La percepción de la ciencia, tecnología e innovación en estudiantes del nivel medio y medio superior de la Zona Metropolitana de Guadalajara, México.

The perception of science, technology and innovation in students of middle and Higher Education of the Metropolitan Area of Guadalajara, Mexico.

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Resumen

La ciencia ha fortalecido a través de la historia, la consolidación de los procesos tecnológicos y ha impactado en la cultura de los pueblos. Al formar parte de la cultura de la sociedad -incipiente en algunos casos, consolidada en otros- la ciencia ha colaborado en el entendimiento del momento histórico que viven las personas, se habla entonces de una cultura científica. En México, en los últimos 12 años, se han realizado diversos intentos por conocer aspectos diversos de la cultura científica de los mexicanos, a partir de conocer su percepción social de la ciencia. Las encuestas aplicadas por el Consejo Nacional de Ciencia y Tecnología. El Sistema Educativo Mexicano reconoce que la educación debe proporcionar una formación científica básica para brindar una plataforma común que atienda las necesidades educativas de los adolescentes y dé respuesta a las demandas de la sociedad, impulsando a la vez vocaciones que habrán de contribuir al desarrollo científico y tecnológico del país.

En general, la enseñanza de la ciencia ha tratado de promover en los estudiantes una actitud científica, es decir intentar que adopten como formas de acercarse a los problemas los métodos de indagación y de experimentación usualmente atribuidos a la ciencia (Pozo, 2009).

La presente investigación analiza la imagen que sobre ciencia y tecnología tienen los estudiantes del nivel medio y medio superior de la Zona Metropolitana de Guadalajara del

Estado de Jalisco México, utilizando una metodología cuantitativa a través de la técnica de la encuesta "Percepción de los jóvenes sobre la ciencia y la profesión científica" del Observatorio de la Ciencia, la Tecnología y la Innovación del Centro de Altos Estudios Universitarios de la Organización de Estados Iberoamericanos (OEI), tomando una muestra representativa de 1,222 alumnos.

La imagen global obtenida es ligeramente positiva, las características más valoradas son las contribuciones a la curación de enfermedades, a mejorar la vida diaria o para el desarrollo social y el futuro. La percepción de los impactos negativos son: la incapacidad para resolver la pobreza o el hambre y la falta de confianza social. Por último, se examinan las implicaciones de los resultados de la educación científica y la comprensión pública de la ciencia y la tecnología.

Palabras claves: Percepción, ciencia, vocaciones científicas.

Abstract

Science has strengthened throughout history, the consolidation of technological processes and has impacted the culture of peoples. Become part of the culture of the society - emerging in some cases, consolidated in other- science has contributed to the understanding of the historic moment that people live, one speaks then of a scientific culture. In Mexico, for the past 12 years, have been made various attempts to learn about diverse aspects of the scientific culture of Mexicans, from know your social perception of science. The surveys implemented by the National Council of Science and Technology (CONACYT). The Mexican educational system recognizes that education should provide a basic scientific training to provide a common platform that serves the educational needs of adolescents and to respond to the demands of society, at the same time promoting vocations which will contribute to the scientific and technological development of the country.

In general, the teaching of science has tried to promote a scientific attitude in students, i.e. try to adopt as ways of approaching the problems methods of inquiry and experimentation usually attributed to science (Pozo, 2009).

This research analyzes the image level students have middle and Higher Education of the Metropolitan Zone of Guadalajara in Jalisco State, on science and technology, using a quantitative methodology through the technique of the survey "Perception of young people about science and the scientific profession" of the Science Observatory, Technology and the Innovation of the Centre of High University Studies of the Organization of IberoAmerican States (OEI), taking a representative sample of 1,222 pupils.

The overall image is slightly positive, the most valued features are contributions to the cure of diseases, to improve everyday life or for social development and the future. The perception of the negative impacts are: the inability to resolve the poverty or hunger and the lack of social trust. Finally, discusses the implications of the results of science education and public understanding of science and technology.

Key words: Perception, science, scientific vocation.

