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*Scientific articles*

# Barreras en la formación científica y tecnológica de jóvenes mayas: Perspectivas desde la educación superior en Yucatán

## *Barriers in scientific and technological education for maya youth: perspectives from higher education in Yucatán*

## *Barreiras à formação científica e tecnológica dos jovens maias: Perspectivas do ensino superior em Yucatán*

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## Resumen

Este trabajo presenta los resultados de la segunda etapa del proyecto de investigación titulado "Cuestiones críticas, equidad y justicia en la formación científica y tecnológica de jóvenes mayas en Yucatán". El trabajo tuvo como objetivo examinar los desafíos que enfrentan los jóvenes de origen maya en la educación superior a través de carreras profesionales en los sectores científico y tecnológico.

El estudio se llevó a cabo desde una aproximación cuantitativa, por medio de un cuestionario diseñado a partir de las cuestiones que emergieron en la fase cualitativa de la investigación. El cuestionario se administró en la modalidad de encuesta y fue respondido por 125 estudiantes, quienes cursan la educación superior en disciplinas relacionadas con la ciencia y la tecnología en siete instituciones de Yucatán.

Los hallazgos del estudio revelaron la persistencia de barreras significativas que afectan tanto el acceso como la permanencia de las y los jóvenes de origen maya en disciplinas de la educación superior relacionadas con la ciencia y la tecnología en el estado de Yucatán, a pesar

de ciertos avances. Estas barreras reflejan problemas estructurales más amplios en el sistema educativo mexicano. Se observa una tendencia hacia la asimilación cultural entre los jóvenes mayas, marcada por una disminución en el uso de la lengua maya. Además, factores como la falta de recursos económicos, la necesidad de migrar para acceder a la educación superior, y la relación entre género y etnia presentan desafíos adicionales para las y los estudiantes.

**Palabras clave:** Estudiante universitario, educación superior, mayas, ciencia, tecnología.

## Abstract

This paper presents the results of the second stage of the research project titled "Critical Issues, Equity, and Justice in the Scientific and Technological Education of Maya Youth in Yucatán". The study aimed to examine the challenges faced by young people of Maya origin in higher education through scientific and technological sector careers.

The study was conducted using a quantitative approach, employing a questionnaire designed based on issues that had emerged in the qualitative phase of the study. The questionnaire was administered in survey form and was answered by 125 students who were pursuing higher education in science and technology-related disciplines at seven institutions in Yucatán.

The results revealed persistent and significant barriers affecting both access and retention of Maya youth in scientific and technological higher education in Yucatán, despite certain advancements. These barriers reflect broader structural problems in the Mexican educational system. A trend towards cultural assimilation among Maya youth is observed, marked by a decrease in the use of the Maya language. Additionally, factors such as lack of economic resources, the need to migrate to access higher education, and the relationship between gender and ethnicity present additional challenges for the students.

**Keywords:** University students, higher education, mayas, science, technology.

## Resumo

Este artigo apresenta os resultados da segunda etapa do projeto de pesquisa intitulado "Questões críticas, equidade e justiça na formação científica e tecnológica de jovens maias em Yucatán". O objetivo deste estudo foi examinar os desafios enfrentados por jovens de origem maia no ensino superior por meio de carreiras profissionais nos setores científico e tecnológico.

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O estudo foi realizado a partir de uma abordagem quantitativa, utilizando-se um questionário elaborado a partir das questões que emergiram na fase qualitativa da pesquisa. O questionário foi aplicado na forma de uma pesquisa e foi respondido por 125 estudantes que cursam ensino superior em disciplinas relacionadas à ciência e tecnologia em sete instituições de Yucatán. Os resultados do estudo revelaram a persistência de barreiras significativas que afetam tanto o acesso quanto a permanência de jovens de origem maia em disciplinas de ensino superior relacionadas à ciência e tecnologia no estado de Yucatán, apesar de alguns avanços. Essas barreiras refletem problemas estruturais mais amplos no sistema educacional mexicano. Há uma tendência de assimilação cultural entre os jovens maias, marcada pela diminuição do uso da língua maia. Além disso, fatores como a falta de recursos econômicos, a necessidade de migrar para acessar o ensino superior e a relação entre gênero e etnia apresentam desafios adicionais para os estudantes.

**Palavras-chave:** Estudante universitário, ensino superior, maias, ciência, tecnologia.

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# Introduction

The participation of indigenous peoples in higher education systems in Mexico, particularly the Mayan community, is framed in a complex historical and social context. This context has been characterized by systematic processes of exclusion, discriminatory practices, cultural assimilation policies and, in more recent times, attempts at inclusion and recognition of diversity (Cobá, 2019; Ramos Arcos, 2021; Gómez Navarro, 2022).

In this regard, Schmelkes (2013) offers a crucial historical perspective, pointing out that the education of indigenous peoples in Mexico has gone through various stages, from the absolute denial of cultural diversity to current efforts to implement a truly intercultural education. This context is fundamental to understanding the contemporary challenges that young Mayans face in their access to and permanence in higher education, especially in scientific and technological fields.

The barriers that these young people face in accessing higher education are multiple and complex. Carnoy et al. (2002) identify socioeconomic inequalities and ethnic discrimination as key factors limiting indigenous youth's access to higher education. Their study reveals how these barriers not only affect university admissions, but also the long-term career prospects of indigenous students. For their part, Gallart Nocetti and Henríquez Bremer (2006) highlight the importance of considering geographic and access factors , underlining

how physical distance from educational institutions represents significant obstacles for indigenous applicants for higher education. It is important to note that historically indigenous youth come from rural contexts, with a limited presence of higher education institutions.

