ΣΟΦΙΑ–SOPHIA

Processes of training in research at the University: What is left for students?

Mauricio Rojas Betancur*
Raquel Méndez Villamizar**

* PhD in Social Sciences. Full-time Professor, Industrial University of Santander, Colombia. hmrojasb@uis.edu.co, Orcid.org/0000-0003-0569-8236

** Candidate for a PhD in Social Sciences. Associate Professor, Industrial University of Santander, rmendezv@uis.edu.co, Orcid.org/0000-0003-1005-5809

Abstract

Research training is a central component in the education of the young university student in today's society; and the attitude towards that training can be an indicator about the quality of the training processes, and the possibility of an early entry of the student into university research systems and the training of scientists. In the present study, of cross-correlation type, the attitude of the young person is evaluated from three elements: self-perception, incidence of the professors, and incidence of the universities on the formation in investigation at undergraduate level. A structured instrument was applied to students from eight universities in the metropolitan area of Bucaramanga, Colombia, by simple random sampling. It is highlighted the high value that students give to the learning of research at the university, but the low projection and attitude of the majority towards scientific issues. Additionally, it was found that teachers have a high level of impact on the students' attitude towards research, while social and institutional factors do not represent a high incidence. Finally, the study shows a decreasing trend of the attitude toward research at a higher level in the University.

Keywords: Attitude, student, training, research, university.

Introduction

Studying attitude as a mental disposition that affects the representation of people in their life and social interactions is a very important field of inquiry in the social sciences (Ortega Ruíz, 1986). In the field of education, the study of the attitude towards science in general, and research in particular, is closely related to the existence of a significant formation, represented in the development of the capacities of professors and students to elaborate and dispose of knowledge in a dynamic, provocative and concurrent manner with the purposes of a comprehensive education.

The attitude about research in students is an indicator of the quality of education (Papanastasiou, 2005), and of the importance that it has for students to approach a training closer to the field of scientific development (Rojas, Méndez, and Rodríguez, 2012). Teaching and learning to investigate is a transversal element in the organization of university training processes, at least since the formal and generalized declaration of the educational projects of the universities (Rojas M., 2008). The educational assumption postulated in this paper aims to examine whether this training in research is significant for students at undergraduate level in universities within the framework of the discussion on the training of scientists (Restrepo, 2009).

The attitude toward research depends, to a large extent, on the conditions of the individual's current education context, as well as on their school trajectory. For the university, to train researchers is a crucial issue (Christensen and Eyring, 2011), which should permeate curricular structures and educational daily life towards the construction of a culture of research, in which educational relations be organized around the search for knowledge from the scientific methodologies of the grade level (Bolin, Lee, GlenMaye, and Yoon, 2012).

A culture of research at the university means, on the one hand, the critical and humanistic orientation in research training without distinction or discrimination by the discipline of student choice (Vázquez and Manassero, 1995); and on the other hand, the impulse of a pedagogy of research (Hilarraza, 2012) as a strategy that in addition to teaching the scientific method, promotes in students the habit of inquiry and the transformation of the established knowledge (Olmedo Estrada, 2011), even serving as a resource for full development and exercise of students' citizenship.

Research training at the university can also be understood as the readiness in science for the academic trajectory of students, which, it is hoped, will integrate the academic and scientific communities of the country. The academic communities, from this perspective, acquire their identity as such from the interests that they share by scientific research and by the interaction that they make possible, not by the very essence of the concept of community. This distinction is important insofar as the diversity of interests is understood and the diversity of organizational forms indicate more a way of naming them than a possibility of concretizing them in social terms.

For undergraduate level, there have been pointed out drawbacks and tensions for research training, highlighting the importance that students give to research, the anxiety generated by these processes, the low relevance of research for the future professional and for everyday life of students (Papanastasiou, 2005),

(Rojas and Linares, 2011), and the low relevance it has for scientists (Prince, Felder, and Brent, 2007).

The way to evaluate the progress of undergraduate students in their research training process incorporates their transition to advanced levels (graduate training), their participation in research groups and centers, their academic production and their own attitudes towards research (Denofrio , Russell, Lopatto and Lu, 2007), added to a growing concern about the subjective experiences and motivations of students about their participation in scientific research during the training process (Craney, McKay, Mazzeo, Morris, Prigodich, and Groot , 2011).