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Introduction

The Ibero-American Observatory of science, technology and the society of the Centre of High University Studies of OEI as research established the social perception since 2008 with which oriented his studies towards the articulation between the scientific and technological field and the educational system of level means, under the common denominator of the issue of the promotion of scientific careers among students, having as project leader Dr. Carmelo Polino who has coordinated several studies on these topics in Latin America with the aim of promoting scientific and technological vocations in the young, as well as to analyze the image of young people about scientists and science materials (Polino, 2007, 2010, 2011). The execution of the projects that have been undertaken has been possible thanks to the work of a wide network of collaboration represented by agencies and key institutions of the region, many of them more than one

decade ago that they actively cooperate with the Organization of Ibero-American States (OEI) in the development of the themes of social perception and scientific culture.

The projects carried out between 2008 and 2010 in which met almost nine thousand students in Latin America that make up a representative sample of students of middle and upper level of some capitals, cities and its peripheral areas: Asunción, Bogotá, Buenos Aires, Lima, Madrid, Montevideo and Sao Paulo. In 2012 opens the project in the metropolitan area of Guadalajara, Jalisco, Mexico, taking this study as part of my training from the Master in Management of Science and Innovation and doing fieldwork in December 2013.

Current knowledge

Support for young people to study science and technology reflects a need for public policy as expressed in the Education Goals 2021 as a dynamic program of Latin American knowledge space. In this way, the Centre has collected a problem arise increasingly in educational and scientific institutions, namely concern for the relative stagnation or decline in university enrollments in areas of exact, natural and engineering sciences are key to meeting future challenges with the productive and economic systems of contemporary democracies in Latin America. (Daza, 2011).

One of the particularly sensitive to the issue of science education and, of course, for policies promoting vocations in science, is the problem of insufficient quality of training provided by the middle school today. The document of the Goals 2021 (A. Marchesi, 2009), we propose in this respect that among the main challenges are the lack of competitiveness of public schools, the difficulties of an attractive curriculum and academic performance poor results that have students in the region, compared with young people in developed countries. Performance evaluations as SERCE (UNESCO-OREALC) and PISA (OECD) set the distance between the Latin American countries, especially, and developed countries.

If appeal to the figures is particularly relevant for educational assessment policies, it is also important to note what happens in the pedagogical context of the classroom, where the daily interaction between teachers and students is given. On the one hand, we have some partial evidence to say that a significant part of adolescents, for example, notes that science subjects are bored or are difficult to understand or they do not believe they have increased their appreciation for nature or offer solutions or improvements in their daily lives. These data come from a survey of a representative sample of students from Buenos Aires and São Paulo, and are part of an ongoing investigation of the Latin American Observatory of Science, Technology and Society OEI, which also involved young people in Asuncion , Bogota, Lima, Lisbon, Madrid, Montevideo and Santiago de Chile.

On the other hand, teachers also recognize limitations that affect quality. In the case of Buenos Aires, another ongoing investigation of the Observatory indicates, preliminarily, that teachers are concerned that
They have to devote a significant portion of class time to hold your students (either behavioral problems or family distress); that programs are becoming less satisfied, because there is no time for exhausting; blurred strikes educational planning; that students have significant attention deficits; it costs them to relate contents of a field with another, or find meaning and practical usefulness of what they are seeing in classes; and who also have an accompaniment in the family to serve them support and encouragement.

The general feeling is that things have leveled down. The question that remains is: to what extent this represents an extendable paint reality in Latin America? and, in turn, how this problem can be seen, with its logical nuances, in other countries of Latin America?

These indications, however, not difficult to understand the tremendous difficulties faced by the segment of students who can afford to pursue higher education when he graduated from school. Even youth from families with some capital (symbolic and material), conclude that the middle school did not prepare well enough to study at a university. And it is not just knowledge (which is a problem in itself a considerable extent), but also skills and dispositions to deal with college life. Is there a significant gap, as mentioned by many experts, but appears to increase the extent to which the educational crisis deepens.

And this is the backdrop against which we must project some of the issues concerning the promotion of scientific vocations among adolescents, adopting socially inclusive criteria. Certainly, beyond the need for a country to have institutional strengths that make the scientific profession for young attractive, we can not fail to recognize that training in science and engineering is largely tied to the fate of secondary education today in a cone of shadow.

For there to be scientists, engineers and citizens with good basic training has to be at the same time a concrete social demand. Living in the twenty-first century makes us reflect on the rapid changes that our society has undergone, environmental changes, ideological, but it is especially important fact to recognize that we live in the era of technology, leaving behind the traditional way of communicating, to insert ourselves in the called era of communications, where the use of the Internet, cellular technology and video games are making our young people to make technology more activity into your daily life. Where also the taste for science and scientific careers is increasingly difficult to promote it, ie young people prefer to pursue careers that do not contain materials science, especially mathematics., As there seems to be racing more practical than requiring them less intellectual effort pays off them greater economic gains.