In the fields of science and technology, the challenges for Mayan students are intensified, as in STEM (Science, Technology, Engineering and Mathematics) disciplines, indigenous youth are underrepresented , due in part to the scarcity of role models and the (imposed) perception that these areas are alien to their culture (Navarrete Linares, 2014). This perspective aligns with the work of Tuhiwai Smith (2013), who emphasizes the need to decolonize research and teaching methodologies in science and technology. She argues that this process of decolonization is essential to make these fields more inclusive and relevant to indigenous peoples, including the Mayans.

On the other hand, language and culture play a crucial role in the scientific education of Mayan youth. As Hamel (2008) points out, teaching science in indigenous languages is not only feasible, but can significantly improve indigenous students' understanding and interest in scientific topics. This perspective is consistent with the theories of intercultural education proposed by Dietz and Mateos Cortés (2011), who advocate for the integration of traditional and scientific knowledge in educational curricula. Their work suggests that this approach not only benefits indigenous students, but also enriches the scientific field with diverse perspectives and knowledge, and it is necessary to consider "the importance of the Mayan language as a cultural element in curricular adaptation" (Mijangos, et al., 2011, p. 206).

To address these challenges, Mato (2008) argues for the creation of intercultural universities and specific programs that value and integrate indigenous knowledge and perspectives in higher education, highlighting how these initiatives can provide more appropriate and effective educational spaces for indigenous students. Czarny (2010) emphasizes the importance of developing mentoring and support programs. These programs should address the specific needs of indigenous students in university settings.

In the specific context of Yucatan, the study by Mijangos- Noh and Cardos-Dzul (2011) reveals how factors such as cultural identity, the use of the Mayan language, and family and community expectations influence the trajectories of Mayan youth in higher education. Regarding the specific challenges faced by these young people, the results of the research are consistent with those of Peniche Cetzal and Ramón Mac (2018), who identify that, in addition to social discrimination due to their traditional language and clothing, Mayan

students face obstacles related to the lack of family support for education, since many families do not perceive education as a means to improve their quality of life. Additionally, the influence of the media is more attractive than school attendance, contributing to educational lag. These factors not only make it difficult to complete basic education but also to access and permanence in higher education.

Likewise, Rosado-May (2013) underlines the importance of incorporating indigenous perspectives and knowledge in scientific and technological education, since as he states, the integration of traditional knowledge with Western science can enrich higher education and provide Mayan students with tools to address contemporary problems from an intercultural perspective, which is relevant since it is not limited to the demand for intercultural educational processes, but rather to providing them with tools so that, within the framework of interculturality, Mayan youth can face the challenges of the modern world.

Finally, regarding the role of educational policies in overcoming these challenges, Bertely Busquets (2011) highlights the need for more comprehensive and participatory policies that truly respond to the needs and aspirations of indigenous communities. This consideration is important because despite recent efforts to implement an inclusive, humanistic and intercultural perspective in the Mexican educational system (Secretaría de Educación Pública, 2019), there is still a significant under-representation of indigenous students in disciplines in the scientific and technological sector, as well as acute challenges in their transition through these fields of knowledge. In this sense, through this study, which is part of a broader research project, we seek to analyze the experiences and challenges of the population of young Mayan people pursuing higher education in the scientific and technological sector in Yucatán.

## Materials and methods

This paper reports the results of the second stage of the research project “Critical Issues, Equity and Justice in the Scientific and Technological Training of Mayan Youth in Yucatan,” developed with the support of the National Council of Humanities, Sciences and Technologies (CONAHCYT). The objective of this stage of the research was to examine the challenges faced by young people of Mayan origin in higher education through careers in the scientific and technological sectors, from a quantitative perspective and broader populations than those worked with in the qualitative phase of the macro study.

To this end, a quantitative study was carried out in the form of a survey. This research is descriptive, as it focuses on the reality of the phenomenon studied, seeking to identify what is happening and which subgroups are most affected. This type of research examines multiple factors and effects under natural conditions, without considering causal hypotheses. Thus, it does not seek to corroborate or refute hypotheses. It uses the data to analyze how the occurrence of the event varies based on the characteristics of the study population (Cardona Arias, 2015).

## Techniques and instruments

Based on the results and critical questions that were constructed in the first stage of the research, a questionnaire was developed with the aim of contrasting these results, as well as exploring the experiences and challenges of broader populations of young people with Mayan affiliation who pursue careers in the field of science and technology. The questionnaire allowed us to broaden the scope of the study and obtain a more representative understanding of the situation of the participants.

The questionnaire was reviewed and evaluated by three researchers with experience in educational assessment, educational policies, and cultural diversity and education. To do so, we used the expert judgment method for validation, which is defined as the informed opinion of individuals with experience in the field, who are recognized by others as qualified experts in the subject. These experts provide information, evidence, judgments and assessments about an object, instrument, educational material or a specific aspect of the research (Robles Garrote and Rojas, 2015; Cabero Almenara and Llorente Cejudo , 2013).

In addition, the documentary analysis technique was used to construct the theoretical and methodological basis of the research, remembering that documentary analysis is a technique that consists of exploring in depth the content or form of a document (Martínez Corona, et al., 2023), with the purpose of integrating it into the research process.

## Procedure

Based on the questions that emerged in the first stage of the research, developed from a qualitative approach, as well as situations linked to the challenges of the participants reported in the literature and indicators, a questionnaire was designed consisting of three sections as described below:

*Section I. Socio-demographic data.* In this section, socio-demographic data were collected, including sex, ethnic identification, age, profession, educational institution, place of residence, and family information.

*Section II. Experiences as young people of Mayan origin in scientific and technological disciplines in higher education.* In this section, 15 multiple-choice questions were posed that address the main experiences and challenges of young people of Mayan origin in higher education, specifically in scientific and technological disciplines. The purpose was to explore whether these experiences are shared by other young people with similar origins and contexts. Through these approaches, five dimensions were examined that were built from previous findings. The dimensions of the instrument were: i) Economy and support in higher, scientific and technological education; ii) Structural discrimination towards Mayans in higher, scientific and technological education; iii) Challenges of Mayan women in higher, scientific and technological education; iv) Distances, mobility and migration of young Mayans for access to higher, scientific and technological education and v) Access to higher education and community development.

