JOURNAL OF BALTIC SCIENCE EDUCATION
ISSN 1648-3898 /Print/
ISSN 2538-7138 /Online/

SCIENTIFIC COMPETENCIES: A MECHANISM TO FAVOUR THE INCLUSION OF WORKING MARKET PROFESSIONALS

Alba Guzmán,
Diana Oliveros,
Mauricio Mendoza

Abstract. *Institutions of Higher Education seek to instil in their students the scientific competencies throughout the guidance of different included courses in their curriculums. However, the assimilation of diverse methodologies evidence the lack of development of those scientific competencies necessary for professionals to be graduated and therefore required by the labour market. This research examines the research competencies of students of higher education sample (N=189) to determine their appreciation towards scientific competencies they consider to have developed in both their educational processes. The results prove the perception of subjects in respect to the development of interpersonal and intrapersonal skills, decision-making, problem-solving and acquisition of scientific competences, the basic ones; use of technology, appropriation of new knowledge, self-learning and search of information, specialized competences, drafting of reports, design of articles, presentations, development of degree works and definition of new projects. The application of ANOVA detects that there are significant differences according to the gender of subjects on competencies referred to the search of physical information where women stand out, and reading comprehension of documents in English where men stand out. Besides, it's demonstrated that these competences contribute to students' critical thinking. IES required to include research as mechanism to strengthen the education.*
Key words: *scientific competences, higher education, research training, scientific competencies, labour market.*

Alba Guzmán, Diana Oliveros, Mauricio Mendoza
Autonomous University of Bucaramanga, Colombia

Introduction

The phenomena of Globalization influence the perception of entrepreneurs about the competences that professionals need and require to perform in their job (Conchado, Carot, & Bas, 2015) It implies that the advance of knowledge needs to be constantly updated in issues related to their profession through scientific and technological developments. The current environment invites you to the generation of knowledge through Research, where Technologies of Information and communication TIC, have unleashed the boom of the knowledge for the proliferation of information in an exponential way (Guzmán, 2013), the increase of devices to get access to the information and innovative modes regarding education (Torkunova, 2015).

The earlier implies that Institutions of Higher Education, IHE, need to strengthen education in these aspects considering within their curriculum, the methodologies that contribute to the Development of competencies in Research in their students in order to facilitate their immersion in the work field having considered the required skills for the performance of their job positions, their contribution to the development of critical thinking, collaborative work, creative thinking and problem-solving capacities (Moreno & Soto, 2005).

In the international scope, the competences in Research are oriented toward the fostering of team-working in search of truth leading pointing toward multi-disciplinary aspects in the academy, where IES foster collaborative work throughout different areas of action (Guzmán, 2013; (Pešaković, Flogie & Aberšek, 2014). In the Colombian Context, the strengthening of Research competences in students is fostered from spaces of formation with the Learning-by-Doing strategy, providing an environment based on the following values: collaborative work (based on interdisciplinarity), teamwork, communication, respect of others' opinions, honesty, self-control and ethics (Moreno & Soto, 2005). Here lies the importance of implementing strategies that will facilitate the inclusion of research in the teaching-learning process as a methodology to develop spaces that encourage the

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

development of skills and improvement of the competencies of the students, and the appropriation of values of the researcher shown in students, evidenced by the interpretation made out of real world based on the results they got (Valencia, Macías & Valencia, 2015).

The current research was developed in an Institution of Higher Education in the North-eastern region of Colombia with undergraduate and postgraduate students whose goal consisted on proving subjects' perception towards the development of their acquired skills in implemented competences and research processes leading to the conclusion of the importance of offering enabling spaces for the development of teaching-learning processes.

The Scientific Competencies

Perspectives about the Scientific Competencies

The competencies according to Véliz, Díaz and Rodríguez (2015) and quoting in his/her publication in 2011, are a set of knowledge allowing the involvement of knowledge, of knowing-how (skills, habits, capacities) knowing-how-to-be (values and attitudes). The approaches toward a conception of scientific competencies are diverse. In respect to Torres, Blanchar and Freile (2015) they allow students to contribute to the construction of both scientific and technological knowledge to solve different issues in a specific context taking into account their reality and acquired knowledge. Véliz et al. (2015) consider that scientific competencies favour the acquisition and generation of knowledge for professionals to be qualified starting from the training in sciences and citizen culture. The Gobierno Vasco (2012) shows they are Relevant for Young people to live in a society of change guiding them towards situations of responsibility with their environment, being this aspect necessary for the future of society. For its part, Zhao (2014) mentions that training of professionals in scientific competencies contribute to consolidation of knowledge in an empirical and quantitative matter.

It is important to indicate that Institutions of Higher Education nowadays, require training competent professionals for their High Quality Accreditation Processes. Table 1 shows studies that have been carried out in some IHE in the world, where scientific-investigative competencies have proved to be developed by students in their higher education processes, highlighting their contribution to the fostering of learning and development of other competencies.

Table 1. Studies carried out in IHE to determine the importance of scientific competencies in students of IHE.

Findings... Students require to develop their **scientific competencies because...**	Authors
Allows them to have a wider vision of the world and face their knowledge with the real world throughout the critical, creative and innovative thinking, which happens to be very effective for professionals.	(Véliz et al., 2015)
Favours the application of basic competencies to understand Reality.	(Torres et al., 2015)
Fosters the conceptual foundation in the first academic years at the University to develop the professional's overall performance.	(Falicoff, 2015)
Foster the learning of science taking into account their environment and application from theory to practice.	(Colorado, Ospino & Salazar, 2013)
Allow communication with other students and research groups in order to produce knowledge.	(Pollo-Cattaneo, Rodriguez, Britos & García, 2009)

Likewise, scientific competencies can be considered as elements that favour scenarios for the development of critical thinking in students, one of the main factors labour market demands from the recently graduated(Conchado et al., 2015; Falicoff, 2015; Lamanauskas & Augienė, 2009).