For graduate training, focused on research of higher quality and better efficiency in the incorporation of new scientists into the academic communities, basic and theoretical training is important as a preparation for the most advanced experimental scientific tasks, basically attitudinal preparation in the grade (Chakrabarti, 2011), where the research in the classroom is highlighted as a permanent training activity (Garzón and Gómez, 2010) and improvement of teaching as a basis for the further progress of science (Duit, 2006).

The attitude toward undergraduate student research is also traversed by the models and research structures of the training centers (Restrepo, 2009). When the research does not have a high development in the university, besides the individual factors of students, the conditions of infrastructure and teaching are key in the formation of this attitude, understanding that additionally there are great differences between universities and between regions (Salazar, Lucio-Arias, Ruíz, and Lucio, 2012), and these differences mark the predisposition and the real possibilities of students to continue an academic and research trajectory.

Thus, students' attitude towards research is a multidimensional dimension of university education (Trejo and García, 2009), which can be encompassed in three key aspects: students's own trajectory in terms of their experiences and possibilities, in addition to the institutional conditions of universities and the development of their research systems and the direct impact of this on university education.

To investigate students' attitude, it is necessary to address these dimensions that constitute the mediation of the institutional context in the formation of high or low predisposition towards research, analyzed from the intrinsic motivations of students (Aparicio, 2009), the incidence of teachers and the institutional conditions,

added to the differences according to areas of knowledge and university, emphasizing that although for students, as shown in the present study, research training is very important, but there is a low expectation of carrying out research in a country that, according to students themselves, very little values and promotes research as a possibility and source of personal and social progress (Rojas, Méndez, and Rodriguez, 2012), as well as a conceptual and methodological gap on research training (Rojas and Méndez, 2013), where it is difficult to verify with accurate evidence the result of the educational efforts to form potential scientific trajectories.

Universities, with more or less emphasis, consider research training as one of the foundations of professional training at undergraduate level. However, this is a subject that has been little investigated and developed from a curricular point of view, since even though it is declared as an indisputable purpose of training, little is known about the role and quality of research teaching in universities; and students' attitude towards this formation is one of the dimensions that affect in a positive or negative way the very purposes of higher education.

The attitude towards research is an analysis tool for the study of the quality of education that young people receive today linked to different dimensions of the university: the administrative, teaching, scientific and technical processes that constitute the dimensions that from students themselves are proposed to evaluate through their predisposition toward research. Being a subject of high institutional interest, the attitude toward research represents a critical and differentiated view regarding the quality of training at undergraduate level of universities, and an opportunity to establish quality measures on the institutional, teaching and scientific field, from the particular position of students as central actors in the processes of training in higher education.

This article collects some of the results and reflections on the way in which scientific research is taught and learned at undergraduate level, from the representations and attitudes of undergraduate students of some universities in the city of Bucaramanga, Colombia, in the framework of a necessary discussion on the relevance of higher education in the country that does not incorporate specific topics, such as a pedagogy of research in the framework of the poor results of the country in the development of its scientific capacity.

Methodology

The present investigation is framed in cross-correlation studies; the instrument (that was) applied was a multipurpose survey, consolidated from different sources (Blanco and Alvarado, 2005), (Denofrio, Russell, Lopatto, and Lu, 2007), (Rojas, 2008). In a first application made in 2010, it reported a reliability of 88.2% (Cronbach's alpha), (Rojas, Méndez, and Rodríguez, 2012); in the present application, the reliability of the instrument was 89.6%. The instrument consists of 50 items, 17 of which are used to calculate a Research Attitude Index (IAI, for its initials in Spanish), on a Likert scale. The other items are used as variables for composition and qualification of aspects related to research training. The IAI, is composed of three sub-indexes:

Self-evaluation - IAI: sub-index composed of six variables that allow to establish the perception of students regarding their own place in the activities and levels of research in their school trajectory on academic level, projects, groups, scientific events, research environment and the importance of information. The answers are processed by the method of summary evaluations (Likert-type scales); they contribute up to 18 points to the IAI.

Incidence Teachers -IP: sub-index composed of five variables designed to establish the role of teachers in the research training of students under the theoretical premise that it is in the teacher who supports a very important part of the teaching process and motivation—attitude—towards science. These variables refer to the teacher's confidence in students, the academic requirement, the research professor, their preparation and their capacity to advise on research; they contribute up to 15 points to the IAI.

Institutional Impact -IINT: specific sub-index to evaluate the conditions offered by universities in the perception of their students in the specific research topic, considering that research should be mobilized as a research culture in universities; and that students have or do not have an attitude formed with respect to it in terms of incentives, updating of knowledge, infrastructure, teaching and opportunity of links with scientific activity; from the institution there were also defined 6 variables that contribute up to 18 points to the IAI.