In a study by. (Gartner Isaza, 2010), S & T students and teachers of the University of Caldas. Some results show students that science and technology associated with positive effects for the development of humanity, they also note that the development of science and technology is implicit in communications, health and the productive sector, where its benefits are recognized and consequently is favored area of human and social development, but on the other respondents commented that S & T has also worked for weapons development, which has potentiated risks to destroy mankind.

Despite its benefits students report that S & T is not accessible to all people, and as for the image of the scientist considered unattractive, poorly paid and poorly recognized by society, but in general seems more attractive than teachers. Scientists find it difficult to find work and to consider that in this region there is no proper development of science emphasizes the respondents.

(Ibid) However in Bogotá if the profession is valued as a scientist, but agree with other reviewers that it is not well paid, nor attractive to young people. By contrast, in Spain the FECYT Cited by. (Gartner Isaza, 2010) mentions that the profession as a researcher is attractive for young people and if there is a high social recognition, this positive assessment increases as you get older in people.

Following international studies as one of the multiple objectives of STS education is the scientific and technological literacy for all people, and the goal of science to the literacy teaching and non-exclusive exclusive content is necessary, it is also important to emphasize learning procedures and attitudes, and to adopt assessment criteria consistent with that content. As quoted by Alonso Vázquez & Acevedo Diaz. (Attitudes of students on science, technology and society, evaluated with a model of multiple response, 2006).

In this research, rescue phrases as: which scientists investigate issues that are important to some people, some students involved in this research say that they do not like science and should not force them otherwise, but also accept the advance of science leads to new technologies where they provide to society the means to improve or destroy itself. (Ditto).
Another idea is that students show science is not related to the real world, ie it does not help them solve situations of everyday life. What has somehow caused that young people have as main study options traditional careers such as medicine, engineering and law among others and not feel any sympathy for the study of science as a profession.

Continuing students' beliefs about CTS, another study by. (Acevedo Diaz, 2001) reports that students visualize scientists and brilliant people, honest and very dedicated to work, furthermore considered essential to society, although consistent with the belief that their activity as scientists is boring, which are lonely people working in isolation, and sometimes are crazy. Contrary to this other respondents consider scientists as they relate to others as ordinary people.

Continuing with the opinions of students from different countries, Canadians for their part, tend to confuse science with technology, due in part to the myth that technology is applied science, science and also more positively influences the technology in the society, since they associate with medical research science [ie discoveries to cure diseases], and secondly

the technology associated with pollution, and weapons [as wars, destruction, pollution, etc.]. (Ditto).

In research conducted in Israel by Ben-Chaim and Zoller in 1991, cited by. (Acevedo Diaz Vazquez Alonso, Manassero Mas, & Acevedo Romero, 2002), the prevailing view that scientists are primarily responsible for the damage caused his discoveries. Additional concerned about the obligation of scientists to inform the society in a clear and comprehensible manner on their discoveries.

In Spain. (Solbes & Vilches, 2002), performed a study on the visions of high school students about CTS interactions, and some of the results are that students are positive about the role played by physics and chemistry, say that these materials help make a more comfortable life, who supported both for society as humanly technical progress has, since its purpose is to help the development and human welfare.

In the perception of scientists believe that these ought to worry more to seek remedies to cure diseases, rather than worry about creating nuclear weapons., Because they are aware that science helps many people overcome illness, but know Some products also environmentally friendly. (Ibid)

Scientists also believe that help humanity with their inventions and are people willing to give everything for science research to address some problems, few students find negative aspects in science, as it relates to the manufacture of the pump atomic, and / or weapons in general and cloning of living beings. (Ibid)

As he mentioned. (Acevedo Diaz Vazquez Alonso, Manassero Mas, & Acevedo Romero, 2002), evaluation study on the effects of matter CTS, in Spain, in which high school students do some questions about why invent labor-saving machines then if they cause unemployment? Or Why defend a country with nuclear weapons if they threaten life on earth? So it convenient that people should study more science to understand it better, as this, believe directly affects only those people who show interest in it.

They consider it important positive and negative consequences of S & T are known, always remembering that the goal of science is to make our world a better place to live.

