tecnológico, lo que incide en la calidad de la comunidad académica, para lo que se expone brevemente el contexto en materia de competitividad tecnológica y educación y posteriormente se señala el vínculo entre las habilidades tecnologías y las técnicas de estudio, como se asume actualmente. Este diagnóstico forma parte de un proyecto de investigación enfocado en determinar la competitividad de las habilidades tecnológica de las escuelas de nivel medio superior en Macuspana, Tabasco, México.

***Palabras clave**: habilidades tecnológicas; competitividad; educación.*

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1. INTRODUCCIÓN

For education it is of great importance to be competitive in order to improve human development, so it is an essential factor that requires the planning of strategies that exceed expectations and allow to develop inclusion in all areas.

Technological competence is the knowledge acquired from updated techniques and processes with the purpose of maintaining and growing within a society, institution or company. Thus, technological skills are necessary skills in any social, economic, cultural, political or technological field, which affects the quality of the academic community, taking into account the approach for maximum use, improving and updating the processes needed to become more competitive.

Because educational innovation is a key factor of competitiveness, technological skills represent an opportunity for good integral development. Therefore, knowledge of Information and Communication Technologies (ICT) is of fundamental importance for continuity at all academic and professional levels and thus generate experiences as a knowledge base.

2.METHODOLOGY

2.1. Approach

According to Monje (2011), "los paradigmas de investigación cuantitativo y cualitativo comprenden fundamentaciones epistemológicas, diseños metodológicos, técnicas e instrumentos propios que se desarrollan según la naturaleza de los objetos de estudio, las situaciones sociales y las preguntas planteadas para la investigación con el fin de explicar, comprender o transformar la realidad social". [the paradigms of quantitative and qualitative research include epistemological foundations, methodological designs, techniques and own instruments that are developed according to the nature of the objects of study, social situations and questions posed for research in order to explain, understand or transform social reality]. In this regard, in order to determine whether the variables of the personal and institutional socioeconomic context have a significant impact on the technological competitiveness of high schools in the municipality of Macuspana, Tabasco chose to use a quantitative approach with the aim of obtaining quantifiable data to measure the variables and establish the relationships between them.

2.2. Type of study

This study is part of diagnostic research, also called descriptive. This consists, fundamentally, in characterizing a specific phenomenon or situation indicating its peculiar or distinguishing features. The objective of descriptive research is to get to know the prevailing situations, customs and attitudes through the exact description of activities, objects, processes and people. "Su meta no se limita a la recolección de datos, sino a la predicción e identificación de las relaciones que existen entre dos o más variables (Morales, 2012)". [Its goal is not limited to data collection, but to the prediction and identification of relationships between two or more variables]. In other words, the study will know, identify and classify the situations, establish the variables and their relationship between them, and analyze the total summaries to determine a conclusion about the investigated to help acquire knowledge.

2.3. Population

From the perspective of Monje (2011):

> "La población o universo es el conjunto de objetos, sujetos o unidades que comparten la característica que se estudia y a la que se pueden generalizar los hallazgos encontrados en la muestra (aquellos elementos del universo seleccionados) para ser sometidos a la observación. (p. 25)". [The population or universe is the set of objects, subjects or units that share the characteristic being studied and to which the findings found in the sample (those elements of the universe selected) can be generalised for observation].

In this sense, the population or group of subjects to whom the research was applied consisted of high schools in the municipality of Macuspana, located in the state of Tabasco. However, since the number of the universe was considered high, for practicality a sample was extracted in order to observe a portion of the population units and thus obtain conclusions similar to those that would be achieved with the total universe, being in this case a representative sample, according to the description of Monje (2011).

2.3.1. Sample

Four high schools in the municipality of Macuspana in the state of Tabasco were chosen to select the sample. It was decided to include public and private schools in an equivalent way. Then, fair samples were determined from each school: 33 women and 33 men, being 66 students of each school and giving as a total sample 264 participants. To carry out the key factors, the structural analysis was carried out

taking into account 4 experts from Macuspana' schools, taking from them their experiences, expectations and knowledge in order to find the relationships between the factors. Taken into account that this analysis is a paradigm of considering that it develops with exploratory character, from a direct analysis in which the union types, allocate the resources in a social system. “Por ende, su eficacia consiste en la aplicación integral de pensamientos teóricos, maneras de conseguir y estudiar los datos como sugiere Barthes (1977)”. [Thus, its effectiveness consists in the integral application of theoretical thoughts, ways of obtaining and studying data as suggested Barthes (1977).]