Valdés, Nenninger and Noriega (2013) have made the classification of research competencies in both basic and advanced. The basic competencies allow the search, generation and release of knowledge favouring the ability to use it, identify scientific matters and lead to a conclusion based on evidence, aspects that are relevant to comprehend and help in making decisions of the natural world and changes made through human activity. Advanced research competencies allow the release, resource management and commercialization of knowledge.

On the other hand, Campos and Chinchilla (2009) indicate that scientific competencies can be transversal because they are necessary for professionals at the moment of encouraging the development of skills for all disciplines.

Training for Research

The transformation of the world and education as a consequence of globalization, implies that IHE show interest for adopting new Teaching methodologies in order to make students appreciate reality (Véliz et al., 2015) and become critical professionals, being the training for research the key for the development of necessary skills in the working world (Conchado et al., 2015). According to Pollo-Cattaneo et al. (2009) training in Research in Institutions of Higher Education starts from the conception of Research groups, addressing of an experienced research advisor and lines oriented toward the constant training of students. Moreno Bayardo (2005) and Guerrero (2007) point out This training remarks an integrated vision of Teaching, considering it as a process that seeks to instill and facilitate the appropriation of knowledge and Development of necessary attitudes for the improvement of skills related to scientific Research, technology and innovation. According to Valencia, Macias and Valencia (2015) Formative Research is a strategy that stimulates and allows the student to reinforce their acquired knowledge in their field.

Studies carried out in "Universidad de la Guajira" in 2014 to validate both teachers' and students' competencies in the institution in respect to research, it was confirmed their conception about the management of basic research competencies: cognitive, driving and communicative skills (Torres et al., 2015), favouring their working performance. Falicoff (2015) in their research in Universidad Nacional del Litoral (Argentina) carried out in 2014, showed that one of the main motors for the Development of scientific competence in students, was the identification of phenomena, explanation and gathering of scientific proofs generated in the first years of study where, from reality, student approaches to the development of his scientific skills.

Colorado et al. (2013) affirm that Research processes contribute to the Development of scientific competencies oriented toward professional's self-training and training in research. The paragraph above allows to admit that one of the mechanisms to contribute to the Development of scientific competencies in IHE is education from the use of technology as an innovative mechanism for Learning, considering the innovative capacity of processes that favour the application of acquired knowledge avoiding mechanicity (Torkunova, 2015), and working in teams from the cooperation developed from other carried out research (Pollo-Cattaneo et al., 2009).

Therefore, it is necessary to incorporate Research in the IHE academic lives from a pedagogical approach allowing construction and re-construction of transforming research spaces and actions (Campos & Chinchilla, 2009; Moreno, 2005), as well as establishing pedagogical strategies that foster in students attitudes directed to promote curiosity, to problematize, rethink ideas and reconsider methodologies and practices nowadays used from generation of pedagogical contexts facilitating an active and constructive relation with knowledge (Hewitt & Barrero, 2012); with new methods of education favouring the development of scientific competencies from innovation in the ways different courses are taken (Torkunova, 2015); in which the teacher is an important actor who interacts with students starting from some knowledge and fostering classroom participation (Guzmán & Del Moral, 2016).

Precisely, in the activities carried out in the IHE in the training for research, critical thinking is being developed from: elaboration of essays, drafting of articles, bibliographical review about a topic in particular, case study, conversation sessions and integrating projects (León, Núñez & Torres, 2015); analyses of experiences with other students and team-working to carry out activities (Solbes, 2013); reading and writing courses (Oliveras & Sanmartí, 2009); the ones controlled by the "Ondas" program in elementary and secondary education; the development of reflective and proactive thinking favouring the qualification of professionals who are able to solve problems (Valencia et al., 2015); use of technology to carry out activities (Álvarez, 2014).

The Values in Research

Values of human beings are hard to measure, taking into account that it is something intangible and proper of human beings. However, (Tarrés, Montenegro, Gayol & D'Ottavio, 2016) point out that values are experiences related to people's capacities and are generated by feelings expressed toward others. Cascante (2013) assures that research processes in a researcher is affected by values, so it makes people be ethical. Precisely, (Gutiérrez, 2009)

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

points out that values in research are related to ethics and opinion about an individual, fostering participation in the social environment. Even though, (Vidal & Araña, 2014) show in their findings that that approaches of pedagogical models are required in higher education based on: formation of values, study of reality and formation.

The above is considered within the curricular guidelines of higher education programs developing in processes that favour university and professional values.

The values of a researcher start from the satisfaction of curiosity. In this sense Tarrés et al. (2016) and Cascante (2013), point out that the values in the research process are: the intellectuals (humanistic, scientific and technical); Ethical-moral issues related to the formation of character, freedom, responsibility, sense of justice and the greater good; Transcendental aspects related to the vision of the world; and, interpersonal relationships and professional social participation.

The Scientific Competences and the Working World

The training required by students and future professionals of IHE should be oriented towards the development of skills and the acquisition of skills that facilitate their insertion in the working world (Falicoff, 2015). In fact, there are several studies related to the skills required by a graduated person to perform in their personal, professional and work space, which obey the skills acquired in their disciplinary training. Velasco (2014) indicates that this process allows students to be proactive, dynamic and more efficient in the working world, which is why employers prefer those who have been trained under specific aspects of competencies. Campos and Chinchilla (2009); Valencia et al. (2015) point out that the formative processes in research through the Information and Communication Technologies contribute to efficiency, develop autonomy and contribute to flexibility in the activities proposed by teachers; However, it is very important that content offered through ICT were of high quality and oriented towards critical thinking, building collective knowledge and discussing issues collectively to acquire the skills required by the professional.