The target population was defined as the total number of students at undergraduate level with current enrollment in the first academic period of 2014, excluding the students in first semester. The instruments were applied in two state universities: Universidad Industrial de Santander, UIS and Unidades Tecnológicas de Santander, UTS, and six non-state universities: Universidad Autónoma de Bucaramanga, UNAB, Universidad Santo Tomás, USTA, Universidad Pontificia Bolivariana, UPB, Universitaria de Investigación y Desarrollo, UDI and Universidad Cooperativa de Colombia, UCC, (for) being the most representative universities of the Metropolitan Area of Bucaramanga, Colombia.

For this population, there was applied simple random sampling to 52,724 students ranged between second and tenth semester of the eight selected universities, obtaining a final sample of 352 students, weighted according to the relative weight of the number of students in each institution.

Main results

The group of participants in the present study comprises a total of 352 undergraduate students, with an average age of 21.2 years and an accumulated average academic performance of 3.8 points (on a scale of 0 to 5, as it is graded at undergraduate level). According to the Area of Knowledge, 38.6% of the participants belong to Engineering and Related, being the group with the greatest presence in the sample; followed by Humanities and Social Sciences, with 28.1% of participants; Health Sciences with 18.2%; Administration and Related with 14.2%; and the smallest group, Basic Sciences, with 0.9% of the total.
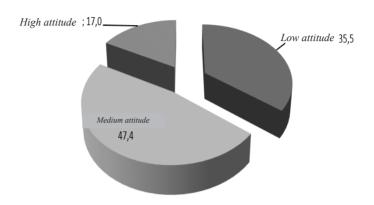
By semester, it was achieved a participation balanced with reality at all levels, concentrating the sample more between 4th and 5th semester; by sex, 46.4% of the total correspond to female students and 53.6% to male students. A large portion of the students' population, 65.1%, report only being dedicated to their study; while 34.9% combine their study activities with some paid work activity.

In general, it was obtained a high IAI in 17.0% of the total undergraduate students; a medium value for 47.4%; and a low value for the remaining 35.5%. The expected (result) was that most students scored in average terms; however, the data cause concern since the percentage of students with a low attitude is significantly high, compared to the lowest percentage who obtained high attitude (only 17.0%).

This result is worrisome, as it concerns a university population and a region with high education standards (MEN, 2012)*, which, unlike the general population, has direct contact with scientific issues and, it is

assumed , research is an integral part of undergraduate education in higher education institutions, at least in formal terms.

Figure 1. General index of attitude toward research, (expressed) in ranges, n = 352
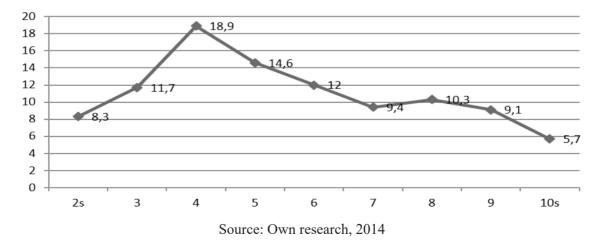

Source: self-made research, 2014

However, the eight universities involved in the present study have structured, with greater or lesser success, university research systems that, among other things, promote the direct connection of students to research activities through scholarships, assistance, nurseries and classroom projects, among others.

An interesting aspect of the way in which students undertake research training is to examine the school's trajectory. In terms of the logic of training, there lies the assumption that the higher the academic level, the better attitude towards science; however, the IAI compared with students' semester presents a different situation. The highest rates are presented in the fourth and fifth semester, but (then) begins to decrease as students progress through their university studies; in fact, the statistical trend indicates that the premise of training is not met; in addition, the more (advanced) the semester, the less attitude (the students show) toward research.