2.4. Technical

“En los estudios por encuesta se pueden obtener datos de una muestra representativa de la población y pueden ser empleados en investigaciones descriptivas, como dice Monje (2011)”. [Survey studies can obtain data from a representative sample of the population and can be used in descriptive research, as Monje says (2011)]. Thus, a structured questionnaire was designed to collect the information necessary for the study.

“Las entrevistas obtenidas mediante la estrategia de grupos focales tienen como objetivo registrar cómo los expertos elaboran grupalmente su realidad y experiencia, esta es de forma estructurada y grupal, planteando la temática y preguntas asociadas para la investigación como lo indica Aigneren (2002)”. [The interviews obtained through the focus group strategy aim to record how the experts collectively elaborate their reality and experience, this is in a structured and group way, raising the topic and associated questions for research as indicated by Aigneren (2002)]. In this sense it was made for the application of the structural analysis, Previous talks in conversation round with the actors involved in the high schools of Macuspana and they came to find specifically experts carrying out the technique brainstorming for the double entry tables.

2.4.1. Instrument

The structured questionnaire for this research was organized into three distinct sections: section 1) Personal socio-economic factors; section 2) Institutional socio-economic factors and section 3) Technological competence to search for information on the internet. Each of these was aimed at collecting specific information.

Section 1 covered various personal socioeconomic factors that were determined to be relevant in access to technology according to the literature review for this study. Similarly, Section 2 covered various institutional socio-economic factors that were identified as relevant in access to technology within schools according to the literature review.

Table 1. ***Aspects studied in the questionnaire applied by section*****.**

Section	Aspects investigated with the questionnaire
1. Personal socio-economic factors	1. Internet at home 2. Internet on a mobile or portable device 3. Desktop computer at home 4. Laptop or electronic tablet at home 5. Smartphone 6. Area of residence 7. Type of education received
2. Institutional socio-economic factors	1. Free internet access at school 2. School with open access computer centre 3. Access to guidance counsellors when using computer equipment at school 4. Access to training or informative talks on the use of computer equipment in schools 5. Access to training or informative talks on the use of computer search engines in school 6. Access to a scientific database to consult academic information by subscription by the school 7. School location area
3. Technological competence to search for information on the internet	1. Ability to distinguish between an electronic database, an institutional repository and an electronic journal 2. Ability to find relevant information in electronic databases 3. Ability to find relevant information in institutional repositories 4. Ability to find relevant information in electronic journals 5. Ability to distinguish scientific information from other information on the internet 6. Knowledge on the indexation of scientific journals 7. Knowledge of the most relevant scientific journals in Latin America 8. Knowledge of the most relevant institutional repositories of scientific production in Latin America 9. Knowledge of the most relevant electronic databases in Latin America 10. Ability to distinguish the genres scientific article, thesis, dissertation, thesis, thesis, monograph and book when searching for relevant information 11. Using Google to search for relevant information 12. Using Google Scholar to search for relevant information 13. Use of Redalyc.org to search for relevant information 14. Using Refseek.com to search for relevant information 15. Using Springer Link to search for relevant information 16. Using Scielo.org to search for relevant information 17. Using Dialnet.net to search for relevant information 18. Using Eric (Institute of Education Sciences) to search for relevant information 19. Using Academia.edu to search for relevant information 20. Using Base-search.net to search for relevant information

Note. Own elaboration.

For sections 1 and 2 of the questionnaire, the use of t trichotomous question was determined in order to know if the socioeconomic factors correspond to negative, positive or intermediate aspects in relation to accessibility to technology. An ordinal measurement level of 0 to 2 was used to perform a quantifiable data analysis.

On the other hand, for section 3 of the questionnaire a Likert scale of five reagents was used with the options Nothing, Very little, Little, Enough and Much, with the values assigned 0, 1, 2, 3 and 4 respectively.

As far as structural analysis is concerned, it consists of three parts; (stopping the factors, as second the identification of the influence of these factors among themselves; which can be direct and indirect through the double-entry table, finally, the visualization of the most outstanding factors through the results obtained in the previous phase.

