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Artículos científicos

Estrategias para el fomento de las vocaciones científicas a partir de la covid-19 en los jóvenes de educación superior en Yucatán, México

Strategies To Promote Scientific Vocations from COVID-19 in Young People in Higher Education in Yucatán, México

Estratégias para a promoção de vocações científicas da covid-19 em jovens do ensino superior em Yucatán, México

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Resumen

La problemática aquí abordada se asocia a la falta de una orientación temprana de las vocaciones científicas que promueva la continuidad educativa en los jóvenes. El objeto del presente trabajo fue determinar estrategias para el fomento de las vocaciones científicas en los jóvenes de educación superior de Yucatán, México, mediante acciones de difusión y divulgación durante la virtualidad provocada por la covid-19. El método de investigación fue por etapa y sistemática. En cada etapa se utilizó el enfoque de investigación cuantitativo. Se contó con muestras de 93.0 % y 97.0 % de confianza y un error de estimación del 0.07 y 0.03 para las etapas uno y dos, respectivamente. Los resultados en la primera etapa permitieron caracterizar a los jóvenes de 15 a 29 años sujetos de estudio. En la segunda etapa se plantean las estrategias para el fomento de las vocaciones científicas y una clasificación de acuerdo con su aplicación. En las conclusiones se pueden vislumbrar las áreas de oportunidad, la escasa búsqueda de información en bases de datos académicas, así como la ausencia de una cultura institucional centrada en la ciencia e investigación.

Palabras clave: divulgación científica, educación, educación superior, estrategias.

Abstract

The purpose of this work was to determine strategies for the promotion of scientific vocations in young people in higher education in Yucatan, Mexico, through dissemination and dissemination actions during the virtuality caused by COVID-19. The research method was by stage and systematic. At each stage, the quantitative research approach was used. There were samples of 93.0 % and 97.0 % confidence and an estimation error of 0.07 and 0.03 for stages one and two, respectively. The results in the first stage made it possible to characterize the young people aged 15 to 29 who were the subjects of the study. In the second stage, the strategies for the promotion of scientific vocations and a classification according to their application are proposed. In the conclusions, it is possible to glimpse the areas of opportunity for young higher level students, the scarce search for information in academic databases, as well as the absence of an institutional culture focused on science and research.

Keywords: scientific dissemination, education, higher education, strategy.

Resumo

O problema aqui abordado está associado à falta de uma orientação precoce das vocações científicas que promova a continuidade educacional dos jovens. O objetivo deste trabalho foi determinar estratégias para a promoção de vocações científicas em jovens do ensino superior em Yucatán, México, por meio de ações de divulgação e divulgação durante a virtualidade causada pela covid-19. O método de pesquisa foi por etapas e sistemático. Em cada etapa, foi utilizada a abordagem de pesquisa quantitativa. Houve amostras de 93,0% e 97,0% de confiança e um erro de estimativa de 0,07 e 0,03 para os estágios um e dois, respectivamente. Os resultados da primeira etapa permitiram caracterizar os jovens de 15 a 29 anos que foram sujeitos do estudo. Na segunda etapa, são propostas as estratégias de promoção das vocações científicas e uma classificação de acordo com sua aplicação. Nas conclusões, podem-se vislumbrar as áreas de oportunidade, a escassa busca por informações em bancos de dados acadêmicos, bem como a ausência de uma cultura institucional voltada para a ciência e a pesquisa.

Palavras-chave: divulgação científica, educação, ensino superior, estratégias.

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Introduction

Students and teachers faced great challenges during 2020 and 2021 with the transformation of education towards virtual settings. Although, on the one hand, progress was promoted in the use of technological platforms for teaching, on the other, there was little investment by families for students to continue their studies from home. Similarly, problems and setbacks were detected, such as the limited availability of economic and technological resources and the inconsistency of the internet service, factors that affected student learning (Cárdenas, Carranza, Plua, Solís and Morales, 2021; Jordan , David, Phillips and Pellini, 2021; Pérez, Vázquez and Cambero, 2020).

In the case of Latin America, 30.0% of students are members of families with socioeconomic disadvantages, which affects their academic performance (Economic Commission for Latin America and the Caribbean [ECLAC], 2021). Along these lines, Ullmann (2015) establishes that the socioeconomic aspect, the quality of teaching and the profile of teachers, among others, influence education in Latin America. Educational development at the higher level takes part in complex processes, which constitute success or failure in the student's perspective. ECLAC (2021) reported that educational desertion in recent years was a reflection of the transition from face-to-face to virtual teaching, a challenge that institutions and students faced and continue to face as an effect of the 2019 coronavirus disease pandemic (covid -19), a situation that required a decrease in mobility and improvement in hygiene and health of the population to avoid and reduce infections (p. 22). Indeed, the pandemic was the factor that triggered the adaptation and innovation of teaching and learning systems. And in this process, the forms and mechanisms for the promotion of scientific vocations in young people and the consolidation of scientific, technological and research skills were absent.

According to ECLAC (2021), the interruption of the school year as a result of the pandemic "mainly affected students who were in a disadvantaged situation since said interruption has only highlighted the educational gaps related to socioeconomic level, area of residence or due to some disability" (p. 24). Online classes involve expenses: internet, laptops and above all a quiet space where the student can concentrate during the sessions without interruption.

One of the problems detected in the educational system in Latin America is the lack of innovation in educational structures, which is even more visible in public institutions (Bernasconi, 2015; Claverie, 2012; Duarte, Gargiulo and Moreno, 2011). There is also the precarious academic preparation of teachers in relation to teaching techniques and the educational level achieved, which reduces interest in promoting science, innovation and research.