*Section III. Challenges and Recommendations* . In the final section of the questionnaire, two questions were raised. The first question aimed to explore additional challenges that might not have been considered in Section II of the instrument. The second question focused on creating a space for participants to make recommendations or proposals. These suggestions are aimed at promoting the participation of young Mayans in higher education, as well as in the scientific and technological fields in Yucatan.

Subsequently, professors and directors of higher education institutions in Yucatán that offer courses related to the scientific and technological sectors were contacted. The purpose of this approach was to socialize the questionnaire and distribute it electronically among the community of higher education students of Mayan origin in Yucatán.

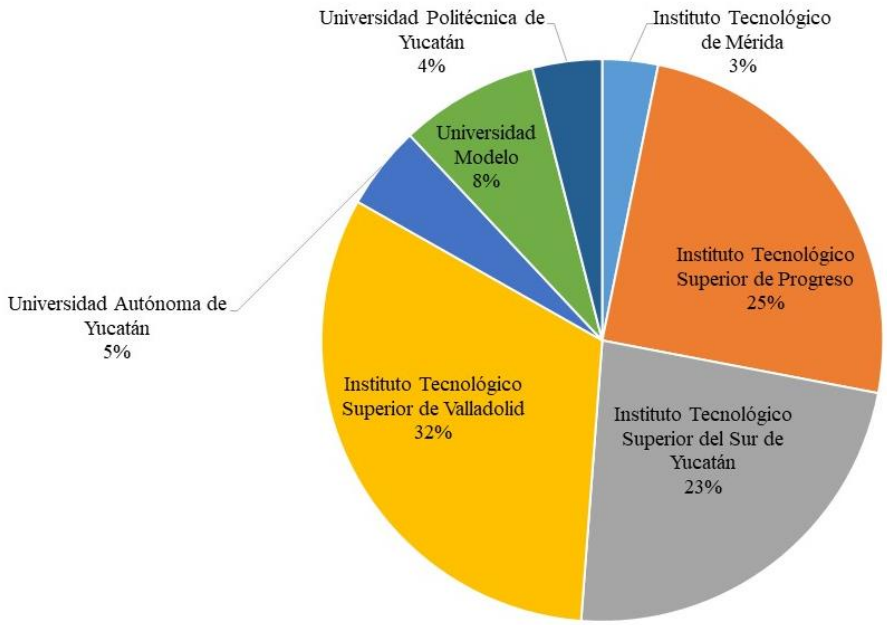
## Results

The survey was attended by 125 students who are studying higher education in scientific and technological disciplines, of whom 71 were men (56.8%), 53 women (42.4%) and one person preferred not to indicate their sex (.8%). The mean age was 20.9 years, with a range between 16 and 31 years. The data were analyzed with the Statistical Package for Social Sciences ( *SPSS* , version 26).

Figure 1 shows the distribution of the participants in the questionnaire, who are studying higher education in seven institutions located throughout the state of Yucatán. The Instituto Tecnológico Superior de Valladolid stands out as the institution with the greatest representation, with the participation of 41 young people in the survey. It is followed by the Instituto Tecnológico Superior de Progreso with 31 participants, and in third place is the Instituto Tecnológico Superior del Sur de Yucatán with 29 participants. It should be noted that these three institutions are located in different regions of the state: east, north and south. In addition, they have a notable presence of young people from various locations, such as towns, police stations, farms and ranches in the interior of Yucatán.

The other four institutions whose students participated in the survey were the Universidad Modelo, with nine students; followed by the Universidad Autónoma de Yucatán, with six participants. Likewise, the Universidad Politécnica de Yucatán had the participation of five students, while the Instituto Tecnológico de Mérida was represented by four young people. The percentage distribution of these data is shown in the following figure.

**Figure 1**Institutions in which survey participants pursue higher education




Source: Own elaboration

Regarding participation by discipline in the fields of science and technology, as illustrated in Table 1, at the Instituto Tecnológico Superior de Valladolid there is a considerable participation of young people in Environmental Engineering, with 21 students,

followed by Civil Engineering with 14 and, to a lesser extent, Administration Engineering with six students. Regarding the Instituto Tecnológico Superior de Progreso, a balanced distribution is observed between Logistics Engineering, with 18 students, and Renewable Energy Engineering, with 13 students. Regarding the Instituto Tecnológico Superior del Sur de Yucatán, it is observed that the majority of students are enrolled in Biochemical Engineering, with a participation of 26 students, followed by Computer Systems Engineering with only two students.

**Table 1**Distribution of survey participants by institution and professional **career**

| Institution | Career Paths | Frequency |
|---|---|---|
| Valladolid Institute of Technology | Engineering in Administration | 6 |
| | Environmental Engineering | 21 |
| | Civil Engineering | 14 |
| Higher Technological Institute of Progress | Renewable Energy Engineering | 13 |
| | Logistics Engineering | 18 |
| Technological Institute of Southern Yucatan | Biochemical Engineering | 26 |
| | Business Management Engineering | 1 |
| | Computer Systems Engineering | 2 |
| Model University | Automotive Engineering | 2 |
| | Industrial Engineering Logistics | 6 |
| | Mechatronics Engineering | 1 |
| Autonomous University of Yucatan | Mechatronics Engineering | 1 |
| | Industrial Chemical Engineering | 4 |
| | Bachelor of Pharmaceutical Chemist Biologist | 1 |
| Polytechnic University of Yucatan | Engineering in Embedded Computer Systems | 3 |
| | Data Engineering | 2 |

| | | |
|---|---|---|
| Mérida Institute of Technology | Biomedical Engineering | 4 |

Source: Own elaboration

As for the remaining four institutions, with a lower presence in the survey, it can be seen that Industrial Logistics Engineering at the Universidad Modelo is the course with the greatest representation in this stage of the research. Finally, the participants are from 30 different communities located in the state of Yucatan.