2.5. The procedure

Prior contact was made with the leaders of the respective high schools that formed the sample of this study. The purpose of the investigation was explained and the corresponding offices were given to carry out the investigation, including the request for authorization by the participants' parents. Once the agreements to implement the instruments had been established, they were administered with the help of experts and teachers from each high school.

SPSS version 27 software was used to perform data analysis. First, all properties of variables were defined. Once the tables with the raw data were prepared, graphs of type bars grouped by sex were made in order to show the count of data in percentage form, as well as to contrast the results of the studied high schools.

Then, from the sections Personal Socioeconomic Factors and Institutional Socioeconomic Factors, global factor scores were obtained for each high school, considering the values assigned to the ordinal scale (0 for aspects considered negative, 1 for aspects considered intermediate, 2 for aspects considered positive). These values were multiplied by the number of students who selected each response option and thus obtained the total positive values obtained by each item. This result was divided by the maximum possible score of each factor and thus the average value per factor was obtained, which became an overall percentage score to compare the results by factor of each section.

Subsequently, from the section Technological skills to search for information on the Internet, global scores were obtained per item for each high school, considering the values assigned on the Likert scale (0 for Nothing, 1 for Very Little, 2 for Little, 3 for Enough, 4 for Much). These values were multiplied by the number of students who selected each response option and thus obtained the total positive values obtained by each item. This result was divided by the maximum possible number of positive scores for each item and the average value per item was obtained. Each average value per item then became a global percentage score.

With regard to structural analysis, work was done with the 4 experts from the high schools of Macuspana, by brainstorming technique for the double-entry table of what experts think is impacting the competitiveness of technological skills in such schools, where 1, if influenced by factor and 0 does not influence, thus obtaining the double-entry table.

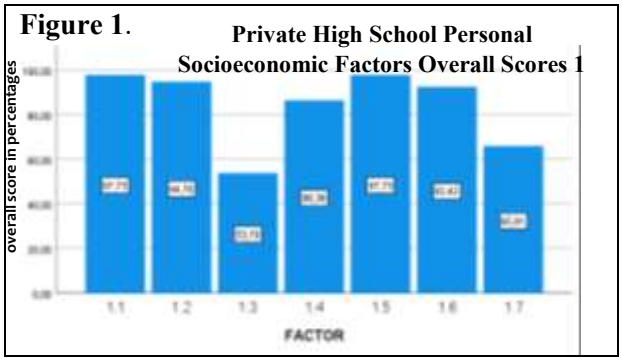
3.-RESEARCH RESULTS

The results are presented in order as described in the methodological procedure. Thus, in the first place, the results of the count of data obtained in the questionnaire of the section Personal socio-economic factors, then the results of the section Institutional socio-economic factors and then the results of the section Technological skills for searching information on the internet. The scores obtained from each section by factor and by item respectively on each of the high schools studied are presented in order to compare the results between them.

Subsequently, taking the factors of structural analysis, which resulted with the brainstorming technique, the double-entry table was made with the binary system; where 1, determines influence of one element on another and 0 determines no influence, for the purpose of analysing the relationship between the factors and obtaining the results.

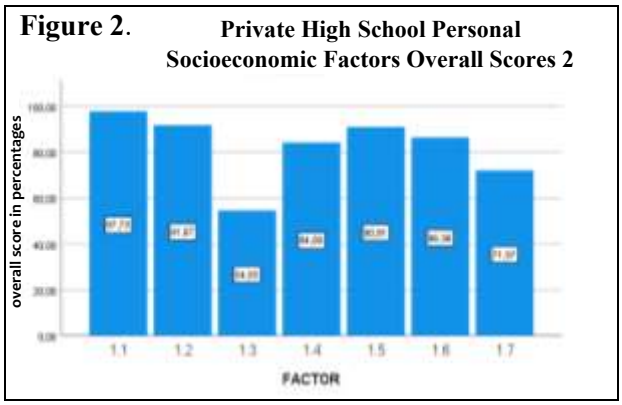
Overall Personal Socioeconomic Factors Scores

Figure 1.