In the case of Mexico, Rochin (2021) indicates that the situations that have affected the drop in the higher level are related to the level of previous academic preparation of the student, the economic resources available and family problems that affect motivation, as well as updating educational programs, among others. For the 2020-2021 school year, 5.2 million people (between 3 and 29 years old) were not enrolled in Mexico due to lack of economic resources. Of this amount, 26.6% considered online teaching unsuitable for their learning, 25.3% indicated that their parents lost their jobs, and 21.9% indicated that they do not have technological equipment for class sessions (National Institute of Statistics and Geography [Inegi], March 23, 2021). Of the total number of non-enrolled students, 2.5 million were women. In short, the causes were generated by covid-19 and by the lack of resources (Inegi, 2021). In Yucatan, the academic drop has been generated by economic aspects, the little interest on the part of the student, family problems and labor incorporation, a situation of greater representation in the female gender (Casais y Ortega, 2015, p. 63).

Educational continuity is little considered by students. Also involved in this choice is the promotion of research through teaching (little highlighted by teachers). Lizcano (1999) records that the conceptualizations in scientific matters incorporate contributions required in the research process. Research is relevant in labor integration, but, on many occasions, it is not valued by the same professor and the student, for which reason the option of a scientific vocation at the higher level is not paid attention to. The problem is presented by the precarious socialization of science in teaching, as well as by the influence and family and social expectations regarding job opportunities, which decreases the interest of students, especially in the female gender (Guevara and Flores , 2018). However, this precariousness was amplified by the presence of covid-19, a situation that called into question the continuity, learning and adaptability of young people.

Objective

Determine the strategies for the promotion of scientific vocations in young people in higher education in Yucatan, Mexico, that encourage the choice of an educational continuity through dissemination and dissemination actions through technological scenarios during covid-19.

General question

What kind of strategies are required to promote scientific vocations in young people in higher education for the stimulation of educational continuity?

Specific questions

1) What is the profile of the students who consider an educational continuity towards postgraduate courses?

2) What are the subjects that encourage research in higher level students?

3) What are the information search spaces used to carry out the research activities?

Hypothesis

According to Fonseca and Cascante (2019), the profile that a postgraduate degree requires includes various age groups, but the age range that ranges from 22 to 30 years stands out. In addition, postgraduate degrees related to social sciences are more popular among women. Through the investigation, the following hypothesis emerges to know the profile of young people in higher education who are heading towards a postgraduate degree:

H1: There is a relationship between age and educational level of young people in higher education who decide to continue their education towards postgraduate studies.

Justification

The higher level is an educational setting that strengthens the student's knowledge and leads to professional specialization (Silas, 2012). This is where teachers play a fundamental role in promoting scientific vocations. Through their participation and integration, linking to the role of knowledge and complementarily with the appreciation and dissemination of activities, they foster the interest of young people. With the sum of efforts,

the possibility of creating stereotypes and distancing science and research is reduced, according to Couso (2018, cited in Fundación Lilly, 2018).

Stimulation in higher education in specialties such as the humanities, arts, sciences and technologies is considered to motivate the growth of competitiveness and employment required in the knowledge-based economy. Technological progress, industrialization and commercial scenarios demand a qualified professional profile associated with the areas of science, technology, engineering and mathematics, but the skills of young people are of international concern, which is why they have become an area of opportunity to attend (Lupión, Franco and Girón, 2019; de Pro and Pérez, 2014; Vázquez and Manassero, 2009). Considering that knowledge is advancing at a greater speed in terms of science, technology and innovation, institutions are being required to design programs and specialties to promote a culture in a space other than the classroom, where the dissemination of established activities plays an important role. essential role in reaching out to youth (Martín y Parejo, 2016; Martín, Parejo y Vivas, 2018; Toharia, 2010).

Regarding the importance of completing professional studies, Silas (2012) mentions that young people consider that completing the higher level will have an impact on achieving a better quality of life, greater preparation to enter the workplace and an increase in job opportunities. job opportunities. This coincides with what Cruz and Sandí (2014) propose, who include the search for a quality life, not only professionally, but also with family, to have greater economic opportunities, as well as to increase the possibility of an economic solvency that allows a better lifestyle and greater freedoms. They also highlight a level in society where personal growth is obtained by reaching goals throughout your life. The Organization for Economic Cooperation and Development [OECD] (2019), for its part, ensures that when the student is integrated into higher education and develops knowledge and skills for effective incorporation into the labor, professional or research sector, gain more confidence in it. An educational continuity in which the quality of research is ensured will lead to the training of scientists and researchers who contribute with their efforts in solving the needs and situations that are currently being faced, which is why the stimulation of scientific vocations plays a fundamental role, since it consolidates the decisions of young students and reaffirms their interest in them.

Conceptual framework

Introduction to scientific vocations

Currently there is a need for educational continuity for successful preparation for the challenges of the future (Lupión et al., 2019; OECD, 2015; Sutcliffe, 2011). A vocation requires a choice based on the individual's personality, tastes, interests, skills, abilities and desires to do in a future life. Then, vocational interest arises from intrapersonal differences that stimulate the personality of the individual directed towards those desires to continue studying or choice of studies (Ackerman and Heggestad, 1997; Rodríguez, Sánchez and Labajos, 2017). The vocational choice is generated when the individual has stimulated their skills and abilities towards an interested specialty and that they wish to continue nurturing, with a direction towards consolidation in a profession, that is, the choice of the career that will bring together these qualities for their eminently working life. . But along the way, scientific vocations are associated with the interest, skills and qualities of the individual forged towards research, science, technology, engineering, humanities and others to contribute with these to the solution of problems detected in a labor and scientific context.