This situation offers elements of analysis of different kinds: it seems that students increase their attitude at the levels in which specific research subjects are scheduled, in fourth and fifth semester, and then simply fall into oblivion. It means that the research methodology courses improve the attitude, but they are not significant learning; that is, they fulfill an important role but they do not form students for research. On the other hand, these data imply that the curricular mainstreaming of research does not go beyond being a declaration of good intentions in higher education that presupposes the contribution of each course, of each subject of the curriculum to research training and, for extension, that teaching is not promoting an interaction with this basic function of the university.
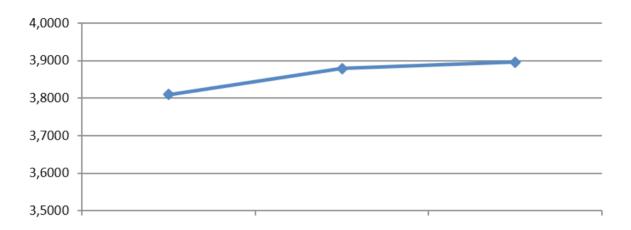
Figure 2. IAI high for academic semester in undergraduate students, n=352

Source: Own research, 2014

In addition to the lack of consistency between the semester and the IAI, the data do not show a level of significance between the index and the academic level of students measured on the accumulated average in the scale of 0 to 5 points. Although students with high IAI have a slightly better academic average, there is no statistically significant relationship between these two variables.

Figure 3. IAI for academic average in undergraduate students, n=352

Academic average

Source: Own research, 2014

When examining the individual scores of the 17 variables used in their original scale from 0 to 3, by the method of analysis of means with statistical variance test, Anova model (Spiegel, Schiller, and Srinivasan, 2007), we have a more detailed of the differences by university.

As it can be seen in table 1, most of the 17 variables show significant differences according to every university, except for the high value that students from the eight participating universities give to the importance of research training, 2.38 points in the general average, being the best rated variable of the group of 17 that make up the IAI. That is, it represents a dimension of high value for students. Similarly, the scores on student participation in scientific events was, on average, 1.05 points, with a low score in all universities. Nor was there statistical significance on the demand for rules of incentives for research, 1.40 points, nor in the requirement of methodological standards for the presentation of academic papers, an important aspect in the learning of research, with 2.09 points on average.

From table 1, it can be seen that in most variables there are notable quantitative differences according to the rating scale, to identify the common places and the common ones in this direction. The highest score variable in all the universities is the importance that students gives to research training, as noted above, but it is highlighted the requirement for the presentation of standards of scientific methodology in the work of students. Students of the UDES also emphasize the accompaniment of the professors to the research processes of students; while in the UNAB, there stand out the good preparation in scientific research that their professors have.

In the USTA, students' satisfaction with the scientific and academic level of the career is also highlighted in a positive sense, as in the UPB and the UIS. UDI students also highlight the infrastructure (that) they have for scientific research.

Among the variables least evaluated by students include the low participation in scientific events, and the absence of academic and economic incentives for the participation of students in scientific research. It is also highlighted that 69.1% of the total of students consider that in Colombia, scientific research is not valued; among students under IAI, this percentage increases to 70.4; and among students with high IAI, it drops to 69.1%. This information is very

Table 1. Attitude index towards research according to IAI variables, scale from 0 to 3, n = 352*
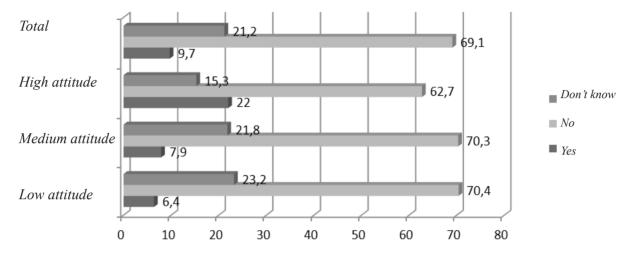
Variables**	UDES	UNAB	USTA	UPB	UIS	UDI	UCC	UTS	ANOVA
Satisfaction with the academic and scientific level of the career	1,75	1,89	1,97	2,36	1,67	2,17	2,13	1,94	0.000*
Ability to present research projects	1,75	1,76	1,91	1,95	1,46	1,86	1,77	1,56	0.020
Knowledge of research groups	1,25	1,53	1,66	2,07	1,42	1,38	1,47	0,94	0.001*
Participation in scientific events	1,30	0,98	1,06	1,40	0,98	1,14	0,93	0,56	0.054
There exists a good research environment	1,60	1,87	1,60	2,05	1,34	1,93	1,73	1,17	0.000*
Importance of research training	2,15	2,24	2,40	2,40	2,39	2,59	2,40	2,61	0.445
Professors acknowledge scientific research skills in students	1,55	1,71	1,77	2,05	1,51	2,07	1,90	1,78	0.002*
Incentives for scientific research	1,75	1,55	1,77	1,93	1,50	1,79	2,00	1,61	0.073
Requirement of methodological norms for the presentation of academic papers	1,80	2,09	2,26	2,33	1,94	2,21	2,23	2,06	0.141
Professors present their own scientific research works in (their) classes	**1,00**	1,71	1,49	1,71	1,23	1,83	1,50	1,17	0.001*
There are academic or economic incentives for students who perform scientific research	1,20	1,33	1,29	1,93	1,19	1,86	1,43	1,50	0.000*
The university is worried about updating its scientific knowledge	1,20	1,78	1,77	2,14	1,49	2,14	1,77	1,67	0.000*
The University has infrastructure for scientific research	1,40	1,69	1,57	2,07	1,41	2,24	1,73	1,00	0.000*
Professors are well-prepared in scientific and technologic research	1,65	2,00	1,91	2,36	1,75	2,17	2,00	1,78	0.000*
The process of scientific research is taught in regular courses	1,55	1,65	1,71	1,83	1,30	1,66	1,90	1,33	0.001*
Professors accompany the scientific research process	1,80	1,80	1,80	2,05	1,47	2,03	2,10	1,61	0.000*
There are regular calls to get engaged in research projects	1,30	1,62	1,71	2,02	1,29	2,03	1,63	1,39	0.000*