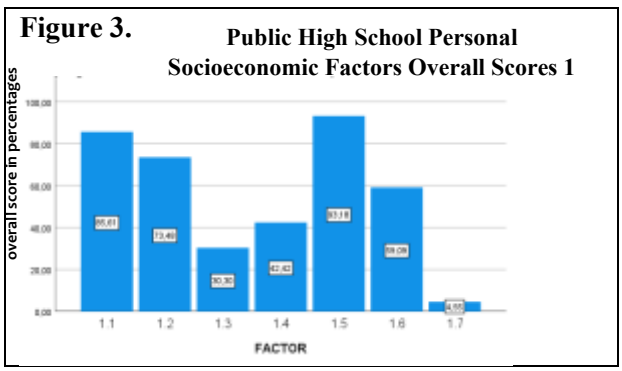
Note. Own elaboration.

Figure 2.



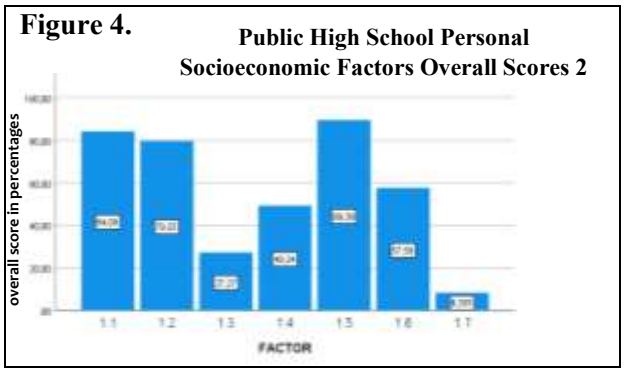
Note. Own elaboration.

Figure 3.



Note. Own elaboration.

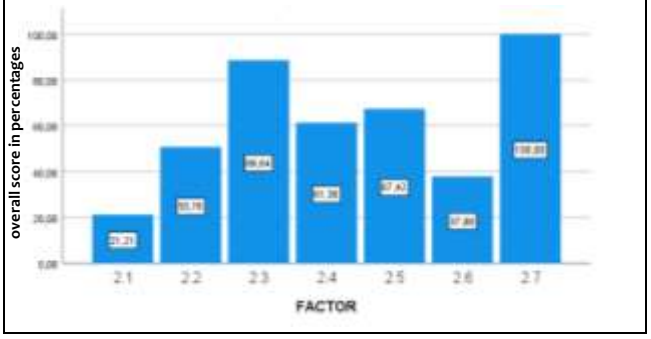
Figure 4.



Note. Own elaboration.

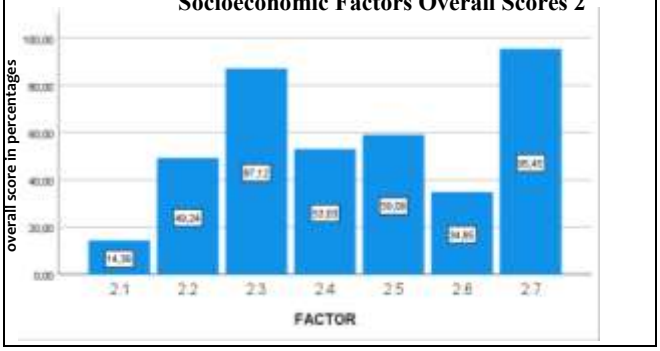
Institucionales Overall Scores of Institutional Socio-economic Factors

Figure 5. **Private High School Institutional Socioeconomic Factors Overall Scores 1**



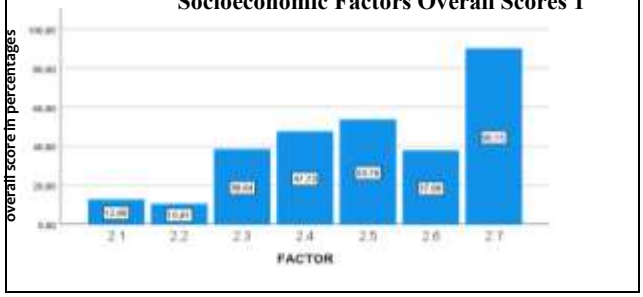
Note. Own elaboration.

Figure 6. **Private High School Institutional Socioeconomic Factors Overall Scores 2**



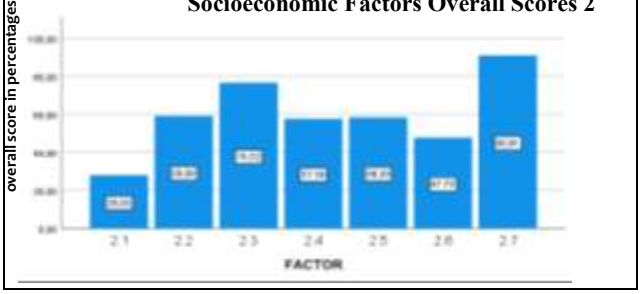
Note. Own elaboration.