Scientific literacy is a way to clarify the terminology used for its accessibility, which dispels doubts about the knowledge that is possessed of it. It is also a reference in situations that require dialogue, debate and argumentation. It is then when the promotion of scientific and technological vocations has the objective of disseminating the great specialties, bringing together and connecting young people who are studying or are about to graduate from a professional level, seeking through the efforts of dissemination and dissemination of gender equality (Retana, Vázquez and Camacho, 2018). In this sense, Guevara and Flores (2018) indicate that scientific education has a greater presence and relevance internationally due to the fact that its exclusion causes a problem of social justice, of the female gender, which will affect the increase or decrease of the participation of women in research and science scenarios. On the other hand, although there are various strategies to promote scientific vocations, the pandemic is a factor that has intervened and modified this range, especially in actions aimed at youth, since a completely technological scenario predominates.

Scientific dissemination strategies

Strategies are efforts planned and established with the purpose of directing energies in an organized manner, where actions are precisely described for the successful achievement of results. The approach of the strategies is associated with the resources available in the organizations, as well as with the commitment of the managers for their application. The senior managers and the delegation that they exercise at other levels in the organic structure intervene in them (Contreras, 2013). Therefore, the implementation, execution, monitoring and control of strategies becomes the most important challenge for organizations. The latter, specifically, to verify effective implementation (Sanabria and Moreno, 2018). Likewise, it is the teaching and learning strategies that define the students' perception of science and technology issues as part of the culture of educational institutions. In this case, the teaching strategy refers to the use of methods and techniques that are necessary in the subjects for their understanding. For this, teachers are required to be available in learning to teach, that is, prepare for the selection, organization and processing of information and knowledge they receive, with the use of various ways to mobilize knowledge towards students (Jeronimo and Yaniz, 2019).

In the 21st century, students are the actors in the teaching-learning process, towards whom it is sought to direct concrete and effective learning actions, considering the challenges they face in each of their subjects. Problem solving, teamwork, entrepreneurship, autonomous learning, citizen training, etc. are among the abilities that are required to be awakened in the actors independently. (García, Fonseca y Concha, 2015).

The communication of knowledge is carried out through a range of agents, activities and products that foster interest and opinion, and thus favor the understanding of citizens about science and technology. The spaces for the dissemination of science that have been used are: television, radio, magazines, documentaries, books, social networks, among other spaces. Similarly, there are spaces where direct interaction with researchers or scientists is possible, such as: congresses, seminars, panels, conferences, debates and mainly in activities carried out for the general public during events and celebrations. dedicated to science and technology (Cortassa, Wursten, Andrés and Legaria, 2020). It is then when the results of the communication are associated with the proposed strategies and the ideal and accessible spaces are selected for the study subjects or profile involved, that is, the effectiveness of scientific communication will depend on the medium used. For Martín and Gorina (2017),

"universities are one of the main sources of scientific production, in charge of transmitting to society, through various channels, advances in science and technology" (p. 6), that is, educational institutions are the link between researchers, scientists and specialists to communicate projects, research and advances in scientific matters in an accurate, friendly and accessible way.

Currently, society and the population in general demand greater support for scientific information, derived from technological expansion for access to information, consultation, analysis and dissemination of knowledge, taking into consideration that institutions are the space where academics, scientists and others are the generators of scientific and technological production (Cassany, López and Martí, 2000; Martín and Gorina, 2017). That is to say, the search for spaces in which to host research results on Internet sites, visible and open access for other researchers, professors and students with related topics, and in this way contribute to the solution of problems in the different territories. . Therefore, the approach of strategies for the effective communication of science is required.

Scientific dissemination is a continuous process that involves the integration of actions to communicate the efforts or results of science, research and technology. The technological scenario is the first medium that enhances the visualization of results, such as that of the Organization of Ibero-American States (OEI) (Iberciencia and Iberdivulga), the Network for the Popularization of Science and Technology in Latin America and the Caribbean (RedPOP) and specialized journals in education and science, among others (Escobar and Rincón, 2018). It is about generating spaces for the socialization of knowledge to the target population, in this case young people in higher education.

In Mexico, through the National Council of Science and Technology (Conacyt) scientific vocations are promoted. Through its annual call, the institutions present their proposals aimed at stimulating them in different areas of education and territories for their assessment and approval. Similarly, the effort of each educational institution to channel actions among its professors, researchers and professors is highlighted.

Regarding the gender distribution in postgraduate courses in Mexico, according to the Ministry of Public Education [SEP] (2021), there is less participation of women, with 49.8% (2020-2021) and 49.7% (2019-2020).), a difference of -0.1%, a situation detected in postgraduate courses offered by public institutions; Otherwise, it occurs in the postgraduate courses of private institutions, where the highest percentage falls on women. In the more specific case of the state of Yucatán, there is a greater participation of women in the

continuity of studies towards postgraduate degrees (54.1% in the 2020-2021 school year); and for the state capital, the city of Mérida, there is also the same predominance (54.3%). Even with everything, compared to national data, it is women who have the lowest registration in public institutions for postgraduate studies, a situation detected in the 2019-2020 and 2020-2021 cycles, with 48.9% and 47.9%, respectively, this that is, a decrease of -1% in relation to the immediate cycle in the Yucatecan entity (table 1).