* Significant at 0.01

** Acronyms of the institutions: Universidad de Santander (UDES), Universidad Autónoma de Bucaramanga (UNAB), Universidad Santo Tomás (USTA), Universidad Pontificia Bolivariana (UPB), Universidad Industrial de Santander (UIS), Universitaria de Investigación y Desarrollo (UDI), Universidad Cooperativa de Colombia (UCC), and Unidades Tecnológicas de Santander (UTS).

important as students, those who have close contact with the academy, consider that the value of science in Colombia is very low, which negatively impacts the possibility of a better attitude toward research, and a projection away from scientific work in the future for young people.

Figure 4. Percentage of students who consider that in Colombia, scientific research is valued according to IAI, n=352*
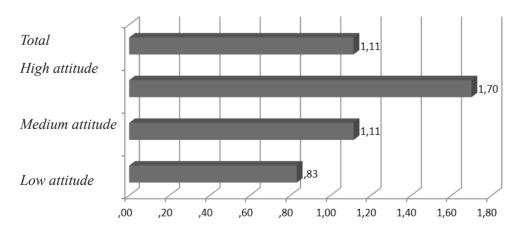

* Significant at 0.01

Source: Own research, 2014

In correspondence with the data presented on the social value of research, students consider that the national government does not encourage scientific research in the universities, 1.11 points on the scale of 0 to 3. There are internal differences among students according to the IAI. While students with low IAI, report 0.83 points, high IAI students score with 1.70 points, showing the trend that has been generalized in the data: the higher the attitude, the better the evaluation of the different variables examined.

Figure 5. Score on the role of the national government in the promotion of scientific research in universities, according to IAI, n = 352*

* Significant at 0.01

Source: Own research, 2014

Self-assessment, the professors and the institution and their impact on the attitude towards research training of undergraduate students

The three dimensions involved in the analysis of the attitude of students towards research: self-evaluation, teachers and institutional aspects, allow to separate those situations of incidence and analyze them separately. The premise that a good attitude for training is necessary to develop a scientific process that, with greater certainty, promotes the expansion of academic and scientific communities, encourages the greater participation of young university students in research systems and, ultimately, contributes to the development of scientific knowledge in the country.

Self-perception, in the first instance, implies a look from students themselves in the training tasks, which are translated into the six variables used for the sub-index. The low participation of students in scientific events stands out on the Likert scale used. It is striking because, precisely, scientific events have the intention of communicating science and increasing the participation of students in research systems; probably this is understood by different causes: the low number of scientific events in institutions, the economic cost and the lack of a good communicative strategy; in any case, when students are really motivated to participate, they also have the capacity to search and manage the necessary resources for their participation.

In this same direction, students do not know (about) many of the research groups in their universities. This fact is important since all the research activity, including training, has been organized around the groups in the university systems (Fortoul, 2011). In addition, the groups are the level of organization of science most suitable for the entry of new researchers or researchers in training, it is also the space with the greatest impact on research training since students, through different models, learn to investigate and have the opportunity to interact significantly with experimented researchers of the universities.