Figure 7. **Public High School Institutional Socioeconomic Factors Overall Scores 1**



Note. Own elaboration.

Figure 8. **Public High School Institutional Socioeconomic Factors Overall Scores 2**

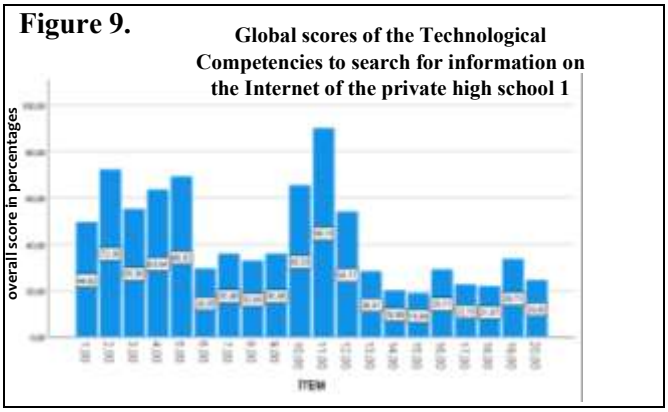


Note. Own elaboration.

Global Technology Competency Scores for searching for information online

Figure 9.

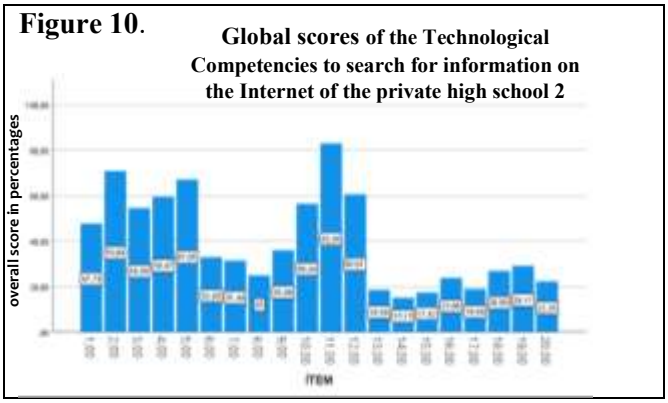
Global scores of the Technological Competencies to search for information on the Internet of the private high school 1



Note. Own elaboration.

Figure 10.

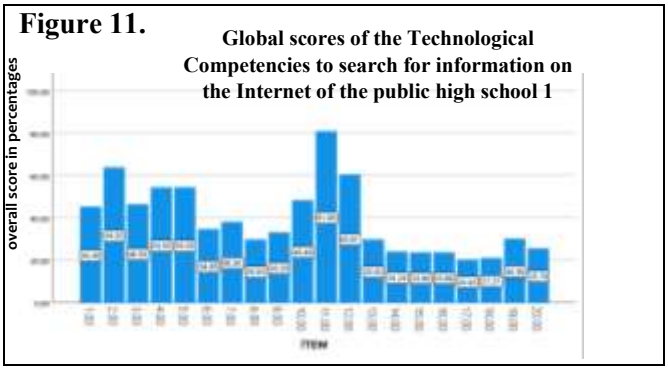
Global scores of the Technological Competencies to search for information on the Internet of the private high school 2



Note. Own elaboration.

Figure 11.

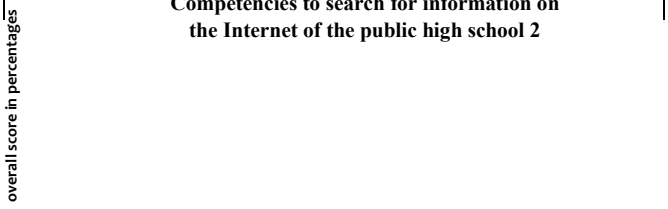
Global scores of the Technological Competencies to search for information on the Internet of the public high school 1



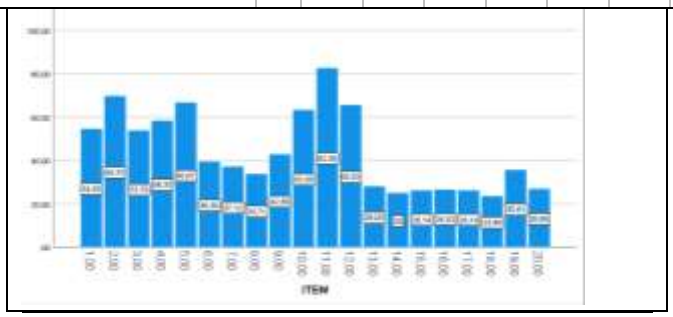
Note. Own elaboration.