Following the affiliation criterion, 40 of the participants indicated that they do not identify as Mayans, so the results are presented below based on the information provided by the 85 students who identified themselves as Mayans.

As illustrated in Table 2, 16.5% of the participants speak the Mayan language, indicating a low prevalence of language use among Mayan youth in higher education. In turn, 21.2% of the youth identify themselves as indigenous Mayan people. This percentage suggests that, although some youth do not speak the language, they still maintain a strong connection to their cultural and ethnic identity. Identity can be linked to other cultural and community aspects beyond language. On the other hand, 62.4% come from a family where at least one of the main members of the household speaks the Mayan language. This data is crucial because it indicates that, despite the possible decrease in the use of the language among youth, the family environment remains an important factor for the preservation of Mayan identity.

**Table 2a** Mayan person indicated by the participants in the study

| Criteria for assignment | Frequency | Percentage |
|---|---|---|
| I speak the Mayan language | 14 | 16.5% |
| I identify as an indigenous Mayan person | 18 | 21.2% |
| I come from a Mayan family | 53 | 62.4% |
| Total | 85 | 100.0% |

Source: Own elaboration

Regarding the higher education background of the parents of those who participated in the study, Table 3 shows that the majority of young people of Mayan origin have parents who were unable to access higher education. It is observed that 68.2% of the participants indicated that neither of their parents attended higher education. This data is significant because it suggests a structural barrier to access to higher education for previous generations of the Mayan population in Yucatan.

Only 4.7% of participants reported that both parents have higher education, a very low percentage that highlights the exception within this group. The low presence of parents with higher education could reflect the historical difficulties faced by Mayan communities in terms of access to education.

**Table 3background** of parents of participants

| | Frequency | Percentage |
|---|---|---|
| Both (Father and mother) | 4 | 4.7% |
| None | 58 | 68.2% |
| Only the father | 12 | 14.1% |
| Only the mother | 11 | 12.9% |
| Total | 85 | 100% |

Source: Own elaboration

As described in the methodological section, the instrument consisted of five dimensions, which in turn comprised 28 statements in its three sections. The results for each dimension are presented below, describing the responses for each item based on the theoretical mean obtained from a Likert scale where the maximum value was four (Totally agree) and the minimum was one (Totally disagree).

**1) Economy and support in higher, scientific and technological education**

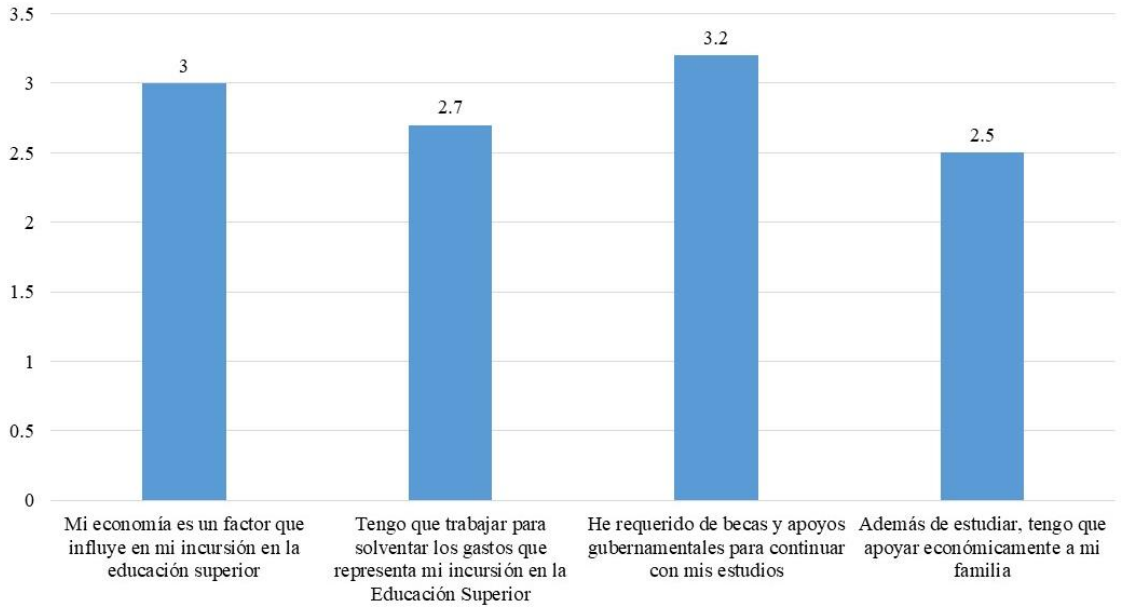
The first dimension of the instrument was made up of four items, which were intended to explore the influence that socio-economic status has on the participants' trajectory in higher education. As can be seen in Figure 2, the highest score in this dimension corresponds to item number three, “I have required scholarships and government support to continue my studies,” since the average was 3.2, which suggests a strong dependence of Mayan students on scholarships and government support to continue their higher education. This underlines the importance of support programmes, such as student scholarships, to facilitate access to and retention in higher education.

The second statement with the highest mean in this dimension was “My finances are a factor that influences my entry into higher education” ($\bar{x} = 3$). The result indicates a strong tendency of students to consider their economic situation as an influential factor in their access and permanence in higher education. With a mean of 3 on a scale of 1 to 4, it is evident

that the majority of respondents perceive that their economic condition has a significant impact on their educational opportunities.

The two remaining items in the dimension had lower scores but were above the mean: " I have to work to cover the expenses of my foray into Higher Education" ($\bar{x}$ = 2.7) and "In addition to studying, I have to financially support my family. Mean of the item" ($\bar{x}$ = 2.5). Although these were the lowest scores, the data reveal that a considerable proportion of students must work to cover their expenses and financially support their families, which implies an additional burden that could affect their academic performance, as well as increase the pressure and challenges they face.