Similarly. (Polino, 2011), points out that science is not seen as career options, only 20% of students surveyed expressed interest in scientific work, while a third felt that scientific careers were not considered attractive for the youth of his generation.

Following the same idea, a good number of teenagers claim that science subjects are boring, or find it difficult to understand, and this situation relate to teaching using teachers who teach science, where science leaves them meaningful learning, that is, as already mentioned learning science does not guarantee solving everyday problems. (Ditto).

This could be an argument for why young people are not interested in choosing careers that have to do with science, since little or inadequate approach they had with them has not piqued your interest. According to the above it is necessary to speak of a scientific and technological literacy, says Acevedo et al; 2002; Manassero and Vazquez, 2001; Rubba and Harkness, 1993; Solbes and Vilches, 2001 and 2004), cited by. (García-Ruiz Peña González, Alonso, & Angel, 2009) Given that studies in Mexico, shed as a result, teachers and students do not have adequate understanding of CTS.

And conception problems and attitudes of teachers in basic and upper towards science and environmental education. Another problem is that only 7% of students who finish basic education continue to higher education, of which a very small number working in the area to be formed. These children and youth who do not continue their studies are disadvantaged in access to knowledge in science and technology, in relation to that if they finish a race.

An indicator of the need for this literacy are attitudes toward CTS and its relation to the environment, this shows that there is in Mexico a minimum teaching about CTS, which makes for a poor understanding of their agenda items environmental, forcing us all to show the right attitude about science and technology and their relationship to health and the environment. (Ibid)

Continuing studies in Mexico. (Marquez Nerey & Tirado Segura, 2009) shows that teens who have more education tend to have more educated judgments about the possibilities of scientific knowledge. Within technology, the Internet occupies a very important place in

their technological imaginary, then come to him to solve all your doubts and is the most visited them as a source of school consultation. Other translations of the study is inadequate vocational guidance in science, as a consequence of the limited success of the dissemination and appropriation of scientific and technological knowledge among adolescents.

For their part, public school students relate scientific knowledge with a positive relationship to science and interest in careers natural sciences, while students attending private schools, associated with technology and behavioral habits of character staff, children of mothers with secondary education scientific knowledge associated with positive attitudes to science and technology, and the children of mothers with college he joined the usefulness of learning. (Ditto).

Continuing young Mexicans, they say they do value science and technology, but they are poorly informed and interested in scientific and technological issues, do not know the Mexican scientists, because their interest lies in the social and sporting activities rather than issues of science and technology . Therefore it becomes important scientific dissemination as a teaching resource, a source of learning, and studied in the field of non-formal education and to complement the formal curriculum teaming for it and overall training of young , enabling them to learn to know, learning to be, learning to live together and learning to learn, as noted by UNESCO., cited by. (Ibid)

Meanwhile (Santos Fajardo, 2006), studied with young Tabasco, says these young people surveyed express their idea of science citing that make great discoveries find their relationship, say that the main cause of improving the quality of life due to advances of science and technology, and also they believe that the application of science and technology increase job opportunities, say that the main problems of science are to use the knowledge for the wars and the loss of moral values.

To conclude Santos Fajardo said that Mexico who still invertirle enough to the field of science and technology, this despite the recommendation made by the Organization for Economic Cooperation and Development [OECD], nevertheless, 18- and 30 years as very important the work of science and technology. Even though for them unattractive, poorly

paid, and little socially recognized situation causing some researchers to go abroad, where they provide more resources to conduct research with better salaries. (Ibid)

Regarding the figure has the scientist in study. (Dominguez-Gutierrez, 2009), Mexican students describe him as a seeker of truth, critics and a privileged mind, also seems a complex, difficult and strange person, Gutierrez Morfileño quoted by. (Santos Fajardo, 2006), says that scientists are people with white coats, goggles and older, who have sold Picture mass media, and which obviously are not identified (Dominguez-Gutierrez, 2009), concludes that young people with the word science provokes contrary feelings like happiness, laziness, indifference, pleasure, but also not motivate teachers who have confusion between science and technology, and also often confused with a scientific communicator or pseudo scientific.

Finally, in assessing the effects of matter CTS ,. (Vazquez Alonso., Acevedo Diaz Mas Manassero, & Acevedo Romero, 2006), close by saying that it is necessary for the teaching of science is on the same page of the objectives of the movement of CTS, which favors in the attitude of the the issue of S & T students. Therefore proposes that knowledge are based on a scientific culture, open to other disciplines, contained proposals avoid excessive obstruction and try academic and theoretical issues. As students do not find their connection with everyday life.