Tabla 1. Alumnado y docentes en nivel superior y posgrado inscrito en los ciclos 2019 al 2021

Municipio/ Estado/País	Alumnos	Alumnos hombres	Alumnos mujeres	Docentes	Ciclo
México	4 030 616	1 945 397	2 085 219	401 367	2020-2021
Posgrados	239 088	111 222	127 866	61 011	
Posgrado en institución pública	121 738	61 062	60 676	35 161	
Yucatán	74 741	38 721	40 940	8272	
Mérida	57 884	29 478	33 109	6984	
Posgrado Yucatán	4920	2258	2662	1461	
Posgrado en institución pública Yucatán	2544	1299	1245	799	
Posgrado Mérida	4703	2148	2555	1412	
Posgrado en institución pública Mérida	2391	1208	1183	764	
México	4 061 644	1 999 078	2 062 566	394 189	2019-2020
Posgrados	248 018	117 494	130 524	56 643	
Posgrado en institución pública	121 475	61 042	60 433	30 810	
Yucatán	74 763	39 190	40 737	7735	
Mérida	58 926	30 296	33 532	6484	
Posgrado Yucatán	5164	2420	2744	1214	
Posgrado institución pública Yucatán	2534	1323	1211	711	
Posgrado Mérida	4902	2303	2599	1158	
Posgrado institución pública Mérida	2364	1232	1132	670	

Fuente: Elaboración propia con base en la Secretaría de Educación Pública [SEP] (2021)

Methodology

Since scientific research is dynamic, changing and continuous, it also encompasses several stages, and each of these requires support that determines the clarity of the study (Hernández, Fernández and Baptista, 2016). The research approach is presented in stages and is systematic. Thus, it is composed of two stages. And in each one an implemented system is included, with a quantitative research approach, which allowed detecting areas of opportunity for the dissemination and promotion of scientific vocations in young people of higher education in the city of Mérida, Yucatán. The results are presented descriptively, with a correlational scope (Hernández-Sampieri and Mendoza, 2018). Therefore, following Hernández et al. (2016), within the peculiarities of the quantitative method is the required objectivity, precision, numerical and percentage interpretation, necessary for the study. In both stages, the study subjects were young people between the ages of 15 and 29 (Inegi, August 10, 2020). They were young people who were studying at a higher level, although the selection of the educational level was random. The study is exploratory and descriptive (stage one); then the variables are related and the strategies are described (stage two).

The instruments were two questionnaires that were developed on the Google and Microsoft Office 365 platforms, with 29 and 20 items for the first and second stages of the project, respectively. The choice of the questionnaire is contemplated because it is a research instrument that throws an order in its application and the terms of the study. Likewise, it is possible to align the interpretation with the variables and enables the comparison between these and with other studies. As a characteristic of this technique, there is impersonality, as it does not require proximity to the respondent (an essential requirement with the presence of covid-19) (Medina y Castillo, 2003; Santoveña, 2010).

In the first stage, information related to the profile of the study subjects was obtained, it was also inquired about the learning techniques used to strengthen the knowledge of the subjects studied, the knowledge that they have regarding the bases of academic data, the support of information and the subjects that stimulate conscientious research, the above as part of the diagnosis for the generation of the proposed State Congress project on Scientific Vocations in the Youth of Yucatan. In the second stage, the strategies implemented in the project are specified and valued and the profile of the participants is characterized.

First stage of the method: description

In the first stage of the study, the results allowed the diagnosis of scientific vocations to be carried out, that is, the profile of the people who responded to the Yucatan higher-level students instrument, carried out during the first quarter of 2020. This instrument yielded 93.0% confidence and an estimation error of 0.07, with probability in favor (p) and probability against (q) of 0.5, respectively, and a record of 63,828 (SEP, 2020) enrolled students (N). The sample was calculated with the formula for finite populations (Torres, Paz y Salazar, 2006):

$$n = \frac{N\, Z_a{}^2\, p\, q}{e^2\,(N-1)+Z_a{}^2\, p\, q} = 199$$

The instrument was a questionnaire that integrated five dimensions (with a Likert scale [table 2]) and the generalities of the study subject.

Tabla 2. Dimensiones determinadas en el cuestionario aplicado

Dimensión	Enfoque	Indicador	Núm. de ítem
Estrategias de enseñanza	Instrucción del profesor	Saber	1, 2, 15, 17, 28
Calidad	Actividades, tareas, proyectos (alumnado)		10, 11, 22, 23, 24, 25, 26
Disposición	Aprendizaje del alumno	Hacer	3, 4, 5, 7, 8, 18, 19, 20
Estrategias de aprendizaje	Aprendizaje-alumno		9, 12, 14, 27, 29
Investigación	Interés por parte del alumno		6, 13, 16, 21

Fuente: Pérez y González (2020)

The reliability of the items is high, 0.883, calculated through Cronbach's alpha:

$$\propto = \frac{k}{k-1}\left[1 - \frac{\sum Vi}{Vt}\right] = 0.883$$

k = Number of items = 24

Vi = Variance of each item = 9.5284

Vt = total variance = 61.9790

$\propto$ = Cronbach's Alpha = 0.883

In this document, the research dimension is addressed.