**Figure 2)** of the Economy and support dimension in higher, scientific and technological education




Source: Own elaboration

The results of this dimension reveal that economic factors play a crucial role in the educational experience of young people of Mayan origin in higher, scientific and technological education. There is a clear need for financial support, evidenced by the high dependence on scholarships and government support. In addition, many students are forced to work while studying, which can compromise their academic performance and well-being.

The situation is even more serious for those who also have to support their families financially. This suggests that these young people face multiple economic challenges that may affect their ability to fully concentrate on their studies.

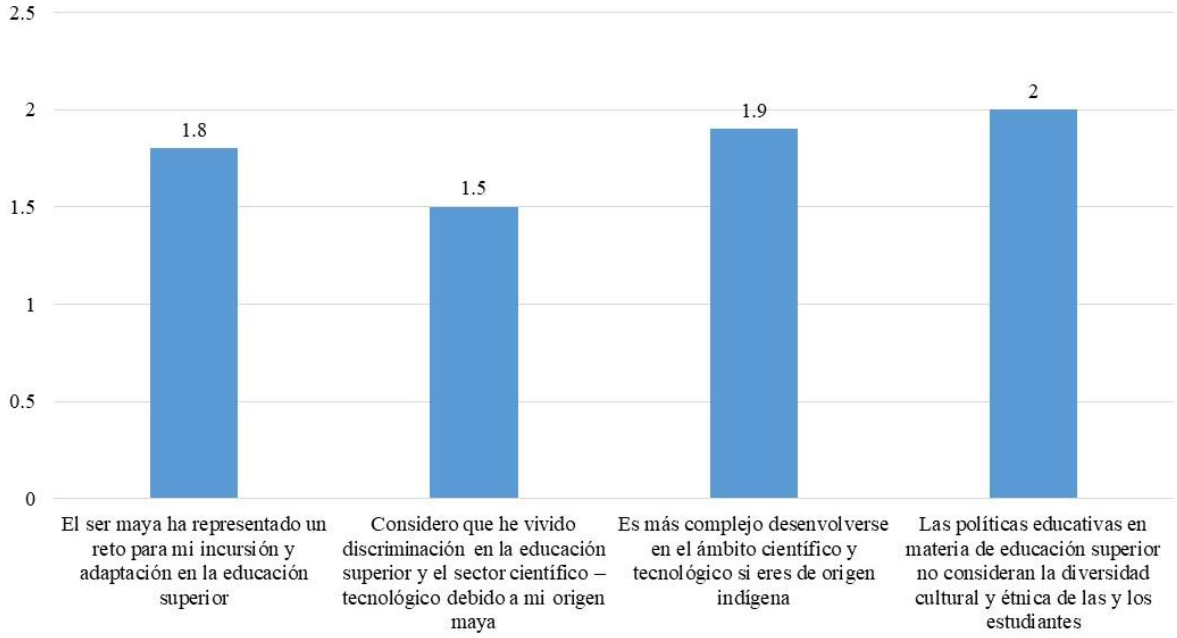
**2) Structural discrimination towards the Mayans in higher, scientific and technological education**

In this dimension, statements were made in order to capture the experiences of participants in relation to possible discrimination they have experienced due to their ethnic origin. As can be seen in Figure 3, the statement with the highest mean ($\bar{x}$ = 2) was "Educational policies in higher education do not consider the cultural and ethnic diversity of students." This result suggests that there is a perception that current policies do not fully address the specific needs of students of Mayan origin.

The second highest-scoring statement in this dimension was "It is more difficult to function in the scientific and technological field if you are of indigenous origin," with a mean score of 1.9. This score, close to 2, indicates a moderate perception that indigenous origin can represent an obstacle in the scientific and technological field. This indicates that students perceive additional challenges linked to their ethnic origin in the scientific and technological fields.

The statements with the lowest scores in this dimension were "Being Mayan has represented a challenge for my entry and adaptation into higher education" ($\bar{x}$ = 1.8) and "I consider that I have experienced discrimination in higher education and the scientific-technological sector due to my Mayan origin" ($\bar{x}$ = 1.5). These results allow us to affirm that, although not all, the participants have faced challenges due to their ethnic origin and have experienced discrimination.

**Figure 3)** of the dimension Structural discrimination towards the Mayans in higher, scientific and technological education




Source: Own elaboration

The results of this dimension reveal a moderate perception of structural discrimination towards Mayan students in higher scientific and technological education. Although high levels of direct discrimination are not reported, there is an awareness of subtle and systemic challenges associated with Mayan identity in these educational contexts.

The strongest perception relates to the lack of consideration of cultural diversity in educational policies, suggesting a gap between the needs of Mayan students and current institutional structures.

It is necessary to delve deeper into this variable, since in the previous stages of the study serious critical issues emerged linked to the discrimination that the Mayans face in higher education. These discordant results may be due to the fact that in the first phase qualitative techniques were used, which allowed for a deeper understanding of the experiences and conceptions of the participants.