Figure 12.

Global scores of the Technological Competencies to search for information on the Internet of the public high school 2



Double-entry table											
Influence of/on		Direct influence									
Factor	**Description**	**F 1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**Total mobility**
F1	internet access	-	1	1	0	0	0	1	0	0	3
F2	Access to electronic devices with internet connection	1	-	1	1	0	0	0	1	1	5
F3	area of residence	1	1	-	0	0	0	0	0	0	2
F4	Educational background	1	0	0	-	1	1	1	1	1	6
F5	Technological educational advice	1	1	0	1	-	1	1	1	1	7
F6	School with membership to database	1	1	0	1	1	-	1	0	0	5
F7	type of school	0	0	0	1	1	1	-	1	1	5
F8	Knowledge about the different databases	1	1	0	1	1	1	1	-	1	7
F9	Competencies to use different databases	1	1	0	1	1	1	1	1	-	7
	Total dependence	7	6	2	6	5	5	6	5	5	47



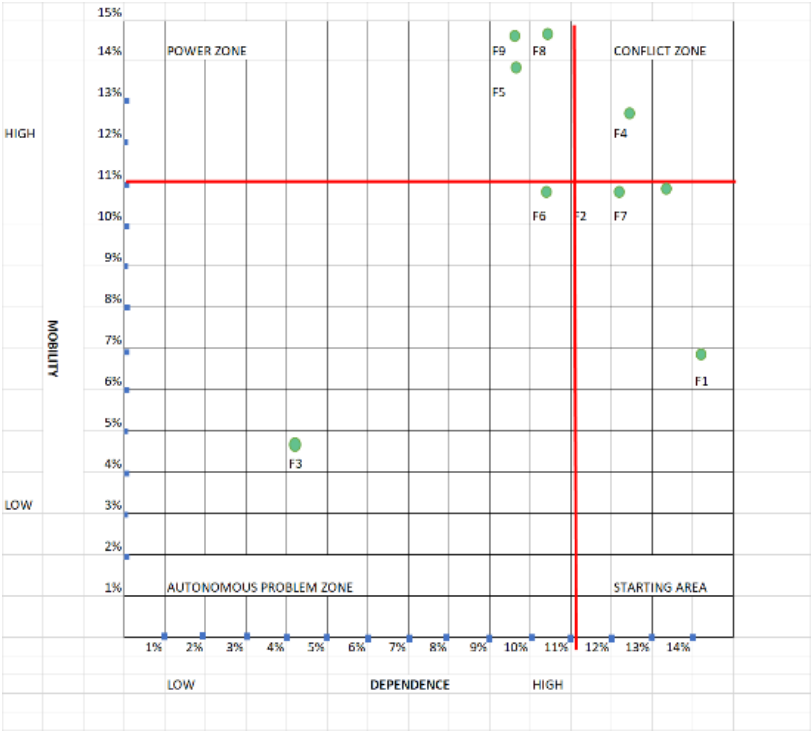
Note. Own elaboration.

Structural analysis

Table 2: ***Mobility and dependence table***

Source: Double-entry table with data provided from schools 2023.

Figure 13. ***Display of the most outstanding factors.***



Source: Researcher's contribution 2023.

4.- DISCUSSION AND CONCLUSIONS

The results obtained from the application of the instruments allowed us to know different findings. Starting with the structural analysis, it was observed that the outstanding factor was F4, academic training, in coordinates (12.76: 12.76); this factor is significant in competitiveness in technological skills, since it leads to the education obtained from the collaborators of the institutions, which is reflected in the orientation towards the students in the classrooms, so it is fundamental to the competitive achievement. Therefore, if they do not have a good academic level, it will be reflected in the knowledge acquired by the students.