Nor is encouraging the perception of the university environment for research or the students' self-perception regarding their own abilities to manage research processes by themselves.
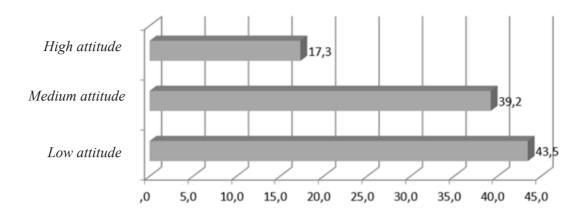
Table 2. Variables related to the students' self-evaluation in the attitude towards research, n=352

Variable	Never	Sometimes	Often	Very often
I am satisfied with the academic level of my career	4.8	21.9	50.0	23.3
I am able to present research projects according to the rules of my university	8.8	32.1	40.1	19.0
I know the research groups of my university	17.3	32.1	33.2	17.3
I participate in scientific events organized by my university	33.0	39.2	18.2	9.7
I consider that in my institution, there exists a good environment for research	10.5	35.2	35.8	18.5
I consider that the training in research is very important for my professional life	3.1	11.1	30.1	55.7

Source: Own research, 2014.

These variables, in general, indicate a low self-perception of undergraduate students towards research, as it can be seen in the following graph. Only 17.3% of students have a high incidence in this dimension; that is, 43.5%; and 39.2% of all students express a low attitude toward research.

Figure 6. Incidence of the self-assessment variables in the attitude towards research training, n=352

Source: Own research, 2014

When contrasting the incidence of self-perception in the IAI, among students with low self-perception, 71.2% and 28.8% have low IAI; on the contrary, among students with high self-perception, 75.4% reported high IAI.

Table 3. General incidence of the variables related to the self-assessment of the student in the IAI, n=352*

		Low attitude	Medium attitude	High attitude
Incidence in ranges	Low incidence	71.2	28.8	0,0
	Medium incidence	11.6	78.3	10.1
	High incidence	0,0	24.6	75.4

* Significant at 0.001

Source: Own research, 2014.

If self-perception is an important dimension to understand the results of the IAI, teachers, who are central to training, are equally interesting to assess attitude. Undoubtedly, they are the center of the pedagogical act and the driving force of the research processes in the university (Stenhouse, 2004); they also are the support of the social extension of the benefits of research and technological development; that is, they are the center of the missionary functions of the university: formation, research and extension.

In the Colombian case, universities support these functions in professors, very few of them have a full-time staff as researchers or as exclusive knowledge extension staff, although historically the teacher's work has been focused on the training processes, in recent decades, their profile and institutional requirements indicate a profile oriented towards the exercise of scientific functions and university extension (Patiño, 2007).

According to the variables that make up this dimension, it is a (matter of) concern the fact that, in general, teachers seldom or never expose their own research works in class. It is necessary to clarify that not every teacher is a researcher, although the normative ideal of the institutions affirms this as an ideal of the teaching profile, and that there must be a direct relationship between research and classroom training. Another element that causes concern about teachers is the student's perception of the confidence they have in the research capacities of the students, a concern that refers to the trust, motivation and the value of the science training processes, which should be an everyday formative action in the university.

In contrast with the above, according to students, the professors are well prepared in scientific and technological research and that, in general terms, they are willing and able to advise and guide students, which implies that from (the point of view of) students, their professors are good researchers but not so good trainers in research, expressing a distance in professors themselves, between the researcher and the trainer.
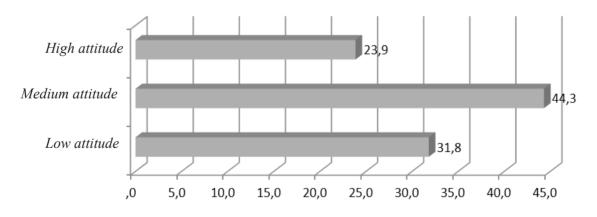
Table 4. Variables related to the teacher's role in the student attitude toward research, n=352

Variable	Never	Sometimes	Often	Very often
My professors trust on my skills to perform scientific research	7.1	30.7	44.6	17.6
My professors demand that I use methodological norms in my academic works	5.4	20.2	34.7	39.8
My professors present their own scientific research works in (their) classes	18.8	35.2	29.0	17.0
My professors are well-prepared in scientific and technologic research	4.8	23.0	46.6	25.6
Professors in my career advise me well, in order to perform research	8.8	30.1	38.4	22.7

Source: Own research, 2014.

The data, in general, indicate that professors have a higher incidence in the IAI than the self-assessment variables described above, with a high incidence of 23.9% and an average incidence of 44.3%.

Figure 7. Incidence of variables related to teachers in the attitude towards research training, n = 352

Source: Own research, 2014.