Within the main competences that are developed during the Research process are the transversal ones to the disciplinary areas since they are necessary in all professionals (Campos & Chinchilla, 2009); Learning, networking, leadership, critical thinking and problem-solving skills are also favored, using Information and Communication Technologies, allowing self-management of the graduate's career (Moreno & Soto, 2005). Finally, the competences that a person graduated from an HEI must possess to perform in their personal, professional and work space, obey, undoubtedly, their disciplinary training (Conchado et al., 2015).

The Scientific Competences: Colombian Case

As it is mentioned, scientific competences are necessary for student and future professional develop different skills. In Colombia, the training by competencies has been carried out since 2000, when students were given more freedom to be competitive in his doing (See Fig. 1). It is important to remark that nowadays training in HEI is task-oriented, however, in Europe there have been advances in developing spaces where teachers and students interact (Salas, 2005). In fact, the author points out that Colombia has not only had two structural upgrades of the educational system: law 39 of 1903 which contributed to the creation of the educational system, and law 115 of 1994 which defines education as the training process considering the person, culture and society.

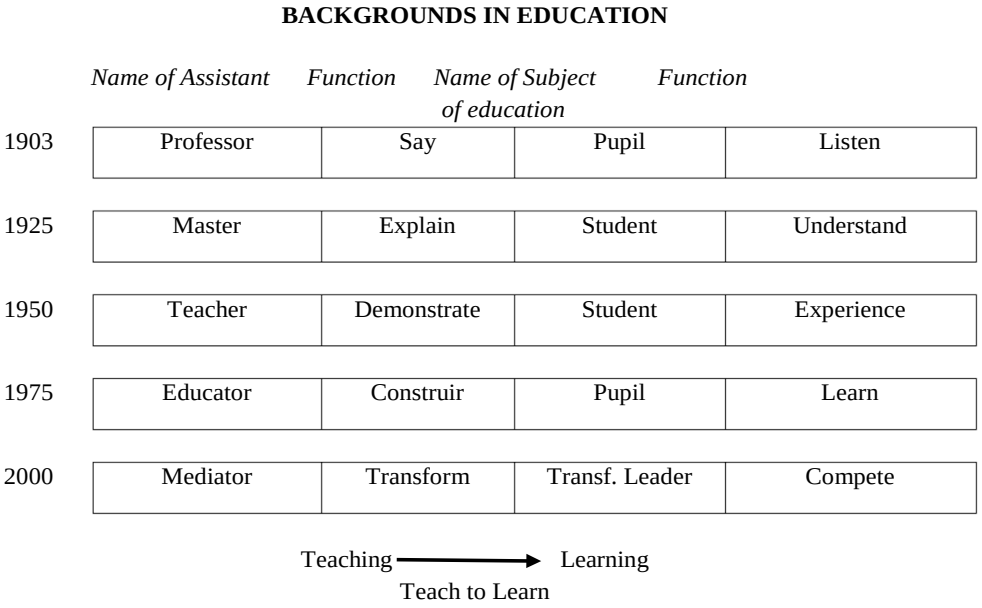

Figure 1: Educational backgrounds in Colombia.
Adaptation of Salas (2005).

Figure 1 also evidences how the function of educational models in Colombia have changed from having a teacher who tells to the student what he wants to listen to a mediator that transforms the process and interacts with the leaders (students) to create shared knowledge contributing to the development of critical thinking. .

In fact, there have been carried out several studies to determine the competencies that a professional requires considering his training in research. León et al. (2015) studied the influence of This training in the Academic qualification of students of accountancy in Colombia, finding the need of strengthening the academic programs and the training for research, because there exist an ignorance of students who don't find themselves identified with research because it makes them feel fear and uncertainty. Torres et al. (2015) assessed both the basic Research and Cognitive skills in the Research process, driving skills and communicative skills of undergraduate students from Universidad de la Guajira, identifying the Research competences they have, which are supported by the use of ICTs. Colorado et al. (2013) detected that students who belong to Research seedlings tend to better develop their scientific competences. Oliveras and Sanmartí (2009) found that students who have participated in these processes are adhered to the culture of science, technology and innovation, making this an interesting questioning to rethink the teaching-learning processes using research as a pedagogical strategy.

Last but not least, for the case of the concern of scientific skills and competencies that ought to prepare professionals graduated from Higher education institutions to get into the working market, the following questions are approached:

- How Research Competencies affect or influence critical thinking that is used for problem-solving in the professional's working performance?
- What is the contribution of scientific skills and competencies to graduates' working performance?
- What pedagogical strategies can be carried out in Higher education Institutions for the Development of competencies of students throughout formation processes in research?

Methodology of Research

General Background of Research

To measure the scientific competence the four dimensions considered by Gobierno Vasco (2012) are used: explanation of natural reality, comprehension of scientific knowledge, the acknowledgement of the key features of

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

scientific research and the use of scientific knowledge to make decisions. So, in the HACOIN form (See description in the "Instrument and Procedures" section) the following dimensions were considered: Values, technology management, cognitive skills, competencies in research (basic and specialized). The Research type is Descriptive and addressed to Higher education students in undergraduates and postgraduates in Santander-Colombia on September 2015.

Sample of Research

The Research is descriptive and was carried out in an Institution of Higher Education in Santander Department in Colombia in September 2015, using a digital source to gather information and focused on 189 students which was the population of Higher Education enrolled students: undergraduate (48.7%) and postgraduates (51.3%), who answered an online questionnaire to determine their appreciation on the development they perceive of their scientific competencies within both their academic and research processes. To confirm if there were differences between both groups, an ANOVA program was applied and results showed there wasn't any significant difference, therefore, the sample is taken as a homogeneous group for data management.

It is observed that 55.6% of the surveyed population were women, the highest percentage of participants are "between 18 and 25 years old" (50.3%), followed by the ones "between 26 and 35 years old" (27.5%), the ones "between 36 and 45 years old" (12.7%), "between 46 and 55 years old" it is only 5.8%, and only 3.7% are "under 18". From all of participants, 59.3% of the population has not received any training in research.