The teaching of science in basic education must be compulsory, aim for students to understand the functionality of science and technology today, without wishing only to train scientists. (Ditto). We can conclude that know the perception of high school students and high school students about science and his attraction to her profession, will give elements to promote a scientific culture within universities promoting the creation of workshops which provide scientists but significant knowledge high school students.

On the other hand it has questioned the education systems of the need to meet the demand for skilled professionals, throwing to scientific careers do not look attractive to young people, who not displayed as part of its future, as they consider to be careers that do not allow them easy entry into the labor market and they also do not generate economic returns. And even when they are required to carry materials science, they believe they are

boring, difficult, they do not understand them and they do not find it brings them to their daily lives.

Therefore, the importance of scientific literacy in basic education, with teachers who awaken and foster a love of science and that this generates sufficient tools to properly route to a vocational guidance is clear where the figure of the scientist and his activities not formed from the media, but through a methodology used by the teacher, consisting of an everyday approach to science and the activities of a scientist. It is also important that teachers Educate students from basic education levels distinguish science from technology, the benefits that we each, as well as the obligation to use it responsibly. Especially if it has been argued that today's society is the knowledge.

Methodological framework

General objective:

Analyze the perception of students about science and technology in the high school and middle level of the Metropolitan Area of Guadalajara in order to make proposals to foster a culture of popularizing science among young people.

Specific objectives:

- Know the perception that students from high school and half of the metropolitan area of Guadalajara, Jalisco, have on scientific vocations and their vision for their own professional development, analyzing if they consider the scientific profession as a job option.
- Identify the image that students have about science and technology and on scientific, identifying their interests in science and how they perceive those engaged in scientific work.
- To investigate the contribution that science subjects in different areas do students determine if being in contact with these materials has changed his lifestyle.

- Determine if the news habits of students are sufficient, according to the consumer that make the media and the type of queries that perform.

Methodology

Type of study:

The research is applied type and used the technique of self-administered survey within the campuses. The corresponding sample is selected for each group, students were cited in the computer classrooms of higher education institutions selected and answered the questionnaire online at the following address: www.surveymonkey.com in the case of the sample in Guadalajara Metropolitan Area.

Instrument:

The instrument used for the study is a questionnaire that has been applied in the study by Chiappe and Polino in 2008 in Buenos Aires, Argentina, where the perception of young people about science is measured and the profession scientific, whose results were published in 2009.

Method and procedure

The survey was conducted on a representative sample of students from middle and upper middle of the metropolitan areas of the cities of Asuncion, Bogota, Buenos Aires, Lima, Madrid, Montevideo and Sao Paulo from 2008-2010 and in 2012-2013 Guadalajara Metropolitan Area. The overall design consisted of a self-administered survey, implemented under supervision, in educational institutions themselves. The designs of the samples in each city respected common parameters for comparison while considering the specificities of different population universes, in each case using the statistics provided by the relevant government agencies.

Methodological Showcase

This was a cluster sample in two stages: the first consisted of the probabilistic selection with probability proportional to size of educational establishments and the second in the quota selection of a division to be surveyed within each school. It is noteworthy that the quotas were defined as the "year of study".

Analysis dimensions

1. Image of science and technology
2. Representation on scientific careers and profession
3. Perception of vocational training and science careers
4. Assessment of the contribution of science subjects in different aspects of life
5. Habits information on science and technology
6. socio-demographic characterization of students

Results and discussion

The following table shows a comparison of the nine studies conducted in Latin America from 2009 to 2013, highlighting the geographical area of application in cases of Asuncion, Buenos Aires, Lima, São Paulo and Guadalajara applied in metropolitan areas, taking care always shown representativeness and with a confidence level of 95%.