Second stage of the method: development

In the second stage of the project, the virtual assistance of 4805 participants was reached, who make up the study sample (higher level students from Yucatan participating in the State Congress on Scientific Vocations in the Youth of Yucatan, held on October 22 and 23, 2020, the event was developed 100% online). The sample was determined based on the formula for finite populations, with 98.0% confidence, 0.02 estimation error, with probability in favor (p) and against (q) of 0.5, respectively, and a population of 63,828 students. top level (SEP, 2020).

$$n = \frac{N\, Z_a{}^2\, p\, q}{e^2\,(N-1)+Z_a{}^2\, p\, q} = 3196$$

With the established profile, a final sample of 3842 students (from 15 to 29 years old) was obtained, who responded to the applied instrument.

Results

First stage of results

In the first stage, responses were obtained from 199 higher education students enrolled in more than 20 academic institutions in Yucatan. The characteristics that these possess are: 94.5% have a single marital status, the predominant age fluctuates between 20 and 24 years, a block that represents 79.9% of the total, the most representative educational level studied was the sixth grade, with 26.5 %, and the majority were assigned to a four-month educational system (60.8%) (table 3).

Tabla 3. Caracterización de los jóvenes sujetos de estudio

	Media	Desv. Estándar	Varianza	Asimetría	Curtosis
Estado civil	1.09	0.463	0.214	6.821	52.203
Edad	1.91	0.44	0.194	-0.445	1.862
Grado	5.71	2.371	5.622	-0.084	-0.893
Sistema educativo	1.39	0.489	0.24	0.446	-1.819

Fuente: Elaboración propia

To answer the initial question, "What is the profile of the students who consider an educational continuity towards postgraduate courses?", the data was analyzed, which showed that 23.0% decide for a postgraduate course and the ages are in the range of between 20 and 24 years old, with 52.0%; Also, 34.0% of young people are between 15 and 19 years old and 14.0% between 25 and 29 years old did not show interest in continuing their studies. The educational level of studies presented variation (table 4).

Tabla 4. Grado educativo de los sujetos de estudio

Grado	Frecuencia	Porcentaje	Porcentaje acumulado
1.º	7	3.5 %	3.5 %
2.º	10	5.0 %	8.5 %
3.º	31	15.5 %	24.0 %
4.º	17	8.5 %	32.5 %
5.º	14	7.0 %	39.5 %
6.º	53	26.5 %	66.0 %
7.º	18	9.0 %	75.0 %
8.º	11	5.5 %	80.5 %
9.º	35	17.5 %	98.0 %
10.º	2	1.0 %	99.0 %
11.º	2	1.0 %	100.0 %
	200	100 %	

Fuente: Elaboración propia

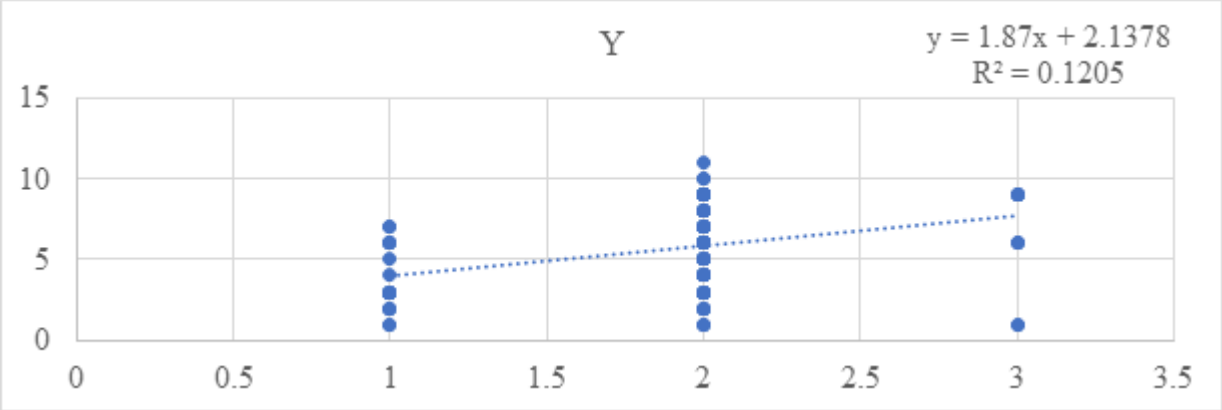
On the other hand, in the proposed hypothesis, H1: There is a relationship between age and educational level of young people in higher education who decide for educational continuity towards postgraduate studies, the result revealed that r = 0.3472, that is, it has a correlation low, so the proposed H1 is rejected, since age is not associated in all cases with the educational level completed in the choice of an educational continuity (figure 1).

$$r = \frac{n\,(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\,\sqrt{n(\sum y^2) - (\sum y)^2}} =$$

$$r = \frac{199\,(\sum 2241) - (\sum 380)(\sum 1136)}{\sqrt{199(\sum 764) - (\sum 380)^2}\,\sqrt{199(\sum 7598) - (\sum 1136)^2}} =$$

$$r = \frac{445959 - 431680}{\sqrt{7636}\sqrt{221506}} = \frac{14279}{(87.38)(470.64)} = \frac{14279}{41124.52} = 0.3472$$