Instrument and Procedures

The measure instrument called HACOIN (Habilidades y Competencias en Investigación) is composed of four factors: values, technology management, cognitive skills and competencies in research. The measure of the items in which each of the factors is composed, was carried out throughout a Likert scale from 1 a 5 (1=Nothing y 5=too much). To validate the instruments, the Research was sent to ten experts in Higher Education to approach the subject of competencies and, after the answers, a factorial analysis was carried out to determine the validity of the instrument, stating it as valid (Cronbach's α=0.92and for the constructs with the technique of main components, it was detected that they were valid. Like this: values (KMO=0.90; Bartlett Sphericity test $p < 0.0001$; explaining el 78.301% of data); Technology management (KMO=0.87; Bartlett Sphericity testing $p < 0.0001$; explaining 75.185% of data); cognitive skills (KMO=0.83; Bartlett Sphericity testing $p < 0.005$; explaining 73.854% of data); competencies in research (KMO=0.87; Bartlet Sphericity testing $p < 0.0001$; explaining 79.165% of data).

Values are measured according to the following parameters: V1) Respect to others; V2) responsibility; V3) honesty; V4) self-control; V5) team-working; y, V6) Ethics. Technology management is valued asking about the skill in the management of: D1) Text editors (Word); D2) spreadsheets (Excel); D3) Slideshares (power point, Prezi, etc.); D4) internet browsing; D5) statistic software; D6) macromedia; y, D7) Bibliographical promoters.

The cognitive skills measured by items: H1) observation, analysis y synthesis; H2) systematization; H3) analysis of results; H4) Decision-making; H5) Problem-solving; H6) creativity; H7) organization of resources; H8) communicative; H9) interpersonal; e, H10) intrapersonal.

In the end, the competencies in Research were divided into basic and specialized. In the basic ones, the following aspects were considered: C1) Search of Information (physical); C2) Digital Search of Information (magazines, database); C3) self-learning; C4) approaches of Questions/problems; C5) problem-solving; C6) use of technology; C7) design and/or creation of information instruments; C8) use of knowledge; C9) appropriation of new knowledge; C10) knowledge of the scientific method; C11) planning of a scientific research; C12) Identification of components of a research project; C13) reading and comprehension of documents in English. Specialized competencies are measured through: C14) drafting of reports; C15) design of an article; C16) presentations; C17) direction of projects; C18) definition of new projects; C19) detection of new lines or topics; C20) experience in seedlings; C21) experience as young researcher; C22) defense of scientific poster; C23) degree works.

Data Analysis

The statistical techniques used in research were descriptive to the contextualization of the sample, and, the ANOVA to establish meaningful differences in respect to both the gender and age variable using SPSS pack version 23.

Results of Research

Values

By asking the students about the values they consider to have developed in the Research process, they stand out in the "Very High" Level and in the order of importance: Respect to others (83.1%), ethics (83.1%), honesty (78.3%), responsibility (67.2%), teamwork (58.2%) and self-control (51.9%), as observed in Figure 2.

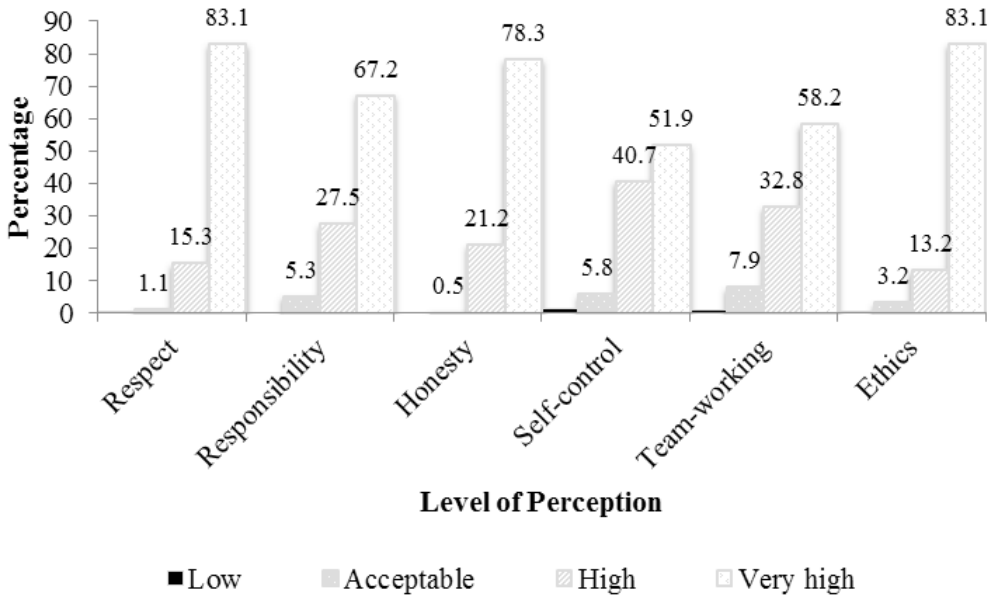

Figure 2: Percentage distribution of the values that students perceive to have developed in their research processes.

In the High level highlight: self-control (40.7%), teamwork (32.8%), responsibility (27.5%) and honesty (21.2%).

It is a fact that research processes contribute to the enrichment of knowledge and development of values, according to the students' perception who participated in the study. It is highlighted that in the "High" and "Very High" levels, they perceive to have developed honesty (99.5%), respect (98.4%), ethics (96.3%), responsibility (94.7%), self-control (92.6%) and teamwork (91.0%).

At the moment of carrying out ANOVA it is detected that with the gender variable, the statistically significant values are the responsibility (F-ratio=7.823, df=1, $p < 0.006$) for women, and ethics (F-ratio=3.185, df=1, $p < 0.076$) for men. With the age variable there exist significant differences as for responsibility (F-ratio=2.595, df=1, $p < 0.0001$) for ages "between 26 and 35 years old", and honesty (F-ratio=2.196, df=1, $p < 0.001$) for the ones who are "between 18-25 years old".