Table No. 1

Comparative studies of perception of science among young people conducted in Latin America 2009-2013

Ciudad	**Area Geográfica**	**Año de estudio**	**Tamaño de la muestra y margen de error**	**Trabajo de campo**
Asunción	Área Metropolitana de Asunción (AMA) que incluye a la ciudad de Asunción y las ciudades periféricas.	Estudiantes de Primero a Tercer año de la Educación Media.	1.248 casos, con un margen de error de ±2.8% (para un nivel de confianza del 9 5%).	Junio-Septiembre de 2009.
Bogotá	Bogotá	Estudiantes de 10º y 11º grados.	1.199 casos, con un margen de error de ±2.8% (para un nivel de confianza del 95%).	Octubre-Noviembre de 2009.
Buenos Aires	Área Metropolitana (AMBA) que incluye a la ciudad de Buenos Aires y a los 24 partidos del Gran Buenos Aires "tradicional."	Estudiantes de Primero al tercer año del Polimodal (Gran Buenos Aires) y Tercero a Quinto año del secundario (Ciudad de Buenos Aires).	1.080 casos, con un margen de error de ±2.8% (para un nivel de confianza del 9 5%).	Octubre-Noviembre de 2008.
Lima	Area Metropolitana.	Estudiantes de 3º a 5º Año de Secundaria.	1.300 casos, con un margen de error de ±2.8% (para un nivel de confianza del 95%).	Septiembre-Noviembre de 2009.
Madrid	Comunidad Autonómica de Madrid .	Estudiantes de 3º y 4º de la ESO y 1º y 2º de Bachillerato.	1.316 casos, con un margen de error de ±2.8% (para un nivel de confianza del	Abril-Mayo de 2010.

Ciudad	**Area Geográfica**	**Año de estudio**	**Tamaño de la muestra y margen de error**	**Trabajo de campo**
			95%).	
Montevideo	Montevideo	Estudiantes de 4º, 5º y 6º año de Liceo.	1.485 casos, con un margen de error de ±2.4% (para un nivel de confianza del 95%).	Abril-Julio de 2009.
São Paulo	Municipío de São Paulo (regions Centro, Leste, Norte, Sul).	Estudiantes de 1º a 3º Ano de Ensino Medio.	1.204 casos, con un margen de error de ±2.4% (para un nivel de confianza del 95%).	Octubre-Noviembre de 2008.
Guaalajara	Zona Metropolitana de Guadalajara	Estudiantes del 3 año de secundaria y 1º, 2º y 3 de bachillerato.	**1,222 casos, con un margen de error de ±2.4% (para un nivel de confianza del 95%).**	Julio-diciembre del 2013

Source: Polino, C. (2011). Students and science. Ibero-American Youth Survey, Buenos Aireas, OEI. Calderon, R and Jimenez, J. (2013). Perceptions Survey in Youth Science ZMG, Mexico, UdG.

To avoid bias in the information sought to achieve representative samples be balanced by gender, but are slightly more participation of women in relation to men, this coincides with the increased enrollment by women in Latin America, not being the If Spain where we have slightly more participation by men.

Within established parameters also it sought that the application does not give in one (public or private) region if not participate both according to their level of absorption of enrollment for secondary level and high school finding greater participation of Institutions public higher education, but stresses that in Lima mostly private institutions participated guy with a 73.9 cases.

As for the distribution by educational sections the selection of studies realized as the first installment secondary education levels and second sections of first to third high school and the last of the sections was ranked fourth through sixth high school, finding greater participation between the second and third sections, this is very important because these sections are generally students in the choice of career is when we can influence through adequate vocational guidance.

Another point that was addressed in the survey was related to the image of the scientific finding that young people who participated in these studies agreed on the grounds that these professionals are passionate about their work, their performance on rigorous people who have an open mind ideas, creativity and innovation, the relatively low proportion considered rare and isolated, concluding that young people have a favorable image of scientific and attitudes in their job performance, which contrasts with the views of an unfriendly person antisocial some media express.

Conclusions

The perception of science, technology and innovation of students in middle and upper middle of the GMA is consistent with the findings with studies in Latin America on this line of research by the OEI. In the imagination of young people are dominating the popular representations of scientists as passionate about their work, logical reasoning and with an open mind to new ideas and other features.

In this sense the sample indicates that students do not share all of the imaginary stereotypes about scientists who are present in the media as rare, distracted or lonely. The young of this study did not show a special interest in professionally pursue science, lack of this appeal can be linked to the issue of science education, since in some significant findings is the difficulty students experience by materials science. The weighting of these factors can influence the choice of careers.

It should be stressed before the end of that scientific culture is a knowledge culture in which the importance of the educational system is to produce people who can solve

problems not only with the application of specific concepts, but with the habits developed in their stands interaction with knowledge networks in their formative stages. The results obtained from this research raises the take on the challenge to boost the dissemination and appropriation of scientific and technological knowledge among adolescents of Guadalajara requiring current and future efforts to enable innovate and work creatively.

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