When contrasting the incidence of professors in the IAI, we can see that among students with low incidence, 83.9% have low IAI; on the contrary, among students with high self-perception, 60.7% reported high IAI.

Table 5. General incidence of variables related to the teacher in the IAI, n=352*

		Low attitude	Medium attitude	High attitude
Incidence in ranges	Low incidence	83,9	16,1	0,0
	Medium incidence	19,9	74,4	5,8
	High incidence	0,0	39,3	60,7

* Significant at 0.001

Source: Own research, 2014.

In addition to the self-assessment and the perception of the teacher's role, the institutional conditions constitute the third attitude sub-index. These make reference to the university context that can favor research training of students. The less favorable aspects, following the line of argument, are in topics such as calls and academic or economic incentives, while the concern to update the knowledge and infrastructure destined for research appear in a more favorable perception, although the opinions are quite heterogeneous in this sense.
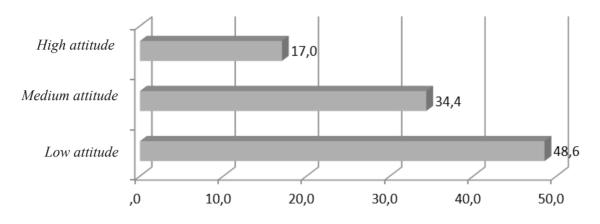
It is important to clarify that these conditions are specific to research in universities, not to their general conditions. The premise, in this sense, is that universities must have good conditions for the development of research, in reference to infrastructure, incentives, quality and visibility of research for students (Rosovsky, 2010).

Table 6. Variables related to the role of the institution in students' attitude towards research, n=352

Variable	Never	Sometimes	Often	Very often
In my career, scientific research is encouraged	10.5	33.8	33.8	22.2
In my university, there are academic or economic incentives for students to perform scientific research	19.9	36.1	28.1	15.9
My university is worried about updating scientific knowledge	8.8	30.7	41.2	19.3
There's (appropriate) infrastructure for scientific research in my university	9.9	36.1	36.5	18.5
I am taught about the scientific research process in my regular courses	12.2	37.2	33.2	17.3
There are regular calls in my university to enroll me in research projects	11.1	40.1	29.8	19.0

When adding the variables in the institutional incidence sub-index, it is the group of variables that less contributes to a good attitude. Despite the dispersion of individual responses, 48.6% of the total students scored low, while only 17.0% reported high incidence on institutional aspects.

Figure 8. Incidence of the variables related to the institution in the attitude towards research training, n=352

Source: Own research, 2014.

When comparing the incidence of institutional conditions in the IAI, 66.7% of students with low incidence present low IAI; on the contrary, 78.3% of students with high self-perception reported high IAI.

Table 7. General incidence of variables related to professors in the IAI, n=352*

		Low attitude	Medium attitude	High attitude
Incidence in ranges	Low incidence	66,7	33,3	0,0
	Medium incidence	9,1	80,2	10,7
	High incidence	0,0	21,7	78,3

* Significant at 0.001

Source: Own research, 2014

Discussion

In this second application of the instrument on attitude toward research, the sample of universities and participating students was expanded, but the data was very consistent with the previous application (Rojas, Méndez, and Rodríguez, 2012); it is highlighted the tendency to a considerable decrease of the index as students progresses in their career, being also a study that corroborates the low incidence of research training at undergraduate level (Prince, Felder, and Brent, 2007), (Denofrio, Russell, Lopatto, & Lu, 2007).

The study of attitude is understood as a mental disposition of the individual that affects the way in which they are represented and they act in a social situation; in higher education, it is observed how these dispositions of students towards research training are extremely complex and problematic (Papanastasiou, 2005). Students' attitude towards research, in the current context in which they receive their professional training, indicates a generalized demotivation against the possibility of continuing in advanced science training (Duit, 2006), despite the importance given to research in general terms.

In this particular case, situations of students' context are highlighted, which within the framework of undergraduate training configure these representations and ways of assuming research in their university life: an institutional context that does not operate as the catalyst for an early entry and the permanence of young people in research systems,

along the lines suggested by some studies (Craney, et al., 2011), (Bolin, Lee, GlenMaye, and Yoon, 2012), (Rojas, Méndez, and Rodriguez, 2012).