Management of Technology

As for the use of different technological tools that students manage in their process of research in the Very High level highlight: the use of browsers (49.7%), text editor (47.6%), slideshares (36.0%) and spreadsheets (21.7%). In the High level students indicate a bigger use of spreadsheets (47.6%), slideshares (46.0%), browsers (43.9%) and text editors (38.6%), insofar as the bibliographical promoters cover 28.6%, followed by statistical software (23.3%), as observed in Figure 3.

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

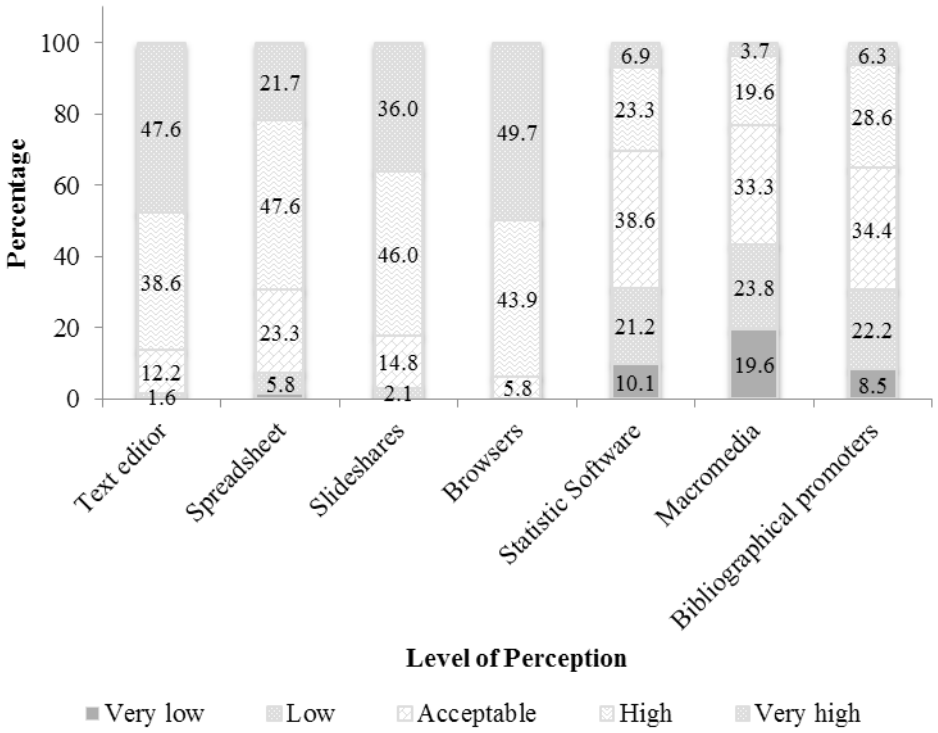

Figure 3: Percentage distribution of Technological management of tools used in the research process

In the analysis of the ANOVA there weren't any statistically significant differences with the gender variable. As for the age variable the differences are found in the text edition (F-ratio=6.44, df=3, $p < 0.040$), spreadsheets (F-ratio=6.44, df=3, $p < 0.0001$), for ages "between 26 and 35 years old", slideshares (F-ratio=6.44, df=3, $p < 0.0001$) and the use of browsers (F-ratio=6.44, df=3, $p < 0.041$), for the ones who are "between 18-25 years old", being significant to 95.0% of reliability.

The Skills as Pillars of Knowledge

Figure 4 evidences the skills that students perceive to have developed in the research process. In the "Very High" level highlight: interpersonal (45.0%), creativity (40.2%), intrapersonal (40.7%), decision-making (39.2%), problem-solving (38.1%), communication (36.5%), and organization of results (35.4%).

In the High level all skills are perceived to be improved, in order of importance: observation (58.2%), analysis of results (55.0%), information systems (52.4%), organization of results (49.2%), decision-making (47.1%), intrapersonal (47.1%), problem-solving (47.1%), communication (45.5%), interpersonal (43.4%), and creativity (34.4%).

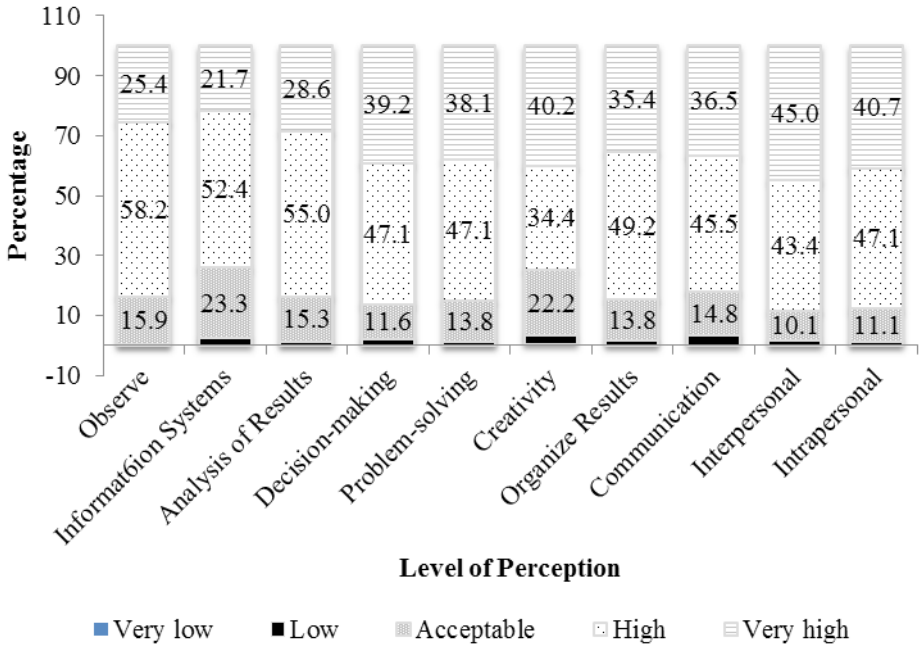

Figure 4: Percentage distribution of skills developed in the process of research.