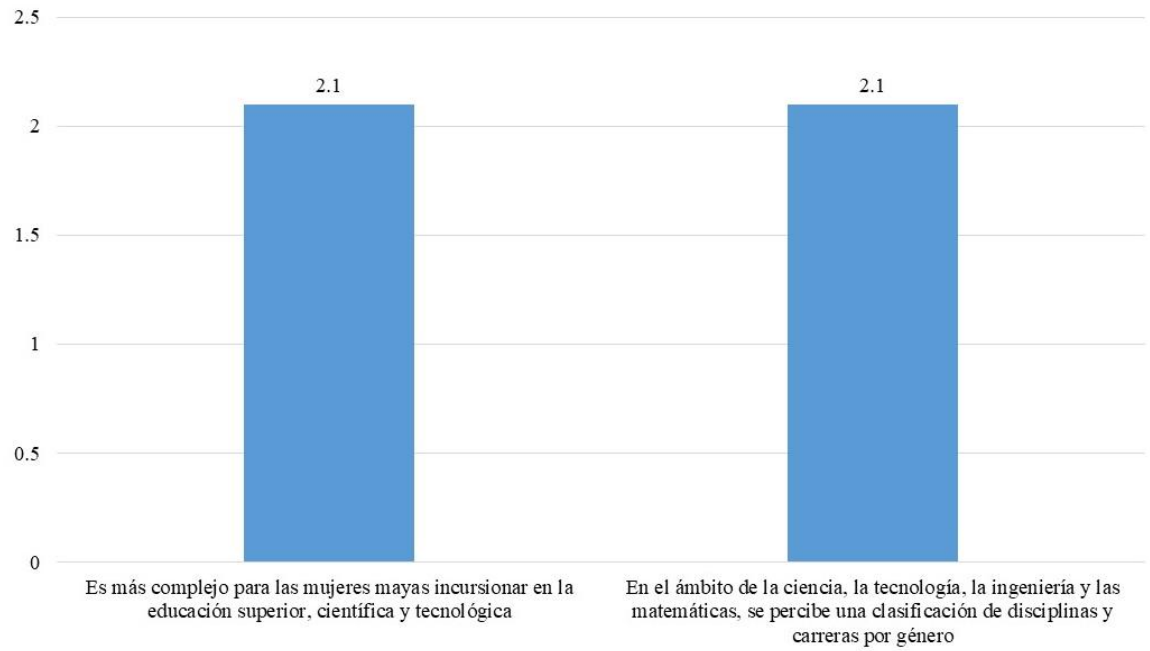
### 3) Challenges for Mayan women in higher, scientific and technological education

This dimension was made up of two items (Figure 4), focused on exploring the participation of women of Mayan origin in the scientific and technological sector of higher education, from the perspective of the survey participants. Regarding the statement “It is more complex for Mayan women to enter higher, scientific and technological education”, the

mean of which was 2.1, slightly above the midpoint of the scale, suggests a moderate perception that Mayan women face greater challenges in their entry into higher, scientific and technological education. It indicates that respondents recognize the existence of additional barriers for Mayan women in these fields, although they do not perceive them as extremely pronounced.

The second question was "In the field of science, technology, engineering and mathematics, there is a perception of a classification of disciplines and careers by gender. Example; Women: health, environment, natural sciences, among others. Men: electronics, mechanics, civil engineering, among others." The mean was identical to the previous question ($\bar{x}$ = 2.1), which suggests a similar and moderate perception of the existence of a gender classification in the disciplines related to science, technology, engineering and mathematics. Respondents recognize that there is some gender segregation in these areas, although they do not perceive it as a widespread phenomenon.

**Figure 4)** of the dimension Challenges of Mayan women in higher, scientific and technological education




Source: Own elaboration

The means of 2.1 on both items indicate that while these challenges are acknowledged, they are not perceived as absolute barriers. This could reflect gradual changes in perceptions or in the opportunities available to Mayan women in these fields.

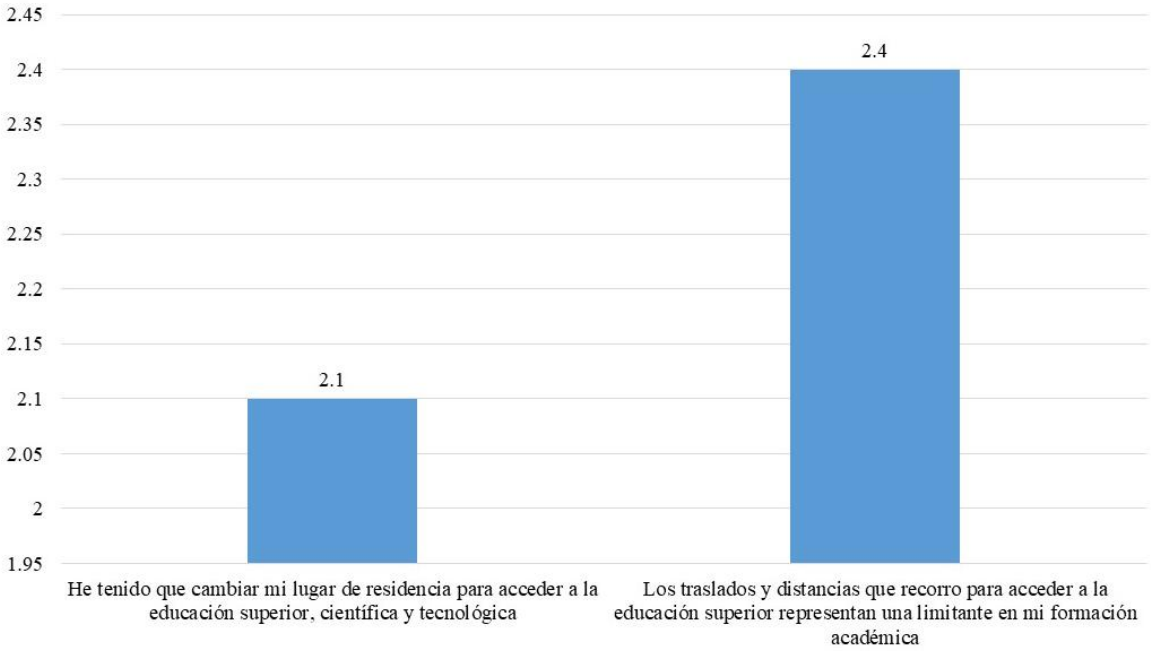
Although perceptions are not entirely negative, the results highlight areas for improvement to promote equity and participation of Mayan women in higher scientific and technological education.