In the case of Personal Socioeconomic Factors, it was possible to identify that there are differences between the benefits of having access to technological resources available to private school students and public school students. These differences are particularly noticeable in the access to a computer, both desktop and portable, as well as in the areas of residence of students and in the type of education received. These factors have a direct impact on access to technological resources.

On the one hand, the possession of technological goods such as computers is directly related to the purchasing power of families, so that most cannot acquire more than one, which creates inequalities

within the family dynamic because it is common for more than one member of the household to study or use these devices for work purposes. On the other hand, the residence area of families is linked to the available technological coverage, as well as access to basic public services, including the internet. In turn, this factor also affects the type of education available in the area, even if the latter also depends on purchasing power. This set of factors makes it more difficult for certain families to access a quality, efficient education with opportunities for growth. Therefore, developing technological skills is much more complex than not having such benefits.

This situation is in contrast to the stipulations of UNESCO mentioned above in this work (Camacho et al., 2020), where it is highlighted that "la educación debe ser inclusiva, equitativa y de calidad para afrontar las carencias digitales de las comunidades más vulnerables". [education must be inclusive, equitable and quality to address the digital gaps of the most vulnerable communities]. These results also support what Martins said (6 December 2016), who points out that "en Latinoamérica las familias que poseen menores recursos económicos no logran acceder a escuelas de calidad con profesores mejor preparados debido a las desigualdades". [In Latin America, families with lower economic resources cannot access quality schools with better trained teachers due to inequalities]

. With regard to free internet access in schools, it was found that, in all schools, regardless of the type of high school, students indicated that they do not have this technological benefit. This situation can be considered an obstacle to implementing technology in the state according to the Programa Institucional de Ciencia, Tecnología e Innovación del Estado de Tabasco 2019-2024, where it was noted that academic institutions should work together with society, government agencies, businesses and research centers to that end.

In the case of the benefit of an open-access computer centre at school, the results were more favourable to private schools. However, the results between the other private schools were similar to those of a public school. Thus, the most unfavourable result could be found in public schools, where the majority of students indicated that they do not have access to a computer center at school, as well as being disadvantaged in accessing guidance counsellors when using computer equipment in school, which is related to the lack of a computer center to which students can freely enter.

Thus, the lack of these two factors has a negative impact on the development of students' technological skills, as García-Valcárcel (2016) indicated, “es necesario compaginar la teoría y la práctica mediante la resolución de problemas aplicando las fundamentaciones conceptuales necesarias, lo cual es sumamente complejo sin personal capacitado para brindar esta enseñanza ni centros de cómputo en los que se puedan llevar los conocimientos a la práctica”. [it is necessary to reconcile theory and practice by solving problems by applying the necessary conceptual foundations, which is extremely complex without trained personnel to provide this teaching or computer centers in which knowledge can be put into practice].

It was possible to identify that access to training or informative talks on the use of computer search engines is greater in private high schools, although with very little difference from the results of public schools. “Estas limitaciones no permiten que los estudiantes desarrollen más autonomía sobre sus procesos de aprendizaje, impidiendo una adecuada preparación para su futuro”. [These limitations do not allow students to develop more autonomy over their learning processes, preventing adequate preparation for their future] as previously noted (Ruiz et al., 2008; Soler y Lezcano, 2009). For its part, it was initially established that the indicator of technological competence that would be taken into account for this research, according to Del Cerro and Llorente (2005), would be the use of technological tools for research. n this sense, no significant differences were found in the results regarding technological skills by type of school, as students are generally not prepared with the necessary knowledge about the search for quality information on the internet and the technological tools for this, such as the ability to distinguish an electronic database, an institutional repository or a scientific journal, as well as having no skills to employ any of these. In the case of the use of scientific repositories and search engines, it can be determined that most students do not make varied use of these when searching for information on the Internet, and that significantly use Google, minimally resort to the use of Academic Google. Therefore, in general it can be emphasized the findings described in the work of Matus and Ramírez (2012), where it was argued that connectivity is not the only thing required to contribute to technologies, but it is necessary to train communities to make a functional use of them.