On the Other hand, skills that students perceive to be developing in their Research processes taking into account the "High" and "Very High" levels are: interpersonal (88.4%), intrapersonal (87.8%), decision-making (86.2%) and problem-solving (85.2%), fostering Communication and teamwork throughout problem-based learning (PBL).

At the moment of carrying out the ANOVA considering both the gender and age variables, it has been detected there are statistically significant differences with the use of Information Systems (F-ratio=5.932, df=1, $p < 0.016$), organization of results (F-ratio=7.785, df=1, $p < 0.006$) and intrapersonal skills (F=3.700, df=1, $p < 0.056$) for women and interpersonal skills (F-ratio=3.944, df=3, $p < 0.049$) for men. In the age variable there doesn't exist any significant difference.

The Scientific Competences: Basis for Work Employability

Students were asked about their perception in respect to the basic and specialized competencies in research. As for the basic ones, in the high level they highlight appropriation of knowledge (58.2%), application of knowledge (54.0%), self-learning (52.4%), problem-solving (50.3%), approach of questions/problems (49.2%), search of digital information (48.1%), use of technology (45.5%) and search of physical information (41.8%) (See chart 2). In the Very High level the basic competence that is perceived as the most developed is: use of technology (38.1%), followed by the search of digital information (29.1%), problem-solving (27.0%), application of knowledge (26.5%), self-learning (25.4%), application of new knowledge (23.8%), and approaches of questions and answers (22.2%).

As for Specialized competencies in the High level they highlight drafting of reports (43.9%), design of an article (37.0%), definition of new projects (32.3%), presentations (30.2%), Development of degree works (29.6%), and, with 29.1% of each of them are found the indicators of direction of projects and detection of new lines or problems. Insofar as in the Very High level, the perception of having developed the Specialized competencies is not remarkable, since only 16.9% of the students indicate drafting of reports, el 12.2% development of degree works, el 13.8% presentation and 10.6% indicators of direction of projects and detection of new lines or topics.

Students indicate that the basic competencies that have been better developed in their processes related to Research are use of technology (83.6%), appropriation of new knowledge (82.0%), application of knowledge (80.4%), self-learning (77.8%), problem-solving (77.2%), search of digital information (77.2%), and approaches of questions/answers (71.4%). As for Specialized competencies they highlight drafting of reports (60.8%), and less considered,

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

design of an article (46.0%), presentations (43.9%), development of degree works (41.8%), and definition of new projects (40.2%). The earlier implies that Research processes in IHEs need to be strengthened from academy taking.

ANOVA was used in order to establish whether the gender variable affects the perception regarding the development of the basic competences and specialized in research. It was detected that in the basic there is a significant difference in the indicator of searching for physical information (F-ratio=7.026, df=1, $p < 0.009$) where women stand out, and reading and comprehension of documents in English where men stand out (F-ratio=4.362, df=1, $p < 0.038$).

After having applied the ANOVA app in the specialized competences only the indicator of Presentations happens to be statistically significant for them (F-ratio=4.049, df=1, $p < 0.046$). In the age variable there doesn't exist any significant difference.

Discussion

One of the greatest contributions of Research process towards the Development of the competencies of graduates is being observed at the moment of considering the values that students perceive to have improved right after having participated in the Research processes. Precisely, research evidences that the values are related to people's capacities and their empathy favours the interaction of students in the process, just like Tarrés et al. (2016) mentions when they point out that people's feelings are generated towards others due to the existing closeness between them at the moment of carrying out a research. One clear example of this is respect and ethics.

Students in their Research processes involve knowledge, they know how to do (shown through the acquired skills) and know how to act in unexpected situations just like Véliz et al. (2015) points out by mentioning the importance of these aspects in the Development of their competencies, just like how students have expressed throughout their answers with the measure instrument. The earlier statement implies that Institutions of Higher Education require to include within their curriculum, tools and courses that facilitate research-based learning.

On the other hand, students' perception regarding the development of their competencies in Research processes is reflected in the improvement of communication and teamwork throughout Problem-Based Learning (PBL) methodology, as a new mechanism to contribute to the improvement of social issues and to the development of critical thinking in order to foster this contribution to society. It is evident that scientific competencies favour professionals to improve in the professional field and citizenship culture (Véliz et al., 2015), the Development of responsibility towards society (Gobierno Vasco, 2012) and applicability of knowledge (Conchado et al., 2015; Valencia et al., 2015; Zhao, 2014), competencies that are necessary for the graduates' professional performance in the working world (Campos & Chinchilla, 2009).

As for the consideration on competencies and their relation to the Development of their process and the use of basic and specialized technologies, it highlights that the earlier implies that Research processes in IHEs need to be strengthened from academy taking into account different points of view of authors and involving research in the curriculum of institutions.

On the other hand, gender and age are variables that differentiate students. Women give bigger value to responsibility while men do it for ethics.

This Research let us evidence the importance of the inclusion of Research processes in classes in both undergraduates and postgraduates, similar to the measure in Universidad de la Guajira in 2014 (Torres et al., 2015) to favour the working performance, in coincidence with students' perception towards research and, showing that one of the most developed skills is critical thinking. Velasco (2014) affirms that thanks to the competencies, students are effective in the working world. This implies that students who are formed in scientific competencies are the most preferred by employers.