**4) Distances, mobility and migration of young Mayans for access to higher, scientific and technological education**

In the previous stages of the research, mainly through qualitative techniques, the issue of mobility of young Mayans to access higher, scientific and technological education emerged as a critical issue. From this, this dimension of the instrument was constructed with the purpose of examining how distances, transfers, migration and mobility in general are present in the trajectory of young Mayans in higher education. The first statement of this dimension was "I have had to change my place of residence to access higher, scientific and technological education." As can be seen in Figure 5, the mean of 2.1 and slightly above the midpoint of the scale, suggests that a considerable number of Mayan students have had to change their place of residence to access higher education. In fact, of the 85 participants classified as Mayans, 34.1% had to migrate to access higher education, which is a significant figure if one considers the complexities that this phenomenon implies for the Mayans of Yucatan.

Regarding the question "The trips and distances I travel to access higher education represent a limitation in my academic training", the result ($\bar{x}$) was 2.4, with a higher mean than the previous question. This result suggests that trips and distances are perceived as a more significant limitation in the academic training of Mayan students. It allows us to analyze that, even for those who have not changed their residence, distances and daily or frequent trips represent a significant challenge in their education.

**Figure 5young** Mayans for access to higher, scientific and technological education




Source: Own elaboration

As observed in this dimension, there is a moderate tendency among young Mayans to change their place of residence to access higher education in scientific and technological fields. This may entail additional challenges such as cultural adaptation, distancing from family and community support networks, and possible economic difficulties.

**5) Access to higher education and community development**

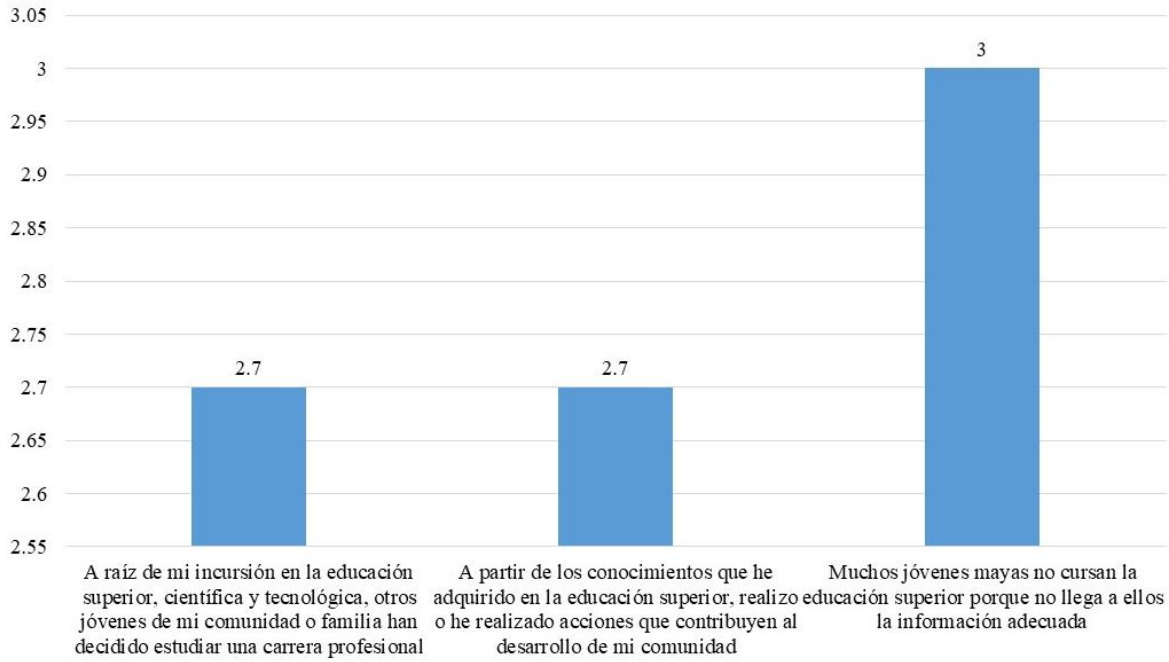
In this dimension, questions were generated in order to analyze how the presence of Mayan youth is having (or not) an influence on their communities, in addition to exploring the limitations in access to information faced by youth from Mayan communities in Yucatan. The question with the highest mean ($\bar{x} = 3$) in this dimension was "Many Mayan youth do not pursue higher education because they do not receive adequate information," which indicates a significant consensus among respondents on the lack of information as a barrier to access to higher education for Mayan youth. The high score compared to the other questions suggests that the dissemination of information is insufficient or ineffective in Mayan communities. The media or information channels used do not effectively reach youth, indicating an urgent need to improve the mechanisms of dissemination and educational guidance in these communities.

On the other hand, the statement "As a result of my foray into higher, scientific and technological education, other young people in my community or family have decided to

study a professional career" obtained a mean of 2.7. This result suggests that the foray of Mayan youth into higher education has a moderate positive effect on the decision of other members of the community to follow a professional career. Although some young people have managed to influence their environment, this influence is not widespread. Possible reasons for this limitation could include economic barriers, lack of knowledge of educational opportunities, and cultural or social obstacles that hinder access to higher education.

Finally, the statement "Based on the knowledge I have acquired in higher education, I carry out or have carried out actions that contribute to the development of my community" also had a mean of 2.7. This data indicates that young Mayans who have accessed higher education consider that they have been able to apply their knowledge to contribute to the development of their community, although this impact is not total. Possible reasons include the lack of institutional or governmental support for community projects, the lack of infrastructure or necessary resources in their communities, and the need for more training or practical experience to carry out more effective actions (Figure 6).

**Figure 6)** of the dimension Access to higher education and community development




Source: Own elaboration

The results of the "Access to higher education and community development" dimension underline the urgent need to improve the dissemination of educational options in Mayan communities in Yucatan, as the lack of adequate information is a significant barrier for young people to access higher education. Although there is a moderate positive influence

of Mayan youth entering higher education on the decision of others in their community to pursue professional careers, this effect is considered to be insufficient due to various socioeconomic and cultural barriers. Furthermore, although these young people manage to apply their knowledge to contribute to community development, the impact is limited. Therefore, it is essential to implement effective strategies to improve access to information and provide the necessary support to enhance community development through higher education.