Research training at undergraduate level is important in social and educational terms, because it involves young people who, potentially, would be the logical candidates for their training as scientists (Hilarraza, 2012), and because the university is the natural place of training of academic communities; that is, research is not just a matter of learning, it is basically the work of building socially available knowledge aimed at impacting the social (Ziman, 2003). However, it is not intended that all students follow the path of science, but that they have access to a minimum of training in research, incorporated into the plans and programs of study (Vázquez and Manassero, 1995), (Trejo and García, 2009). For the reasons stated in the present study, despite the fact that in all universities there is a research component incorporated, there is no significant relationship between research and training; the possibilities and actions with the best impact are extracurricular, especially under the figure of research nurseries and young researchers, which are filter actions that distinguish a more qualified formation than that commonly offered in normal education processes (Prince, Felder, and Brent, 2007).

Both the seedbeds and the young researchers have their niche of development in the research groups and professors-researchers; and a possible link with the National System of Science and Technology (SNCTI, for its initials in Spanish), which develops different frameworks of research training in Colombia (Rojas, 2008). On the other hand, the majority of undergraduate programs have research activities that are designed as culmination of studies through grade works, theses, internships and practices; or through figures such as assistance or research assistance, but in no case is it evident that this guarantees the young man's future as a scientist (Craney, et al., 2011).

All undergraduate students have, with a greater or lesser intensity in the course of their careers, an approach to scientific research as an integral part of their training -depending on universities-, but there is a low capacity of the educational system to understand the importance for the development of the relationship between science and society, and how research training for young people is the foundation of academic communities, especially in a country with a low scientific capacity, in which universities are the institutions that practically produce the totality of scientific knowledge (Salazar,

Lucio-Arias, Ruíz, and Lucio, 2012); therefore, these institutions are the ones that should intensify the process of training new scientists, with better possibilities of integrating (them) into the academic world and formal research systems (Aparicio, 2009).

The youth's attitude towards research is part of the general problems of education and, more specifically, the interest in the development of science in the country. Problem that also promotes reflection on the relationship between research, university, society and its possibility as a social and regional development; the capacity of the higher education system on the way in which knowledge is produced and used, and on the context of action and training of researchers, which should be analyzed in their broadest sense as fields of study of education and pedagogy, and from the sociology of education.

Conclusions

Research training and students' attitude towards research is a fertile field for the social development of the country, the formation of an academic community finds in young people an excellent field of pedagogical action and the best bet for the future of science and its social impact. However, research training is not consolidated as students progress in their school career.

From the attitude of students towards research training, it is also noted that universities, being the largest centers of scientific production in the country, fail to consolidate in students a culture of research or internalize the social value and the possibility of a future in science, based on the following results:

Students do value, the importance of research training for their professional lives. However, very few students project themselves (performing) a scientific career in their future.

Students value positively the different tasks in classroom research developed by their professors, the research training (that) they have, the academic requirement in the performance of research work. However, students do not know the scientific production of their professors, or if they even have one.

There is a high perception of the academic quality of the programs, including the universities, a high recognition of the institutions for updating knowledge. However, students know little about the research groups and systems of their universities, and they value very negatively the possibilities of developing research in the institution.

There is a low predisposition towards research despite the framework of institutional statements that generally place scientific activity as an essential part of training at undergraduate level; and the institutional effort to improve scientific processes is not reflected consistently in the attitude of students towards research.

A low attitude towards research on the part of undergraduate students is a terrible signal for the present and the future of the development of science in this country.

Research training that is explicitly incorporated into the curriculum of most university careers through, for example, research methodology courses, is not positively impacting professional's training.

Young university students highlight the social importance of research, the importance of research training, in addition, to their professional training. However, they do not project themselves as scientists in the future, they distrust the role of the government in the promotion of research in universities and little believe in the level of regional impacts of research carried out by the universities of Bucaramanga.

Research training is a matter of human development; technology, as the basis of current economies, is only possible from the cultivation of knowledge and the people who apply that knowledge, unless we think we are simply passive consumers of what others produce. It implies that science is also a problem of public order, of agenda in the policies of the country, and that, despite the developed processes, we are basically very behind in the purpose of an interaction between the public and the problems of education in training of researchers.

Public policies on the **CTS** in Colombia have not been effective nor sufficient; it is easy to corroborate that in the low number of recognized researchers, the low number of research products developed in all fields of science, and in low enthusiasm for social science, even among young candidates for scientists. But it is not a problem of financial resources or lack of intellectual capacity of people, it is a problem of the quality of education as a whole, at all levels, which deepens in the ignorance of children and young people as central actors of the process of formation and the lack of pedagogical resources to pretend a significant learning.

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