Finally, the development of critical Thinking perceived by the students who participated in that Research, it has agreed with the results of Falicoff (2015) study where it highlights that the explanation of reality improves with the research processes. Apart from the experiences developed by teamwork activities (León et al., 2015; Solbes, 2013) it is evident that the working world is requiring critical Thinking-related competencies from recently graduated professionals (Conchado et al., 2015) and the fastest Higher education Institutions and companies create alliances to favour transfer of knowledge, the better will be for the graduates their inclusion in the working world.

Conclusions

Higher Education Institutions require knowledge transfer since its purpose is to prepare professionals who will become part of the working world. In this sense, the participation of HEIs and companies is required to seek the competitiveness of organizations. Colombia has been performing a huge effort to strengthen this relationship considering that both the management of knowledge and research processes are differentiating factors in the market and foster competitiveness in those organizations throughout the employment of graduates with the competencies that Work market requires.

The development of competencies in research in professionals allow the graduates to expand their work opportunities because it is prepared for the demand of working world and, personally, because it contributes the chance to improve and apply their knowledge through the development of critical thinking in the activities that are carried out in the companies.

It is necessary for HEIs to establish Transversal criteria for the teaching of competencies in Research and that companies make a selection of professionals carrying out measurement of interpersonal and intrapersonal skills, multiple intelligences and the scientific competences themselves.

It is important to remark that students deem relevant to participate in Research processes, which is a promising setting for IHE as long as they consider to foster critical thinking, a fundamental skill for their performance in the graduate's working world. For instance, in subjects oriented in the institution analysed highlight research methodology, involving cores, research seedlings, development of degree works, and contribution of young researchers where students or recently graduated leaders are trained in IHE to become future researchers. There can also be found curriculum of master and doctorate programs focused on postgraduate students with the purpose of answering for demands raised by the economic increase and process of globalization that Colombia is dealing with.

In order to achieve this goal, the following strategies in IHE are proposed:

- It is required to create a connection between programs of different levels of education: elementary, secondary and higher. For that, research must be promoted from elementary and secondary education strengthening initiatives that instil development of research in childhood. For instance, in Colombia the program Ondas works as a pedagogical strategy for the fostering towards research from kids. Likewise, potentiate in higher education research seedlings as an extracurricular activity with the purpose of fostering research culture. Besides, it is needed to support training of young recently graduated researchers joining them to research groups. The former will allow to IHE provide an appropriate scenario for the development of basic and specialized competencies in research allowing the increase of scientific production and visibility of IHE.
    - Foster an adequate environment for Research involving curriculum with Research projects where, from the very first moment of involvement of student to the Institution of Higher Education, make sure that he starts his process as a learning methodology and not as an obligation.
    - Training teachers in Research so they can also train their own students, establishing parameters that allow to adapt a Methodology of Research and PBL to be used as a mediator strategy in the Teaching-learning process.
    - Encourage the application of government policies related to the fostering of Research making University-company-state alliances that allow to increase economic resources for hiring and developing research projects in IHE.
    - Foster a Research Culture, to value and manage knowledge.

All above mentioned evidences the need of strengthening the existing relationship between HEIs and the company with the purpose of improving the transfer of knowledge and work involvement of professionals with competencies in research that are flexibles to change and experienced in the area of formation.

Last but not least, lines of future research related to research process and scientific competencies are related to the proposal of a model which allows determine which of the factors influence graduate's working performance considering innovation and management of knowledge that must be adhered to organizational processes favouring competitivity in the HEIs.

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

References

Álvarez, G., Y. C. (2014). Las habilidades del pensamiento crítico durante la escritura digital en un ambiente de aprendizaje apoyado por herramientas de la web 2.0 [The critical thinking skills for digital writing in a learning environment supported by Web 2.0 tools]. *Encuentros, 12* (1), 27-45.

Campos, C. J., & Chinchilla, J. A. (2009). Reflexiones acerca de los desafíos en la formación de competencias para la investigación en educación superior [Reflections on the challenges of skills training for research in higher education]. *Revista Electrónica "Actualidades Investigativas en Educación", 9* (2), 1-20.

Cascante, M., L. G. (2013). Metodología de la investigación educativa: posibilidades de integración [Methodology of the research education: possibilities of integration]. *Revista comunicación, 12*(1), 182-194.

Colorado, Y. S., Ospino, G. C., & Salazar, K. O. (2013). Semilleros de investigación en una muestra de estudiantes universitarios de Santa Marta (Colombia) [Research seedbeds group, a sample with students at the university from Santa Marta (Colombia)]. *Psicogente, 16* (30), 379-390.

Conchado, A., Carot, J. M., & Bas, M. C. (2015). Competencies for knowledge management: development and validation of a scale. *Journal of Knowledge Management, 19* (4), 836-855.

Falicoff, C. B. (2015). Evolución de las competencias científicas en las carreras de Bioquímica y Biotecnología de la Universidad Nacional del Litoral, Argentina. Un estudio longitudinal/ [Evolution of scientific competence in racing Biochemistry and Biotechnology, National University of Litoral, Argentina. A longitudinal study]. *Enseñanza de las ciencias, 33* (1), 269-270.

Gobierno Vasco. (2012). Informe de Evaluación Diagnóstica. Competencia en cultura científica, tecnológica y de la salud. Marco teórico [Diagnostic evaluation report. Competition culture scientific, technological and health. Theoretical framework]. Departamento de Educación, Universidades e Investigación. Retrieved from http://www.hezkuntza.ejgv.euskadi.eus/contenidos/informacion/dig_publicaciones_innovacion/es_curricul/adjuntos/14_curriculum_competencias_300/300007c_Pub_BN_Competencia_Cientifica_ESO_c.pdf.

Guerrero, U., M. E. (2007). Formación de habilidades para la investigación desde el pregrado [Formation of skills for research from the undergraduate]. *Acta Colombiana de Psicología, 10* (2), 190-192.

Gutiérrez, S., N. G. (2009). Valores universitarios y profesionales de los estudiantes de posgrado de la UNAM [Academic and professional values of the UNAM graduate students]. *Perfiles educativos, 31* (126), 141-146.