Figura 1. Relación grado educativo y edad de los sujetos de estudio

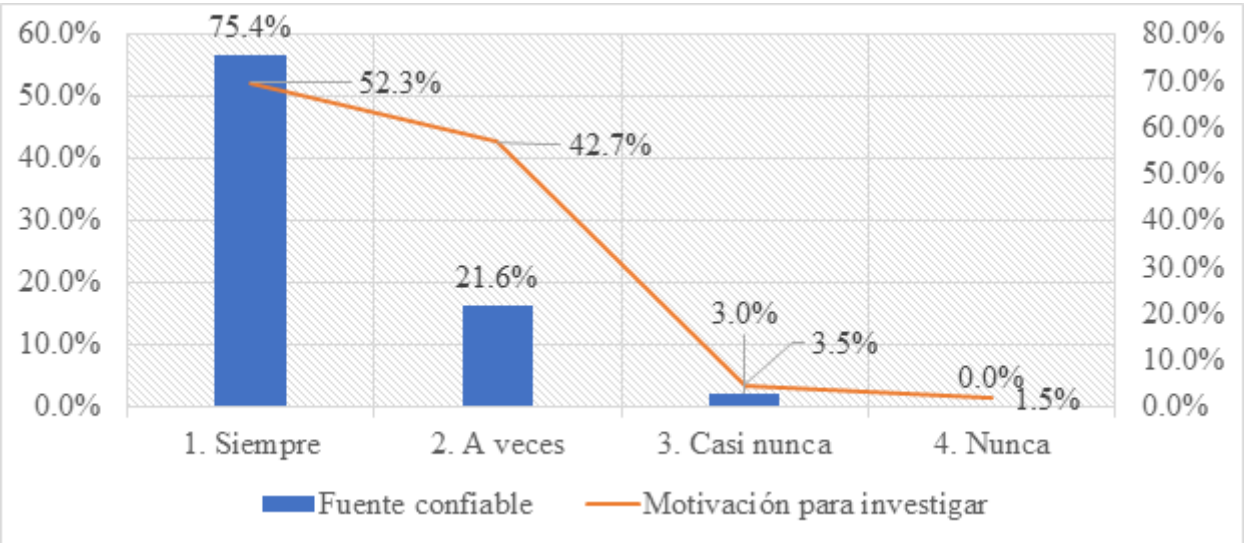


Fuente: Elaboración propia

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}} = \frac{0.3472}{\sqrt{\frac{1-0.1205}{199-2}}} = \frac{0.3472}{\sqrt{\frac{0.8795}{177}}} = \frac{0.3472}{\sqrt{.0045}} = \frac{0.3472}{0.0668} = 5.2$$

Regarding the sources where information is obtained for the tasks, practices and exercises, 75.4% of the students considered that they are reliable; but regarding the motivation to investigate, this presents a result of 52.3% in its realization (figure 2).

Figura 2. Frecuencia en la consulta de fuentes confiables y motivación hacia la investigación



Fuente: Elaboración propia

In response to the question posed that inquires about which are the subjects that promote research in higher level students, it was obtained that, based on the information collected from the study subjects, the subjects that promote research, in the first instance , are "Research methodology" and "Oral and written expression", the above expressed by 65.0% and 15.0%, respectively. Regarding the activities where research is encouraged in the classroom, it was detected that it is through the projects that higher level students develop and through the exhibition activities that young people carry out, mainly.

Second stage of the results

In response to the question "What are the information search spaces used to carry out research activities?", it was detected that 31.4% of young people do not have knowledge of the spaces called academic databases such as Elsevier, Redalyc, Scielo, Eric, among others, to search for information; It was also obtained that the information search spaces that are used in a greater proportion for academic activities are the open search spaces of Google and Academia.edu. On the other hand, it was detected that the professors use the names of the academic databases to suggest the search spaces for the information required in their subjects, however, they do not specify how to obtain that information and access it.

Based on the above, it was proposed to strengthen these scenarios with the following schemes for the promotion of scientific vocations: through workshops, conferences and presentations for the scientific dissemination of research results.

Scientific communication was carried out through conferences, workshops and presentations, using virtual spaces, live broadcasts through YouTube and Facebook, digital flyers as dissemination documents, social networks such as Facebook and Instagram, spaces where greater socialization of the study subjects.

In the development of the activities for the promotion of scientific vocations, internal strategies (table 5) were designed in the leading organization of the event, as well as to strengthen the actions in collaboration with the strategic allies (academic institutions [Autonomous University of Yucatán, Technological National Institute of Mexico-Technological Institute of Motul, Polytechnic University of Yucatan-BIS, Secretariat of Research, Innovation and Higher Education of the state of Yucatan]).

Tabla 5. Estrategias para el fomento de las vocaciones científicas en conectividad virtual 2020

Concepto	Elemento	Estrategia	Objetivo	Meta/Indicador/ Responsable
Estrategia	Procesos	E1: Distribuir las responsabilidades para el desarrollo del Congreso Estatal las Vocaciones Científicas en los jóvenes de Yucatán	*1)* Generar invitaciones para los aliados estratégicos e invitados especiales *2)* Asignar responsabilidades con relación a las 4 grandes actividades (Conferencias, talleres, ponencias) *3)* Supervisar la asignación y avance de las responsabilidades	Director de división Meta 1: Realizar cuatro invitaciones para los aliados estratégicos, seis para conferencistas y 10 para ponentes Indicador 1: Total de invitaciones realizadas/Invitaciones establecidas según actividad Meta 2: Medir avances de los responsables Indicador 2: Total de respuesta obtenidas/Total invitaciones enviadas según actividad
	Difusión	E2: Establecer la frecuencia de divulgación de la publicidad asociada a	*1)* Valorar la imagen del evento, para el envío al área de comunicación	Director de división/vinculación