4.1.-Conclusión

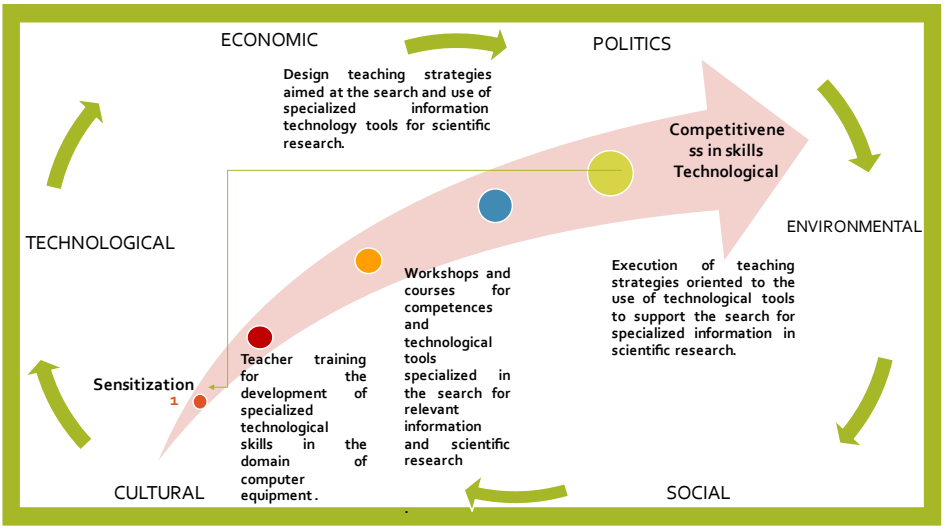
The results of this research allow us to conclude that negative institutional socioeconomic factors are greater than personal socioeconomic factors, since, although students in private preparatory schools demonstrated access to a greater number of technological benefits on a personal level, Most public school students have access to the internet and smart devices to surf the web. Institutional socio-economic factors do have a direct impact on the development of students' technological skills, since students do not have access to basic services within educational institutions such as the internet or computers, as well as training on the use of these and how to search for relevant information in a specialized way, for example, through the use of academic search engines, institutional repositories, electronic databases or scientific journals.

This is reflected in the results obtained when evaluating technological skills, since students usually only use basic or well-known information search tools, They pointed out that they had no knowledge of other means of this activity, which may be due to the lack of education in this area. This is also directly related to the socio-economic factors that determine infrastructure, materials and resources, as well as the educational coverage available to provide quality education.

It can therefore be concluded that the institutional shortcomings of the Macuspana public and private high schools, such as the lack of teacher training and specialized infrastructure, have a negative impact on the development of students' technological skills, Academic training is the basis for consolidating the acquired skills.

4.2.- Model

Model of technological competitiveness in the high schools of Macuspana Tabasco.



Fuente: Aportación del investigador 2023

Context variables have a significant influence on Macuspana high schools, therefore the policy variable for restoration and infrastructure support is needed; the cultural and social variable is essential to promote good knowledge and to make efficient use of technology and to carry out reliable research; the economic variable has an impact on the resources needed to obtain skills, that impacts on the deficiencies that exist to obtain electronic devices and broadband; the environmental, affected globally considering the pandemic 2019; and the technological, innovating quickly and necessary for an efficient and quality education. Starting with the awareness of the collaborators so that they understand the importance of guiding the students who take a technological culture based on reliable and indexed pages. Followed by trainings and courses to acquire skills in both specialized management in computer equipment and technological tools for the search of relevant information and scientific research; therefore, design strategies for the student, as informative talks, trainings, courses and workshops oriented to the use of technological tools to support the search for scientific information; and thus execute these strategies in a comprehensive manner. Finally, return to comprehensive awareness in schools to maintain all employees so that they do not lose motivation.

5.-RECOMMENDATIONS

Based on the findings of this study, the following recommendations are determined:

- Implement training for teachers of high schools in the municipality of Macuspana, Tabasco, to enable the development of specialized technological skills in the domain of computer equipment.
- Implement training for teachers of high schools in the municipality of Macuspana, Tabasco, to enable the development of specialized technological skills in the search for relevant information.
- Implement training for teachers of high schools in the municipality of Macuspana, Tabasco, that allow the development of specialized technological skills in the management of technological tools aimed at the search for specialized information in scientific research.
- Design teaching strategies aimed at finding specialized information for scientific research in the students of the high schools of the municipality of Macuspana, Tabasco.
- Design teaching strategies oriented to the use of technological tools to support the search.

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