Guzmán, D., A. P. (2013). *Factores críticos de éxito en el uso de las redes sociales en el ámbito universitario: aplicación a twitter [Critical success factors in the use of social networks at the University level: application to Twitter].* (Doctoral dissertation), Universitat Politècnica de València.

Guzmán, A. P., & Del Moral, E. (2016). Twitter's contribution to improving strategic communication in Latin American universities. RUSC. *Universities and Knowledge Society Journal, 10* (2), 236-251.

Hewitt, N., & Barrero, F. (2012). La integración de los saberes: una propuesta curricular para la formación en investigación en la educación superior [The integration of knowledge: A curriculum proposal for training in research in higher education]. *Psychologia: avances de la disciplina, 6* (1), 137-145.

Lamanauskas, V., & Augienė, D. (2009). Pupils scientific research activity development in comprehensive school: The case of Lithuania. *Journal of Baltic Science Education, 8* (2), 97-109.

León, R., A. R., Núñez, J., A. L., & Torres, J., M. T. (2015). La formación para la investigación y su incidencia en la cualificación académica de los estudiantes de contaduría en Colombia [Research training and its impact on the academic qualifications of the accounting students in Colombia]. *TEUKEN BIDIKAY,* (5), 100-122.

Moreno, B., M. G. (2005). Potenciar la educación: un currículum transversal de formación para la investigación [Enhance education. a cross-cutting curriculum training for research]. *REICE. Revista Electrónica Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 3* (1), 520-540.

Moreno, P., & Soto, G. (2005). Una mirada reflexiva y crítica al enfoque por competencias [A reflective and critical look at the competence approach]. *Educar, 35*, 73-80.

Oliveras, B., & Sanmartí, N. (2009). La lectura como medio para desarrollar el pensamiento crítico [The reading as a means to develop critical thinking]. *Educación Química, 20* (1), 233-245.

Pešaković, D., Flogie, A., & Aberšek, B. (2014). Development and evaluation of a competence-based teaching process for science and technology education. *Journal of Baltic Science Education, 13* (5), 740-755.

Pollo-Cattaneo, F., Rodriguez, D., Britos, P., & García, R. (2009). *Propuesta de formación de RRHH en investigación basada en un modelo colaborativo. Hacia un Cambio de Paradigma [Proposal for training of human resources in research based on a collaborative model. To a change of paradigm].* Paper presented at the Proceedings of VI International Conference on Engineering and Computer Education. Buenos Aires, Argentina.

Salas, Z., W. A. (2005). Formación por competencias en educación superior. Una aproximación conceptual a propósito del caso colombiano [Training by competencies in higher education. A conceptual approach with regard to the case of Colombia]. *Revista Iberoamericana de Educación, 36* (9), 1-11.

Solbes, J. (2013). Contribución de las cuestiones sociocientíficas al desarrollo del pensamiento crítico (I): Introducción [Contribution of socio-scientific issues to development of critical thinking (I): Introduction]. *Revista Eureka sobre enseñanza y divulgación de las ciencias*, *10* (1), 1-10.

Tarrés, M. C., Montenegro, S. M., Gayol, M., D. C., & D'Ottavio, A. E. (2016). Educación en valores: un enfoque desde la investigación científica [Education in values: an approach from scientific research]. *Revista Iberoamericana de Educación, 1* (1), 83-88.

Torkunova, Y. V. (2015). Optimization Model of Interactive Forms of Education for Formation Innovative and Research Competence. *Procedia-Social and Behavioral Sciences, 191*, 1690-1692.

Torres, E. C., Blanchar, E. B., & Freile, G. M. (2015). *Competencias investigativas: Desarrollo de habilidades para la construcción del conocimiento en la formación profesional [Investigative competences: abilities development for the construction of knowledge in vocational training].* Paper presented at the Global Conference on Business & Finance Proceedings. La Guajira, Colombia.

Valdés, C., A. A., Nenninger, E., H. E., & Noriega, J., A. V. (2013). Desarrollo de competencias científicas en estudiantes de posgrado desde la perspectiva del docente [Development of research-oriented competences in graduate students. A teacher's perspective]. *Educere, 17* (58), 419-430.

Valencia, J., Macias, J., & Valencia, A. (2015). Formative research in higher education: Some reflections. *Procedia-Social and Behavioral Sciences, 176*, 940-945.

Velasco, M. S. (2014). Do higher education institutions make a difference in competence development? A model of competence production at university. *Higher Education, 68* (4), 503-523.

Véliz, F., S. G., Díaz, R. T., & Rodríguez, R., M. T. (2015). La formación de competencias científico investigativas para la sostenibilidad ambiental en el ingeniero agropecuario [The formation of scientific-investigative competitions for the environmental sustainability in the agricultural engineer]. *REFCalE: Revista Electrónica Formación y Calidad Educativa, 2* (3), 59-70.

Vidal, L. M., & Araña, P., A. B. (2014). Formación en valores [Formation of values]. *Educación Médica Superior, 28* (1), 175-186.

Zhao, Z. (2014). Competence Research *Areas of Vocational Education Research* (pp. 167-188): Springer.

Received: *January 18, 2017* Accepted: *March 05, 2017*

Alba P. Guzmán Duque	PhD, Associate Professor, Autonomous University of Bucaramanga, Cl. 42 #4011, Bucaramanga, Santander, Colombia. E-mail: aguzman201@unab.edu.co
Diana V. Olivares Contreras	PhD, Associate Professor, Autonomous University of Bucaramanga, Cl. 42 #4011, Bucaramanga, Santander, Colombia. E-mail: doliveros364@unab.edu.co
Edgar M. Mendoza García	PhD, Associate Professor, Autonomous University of Bucaramanga, Cl. 42 #4011, Bucaramanga, Santander, Colombia. E-mail: emendoza84@unab.edu.co