		las actividades involucradas en el programa	social del gobierno del estado (CSGE) *2)* Solicitar el diseño de los *flyers* del evento (conferencias, talleres, ponencias) *3)* Programar con el área de vinculación la difusión del programa con un mes de anticipación	Meta 1: Aprobación de la imagen del evento dirección de administración/CSGE Indicar 1: Imagen aprobada/Cantidad de imágenes diseñadas Meta 2: Diseño de *flyers* publicitarios del evento Indicador 2: Cantidad de *flyers* aprobados/Cantidad de *flyers* diseñados Meta 3: Difusión de los *flyers* en línea
	Comunicación digital	E3: Programar las pruebas para la transmisión de las conferencias, talleres, cursos y ponencias generadas para y por los jóvenes estudiantes de nivel superior	*1)* Calendarizar las conferencias, talleres y ponencias *2)* Establecer los horarios para las pruebas de transmisión para cada actividad (conferencias, talleres, ponencias)	Director de división/responsable técnico Meta 1: Divulgación en capítulos de libro de las ponencias generadas por los alumnos (100 autores) Indicador 1: 100 autores con artículos

			3) Establecer responsabilidades de transmisión y moderación del evento para cada actividad (conferencias, talleres, ponencias)	aceptados/100 autores que enviaron artículo × 100 Meta 2: Generación del calendario de las actividades (conferencias, talleres, ponencias) Indicador 2: 3 calendarios por actividad final/3 calendarios solicitados × 100 Meta 3: Un responsable por actividad Indicador 3: 1 responsable asignado por actividad/1 responsable delegado por actividad × 100 =
	Divulgación	E4: Evaluar el registro de participantes al evento y conectividad virtual	*1)* Monitorear el registro de participantes al Congreso *2)* Verificar la conectividad de los	Responsable técnico Meta 1: asistentes a talleres = 400 estudiantes

			estudiantes de nivel superior de las instituciones invitadas y de la institución sede del evento virtual	Indicador 2: Cantidad total asistentes a los talleres programados/400 estudias programados para los talleres Meta 2: asistencia conferencias 4500 estudiantes de nivel superior Indicador 2: Cantidad de asistencia virtual conferencias/4500 asistentes programados × 100

Fuente: Elaboración propia

1) Goals

a) Established goal: authors (higher education students: 100, through the publication of book chapters, generated through their presentation at the event, as a presentation)

b) Goal achieved: 105 students presented their papers in a format of 50 articles.

c) Exceeding the goal: 4,635 high school students enrolled.

i. Indicator = goal achieved/goal set × 100 = 105/100 = 1.05 × 100 = 105 % authors (higher level students)

After establishing strategies according to activities involved in association with the goals achieved, these reflected the following:

1) *Process strategy:* distribute the responsibilities for the development of the State Congress on Scientific Vocations in the youth of Yucatan.

a) Goal: strategy that was 100% fulfilled with the sending of the invitations, however, the co-responsibility towards the event was 50.0% in the

strategic allies (academic institutions, which is associated with the lack of experience of the host institution of the event in the first instance and followed by the times in the destination of the resources for the development of the project).

2) *Diffusion strategy:* establish the frequency of diffusion of publicity associated with the activities involved in the program.

a) Goal: this strategy is achieved intensively, considering the resources allocated to September 30, 2020 and the implementation of the project on October 22 and 23 of the same year (considering that for its dissemination, the approval of Communication is required). Social of the receiving entity). It was covered in 15 days intensively using social networks (Facebook and Instagram) and the press for its dissemination, as well as through strategic allies and other instances in order to have the participation and virtual assistance of young people from Yucatan. Indicator = 40 approved flyers/40 designed = 1 × 100 = 100% effectiveness.

3) *Digital communication strategy:* schedule tests for the transmission of conferences, workshops, courses and presentations generated for and by young higher level students.

a) Goal: the indicator reflected that 100% of the lecturers, workshop leaders and speakers carried out the connectivity tests prior to the event. Speaker indicators = 105 speaker authors carry out connectivity tests/100 speakers scheduled = 1.05 × 100 = 105 %

4) *Dissemination strategy:* evaluate the registration of participants to the event and virtual connectivity.

a) Goal: the results of the evaluation of the following indicators:

i. Viewing the event = more than 11,000 students (link http://vc20.utmetropolitana.edu.mx/Default.aspx)

ii. Results achieved in the State Congress on Scientific Vocations in the Youth of Yucatan:

1. 42.46% of the attendees were women (2,040) and the remaining 54.01% were men (2,595) of higher education

2. Teachers = 59 women (1.22%) and 54 men (1.12%)

3. Other activities = 35 women (0.72%) and 21 men (0.43 %)

iii. Workshop attendees: 400 higher education students (250 of them women and 150 men):