## Discussion

From the study, it was found that there is a trend towards cultural assimilation among young people of Mayan origin, marked by a decrease in the use of the Mayan language and a variation in ethnic self-identification, determined to a greater extent by family affiliation. This may be related to the fact that "indigenous young people who live in rural communities assume family responsibilities and community rights and obligations from an early age. These are fundamental in the definition of a family youth identity" ( Sartorello , 2016, p. 730). However, the strong presence of families where the Mayan language is spoken suggests that cultural roots remain deep. For a more complete understanding of these dynamics, it would be essential to conduct studies that explore the reasons behind the variation in self-identification and use of the Mayan language, as well as the influence of education and modernity on these identity processes among Mayan youth in higher education.

The analysis of the data reveal a predominant pattern: young people of Mayan origin who access higher education come, for the most part, from family units where the parents have not had the opportunity to pursue university studies. This situation can represent both a challenge and an additional motivation (Casillas et al., 2012), since on the one hand they may lack direct family models in higher education – or at least traditional ones – but at the same time their entry into university could represent a break in the limitations that the social structure has historically imposed on the Mayans.

The marked influence of economic factors on the educational trajectory of Mayan youth reflects a broader problem of inequity in access to and permanence in higher education. These economic factors not only reflect structural inequalities in the educational system, but also perpetuate the cycles of poverty and marginalization that the Mayan people have historically faced (Robles Zavala, 2010; Barrera Rojas, et al., 2019; Barrera Rojas, 2018). The lack of economic resources translates into difficulties in covering tuition, materials,

transportation, and maintenance expenses, which often results in dropping out or the need to combine studies with work, affecting academic performance (Mendoza Zuany , 2017).

The intersectionality between gender and ethnicity adds an additional layer of complexity to the challenges faced by Mayan women in higher scientific and technological education. In this regard, Oehmichen Bazán (2015) analyzes how indigenous women face additional barriers due to the intersection of ethnic and gender discrimination. From this, it is necessary to delve deeper into how these multiple forms of discrimination affect not only access to higher education, but also the experiences and opportunities of indigenous women within educational institutions and in their subsequent professional careers.

The need to migrate to access higher education poses logistical, cultural and identity-based challenges. In this context, the educational migration of indigenous youth often results in complex processes of identity transformation (Bermúdez Urbina, 2017) and, in some cases, in a distancing from their communities of origin. Furthermore, moving and distance are perceived as a greater limitation than changing residence. This suggests that even for those who remain in their communities of origin during their higher education journey, physical access to educational institutions represents a major obstacle to their academic training.

The results point to a possible inequality in the geographical distribution of educational opportunities in science and technology for the Mayan population, forcing students to face mobility or migration challenges. The need to travel long distances or change residence represents an additional burden for Mayan students, which can affect their academic performance, emotional well-being and economic resources, recalling that, as Martínez Buenabad and Bustos Córdova (2020) state, in Mexico migratory movements from the countryside to the city have increased rapidly.

The lack of adequate information as a barrier to access to higher education reflects a broader problem of disconnection between educational institutions and indigenous communities. This highlights the importance of developing more effective linkage strategies between universities and Mayan communities, promoting both access and the relevance of educational offerings at the higher level.

It is also crucial to strengthen support programs not only financially, but also academically and psychosocially, to address the specific needs of Mayan students. This is in line with the recommendations of Ortelli and Sartorello (2011), who emphasize the importance of comprehensive support for indigenous students in higher education.

## Conclusions

In this work we set out to compare the experiences of a broad population of Mayan youth in higher, scientific and technological education, which was achieved through the design and administration of a questionnaire in the form of a survey, with the participation of 125 young people, of which 85 identified themselves as Mayan people. The participants are pursuing higher education in seven higher education institutions located in different regions of the state of Yucatan.

This study reveals that, despite advances in access to higher education in scientific and technological fields for young Mayans in Yucatán, significant barriers persist that reflect broader structural problems in the Mexican education system.

It is important to note that the majority of the study's participants pursue higher education in institutions located in the interior of the state of Yucatán, where there is a strong representation of the Yucatecan Mayan identity. It is suggested that similar studies be conducted in more urbanized contexts, such as Mérida, to explore how phenomena such as discrimination and colonialism impact the educational trajectories of young people in these environments.

The results and reflections presented in the text raise the need for actions and strategies based on interpretative frameworks such as interculturality, decoloniality and epistemologies of the south. These actions should focus on deep interventions in educational policies, avoiding peripheral or welfare-based approaches for Mayan youth.

In summary, this study highlights the need to transform educational structures in Mexico, particularly in the field of higher education, to ensure authentic inclusion of Mayan youth. The combination of comprehensive educational policies and adaptive cultural strategies could not only improve the access and permanence of indigenous students, but also strengthen their identity and contribution to community development. It is necessary to move towards an intercultural and decolonial educational system that embraces cultural diversity as a strength rather than a barrier.

## Future lines of research

This study lays the foundation for establishing future guidelines in the field of educational research, with the purpose of deepening and recovering the experiences of young Mayans from Yucatan who pursue higher education in fields related to science and

technology. In this context, we propose the development of future lines of research that focus specifically on:

1. Analyze the construction of Mayan identity based on the entry of young people into higher education.
2. Examine the relationship between this evolving identity and ties to family and community of origin.

Furthermore, there is a clear need for a comprehensive analysis in the field of higher education policies, with particular emphasis on:

1. Policies aimed at serving the indigenous population studying science and technology.
2. Support programs available throughout your higher education career.

The objective of this analysis would be to understand the real impact of current policies, with a view to reorienting or strengthening actions in public policies in the educational field.

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