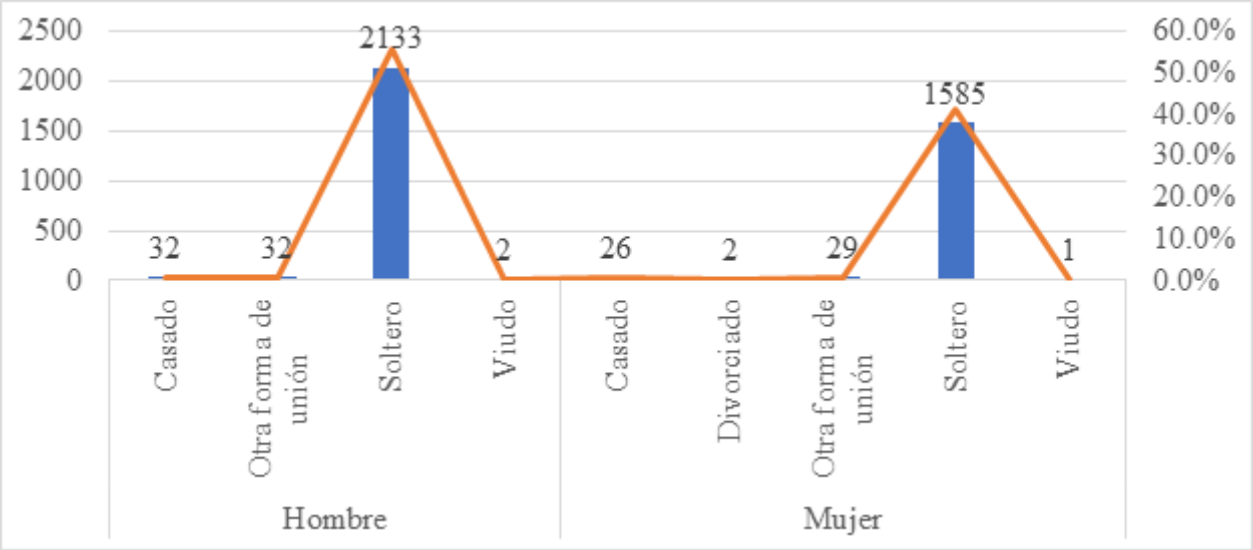
1. Results achieved derived from the State Congress on Scientific Vocations in the Youth of Yucatan = 1020 women (33.28%) and men 1599 (21.23 %).

iv. Lecture attendees: 4,500 high school students from public institutions, records and views the following:

1. Master conference: "Social responsibility as a framework for innovation and entrepreneurship" = 2,993 views (link: https://www.youtube.com/watch?v=RUODILW9F18)
2. Master conference: “Innovation and entrepreneurship in companies in Mexico” = 2,780 views (link: https://www.youtube.com/watch?v=kttS0_0IBFM)
3. Keynote: “Geospatial and remote sensing technology” = 3513 views (link: https://www.youtube.com/watch?v=Ksuc4FnfJe0&t=17s)
4. Total views = 9286 related to the three scheduled keynote speeches

According to the number of participants in the State Congress on Scientific Vocations in the Youth of Yucatan, it was identified that of 4,805 (total participants), 80.0% were young people between 15 and 29 years old. Of them, 57.2% were men, whose marital status was single in 55.5% of cases; in relation to women (42.8%), 41.3% were single (figure 3). The participation of 60.7% between the ages of 20 and 24 of the young higher level students stands out, 32.5% are between 15 and 19 years old and 6.8% between the ages of 25 and 29.

Figura 3. Participación según sexo y estado civil



Fuente: Elaboración propia

Discussion

Scientific dissemination through the different projects for the promotion of scientific vocations plays a fundamental role, since it is required to make science, scientific and research projects accessible in order to make it part of a culture, of a culture continuous and integration for a correct and concrete choice (Briceño, 2012). In the same way, the territory where the activities are carried out must be considered, due to the availability of technology and resources for virtual connectivity, a factor in which institutions, teachers and managers intervene for precise guidance regarding times. , spaces and means of greater economic accessibility for higher level students.

Awakening the interest of young people in science and technology requires the continuity of actions aimed at their participation, for example, through the establishment of programs for the integration of this profile (15 to 29 years old), where they integrate science and research projects and that have a space for the dissemination of their scope. It is from the above that a greater interest of these is awakened. However, in institutions of higher education, a program has not yet been defined and established in a concrete way; For its continuity, it depends on the calls and the resources they provide.

According to Simarro (2012), the world of work needs people with scientific-technical skills, as well as skills for inquiry associated with science, technology, engineering and mathematics and art, which indicates that skills are not only related with the application

of the theory in a world of work, it implies openness and interest in the sciences and the research that consolidates them, which will generate added value in the know-how of the higher level student. Contrary to what the students of the sample of the present work consider, since 77.0% have the objective of joining the productive sector, omitting precise actions of science and research in their preparation at the higher level.

Hence the relevance of promoting scientific vocations and dedication through the design of internal strategies of the organizations hosting the events. Undoubtedly, the comprehensive work of the entire structure of the institutions is required. Inter-institutional linkage plays a fundamental role in reaching new spaces and territories where youth reside and can visualize the efforts made for this purpose and the technological and resource implications are less limiting and more accessible to them. The absence of techniques and tools for research aimed at young people in teaching is also detected, as well as the precise review of projects, tasks and research inherent to the subjects in the institutions, which affects the interest and desire for education. research or science, but above all in visualizing in these a high level of complexity.

Conclusions

In general, it was possible to detect that under the online modality the promotion of scientific vocations in the young people of Yucatan during the covid-19 pandemic stimulated research activities in Yucatan and other states that participated. Under this approach, it is moving towards an educational and teaching culture, strengthening research and its support through the search for information in academic and specialized databases that allow better quality products, projects and research from teachers, researchers, but mainly to guide the higher level student towards that path. In effect, the level of higher education is a space to consolidate science and technology, so that the student glimpses the postgraduate scenario as a space for integration in areas related to her specialty.

Future lines of research

In this way, the following lines of research can be proposed that can guide the effort to promote scientific vocations and that contribute to the integration of young people in higher education by decision and professional choice towards postgraduate courses aligned

with research and science: a) gender perspective in scientific vocations and b) scientific culture.

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