Information Competence of Doctoral Students in Information Science in Spain and Latin America: A Self-assessment

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The study was carried out with students of official doctoral programs of Information Science in four universities in Spain and Latin America with the purpose of finding out, through self-assessments, student perceptions of their own information competence. A survey was designed to determine self-perceptions of knowledge, skills and attitudes regarding information competence, and it was distributed to students of two universities in Spain, one in Cuba and one in Mexico. Student perceptions of the levels of their own information competence in terms of knowledge, skills and attitudes are, in general, high. Nevertheless, despite being immersed in research processes that require these information competencies, they recognize that they are lacking in certain skills related tothe organization, evaluation and presentation of information. Having a self-assessment that identifies those areas of information competence in which students consider themselves to be weak will be a significant help in planning activities designed to strengthen these areas in doctoral programs.

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Introduction

In the last two decades, higher education has witnessed a change in the educational paradigm from the traditional model focused on teaching to a new model focused on learning, in which the student, rather than the professor, is the principal protagonist.[1] This new educational model has been encouraged by factors such as the evolution of teaching and learning, the development of Information and Communication Technologies (ICT) and their application to educational purposes, the processes of innovation, and the requirements of the labor market. With the new model, it is a key issue for the student to develop a significant capacity for self-directed learning, and to acquire maturity in the mastery of competences, especially information competences, while the professor/mentor takes on the role of facilitator and guide in the process.[2] This has implied a new approach and new role for both educators and students. The emphasis is placed on the results of the learning process.[3]

The issue in question is an education based on competences, understood as capacities needed in order to resolve life situations in an efficient and independent way. Among the different competences that students need to master is information competence, which refers to analyzing, synthesizing, evaluating, using and disseminating information, to successfully address the changes inherent to an information society. From that comes the growth of information literacy, understood as the cognitive-affective network that enables individuals, not only to recognize their need for information, but to also understand it, evaluate it, and make use of it.[4] Literacy in information is much more than a logical step toward instruction in the use of resources in libraries, since

its objective is to create habits for lifelong learning, and the capacity to solve information needs, find, evaluate, and use information to resolve problems or make decisions.[5] It implies the understanding of a systematic way of thinking and an understanding of the way in which information flows within different systems.

The process of INFOLIT (information literacy) has been more widely accepted since there have been models and rules for its application.[6] Of relevance to higher education is the *Information Literacy Competency Standards for Higher Education*,[7] widely translated and adapted to diverse countries and contexts. A recent model establishes the framework of INFOLIT beginning with the processes of *connection*, *usage* and *interaction* with information, emphasizing the actions associated with the learning process in each phase, as well as the processes of reflection on the experiences and results of each process.[8] If we concentrate on the preparation of doctoral students, we see that, during this period students will make extensive use of information; they do not only have to be able to recognize their need for information, but they also need to have skills for searching, locating, organizing, evaluating and presenting information. Doctoral students should stay up-to-date with respect to knowledge and use of specialized literature, perhaps even more than an established researcher, due to the implications of writing a doctoral dissertation.[9]

In this context, we consider it important to have a better understanding of the perceptions and attitudes of doctoral students about information in higher education and of their perceptions of their own strengths and weaknesses in the area of information literacy, thus being more able to define areas for improvement. This information can help educators, dissertation directors, and information professionals to better design formative and informative strategies.

In Spain and Latin America, there is a significant lack of research on this topic, and for that reason the aim of this study is to discover and analyze the perceptions and opinions of students undertaking doctoral programs in Information Science in these Spanish speaking regions, focusing on what do they perceive as their own strengths and weaknesses in the area of information competence. This is achieved through a self-assessment survey of the students' knowledge, skills and attitudes designed to identify areas for improvement.

Literature Review

Given the conceptual breadth of INFOLIT and the diversity of contexts in which it is used,[10] we have focused this literature review on two specific areas: on one hand, the integration of INFOLIT initiatives to doctoral programs, and on the other, self-assessment as a form of evaluation of knowledge and abilities with respect to information literacy.

INFOLIT in Doctoral Studies

The application of the process of information literacy for doctoral students is an important topic in higher education addressed by a large number of initiatives. Along these lines, it is interesting to note the compilation done by Booth[11] of studies carried out in various Australian universities in workshops for doctoral students aimed at the management and use of information including topics such as indexing and creation and management of bibliographies.

In the United States, the *Professional Scientist: Postdoctoral and Independent Researcher* program emphasizes aspects related to the new characteristics of the sources of information, such as learning to identify the most important journals in a discipline area, evaluating the implications of the citations in the *Journal of Citation Reports* or how to search the ISI databases.[12] Another interesting study has been carried out in the *SDSU-USD (San Diego State University and University of San Diego) Joint Doctoral Program* to explore the process of INFOLIT and its application in educational contexts,[13] in which the correlation between the courses offered in the doctoral program and the *Information Literacy Competency Standards for Higher Education*[14] was studied. At Nova Southeastern University, in Fort Lauderdale, Florida, they examined the advantages and disadvantages of the design of an online and face-to-face course that would satisfy the needs of preparation in INFOLIT.[15] The first phase was an online test given by the librarians to corroborate the technological skills of students, which oscillated between moderate and advanced. The following modules were aimed at locating information in databases (ERIC, etc.) and at reflecting on the use of sources of information for research purposes. Independently of the strengths and weaknesses detected, a significant aspect of the study was that, in both phases, the students learned to locate and access information necessary for their research. A different experience makes use of the bibliometric approach to analyze the citations given by students at the University of Georgia in their research papers and to verify the sources of information used as well as to consider the influence of the formative activities and the inclusion of different support materials and formats (books, web sites, etc.).[16]

A comparative study of doctoral students from the United States and Australia addresses how students learn to compile a bibliography and examine academic contexts, as well as the characteristics of the students, the reflection of pedagogical practices and INFOLIT in the countries which were object of the analysis.[17] From a qualitative perspective, it presents the results of interviews of six participants — North American and Australian students, as well as those of two specialists in information (one from each country). The students interviewed stated that INFOLIT will play an important role in the beginning of the doctoral research process. In addition, they point out that the process of literature review implies carrying out literacy activities such as seeking, organizing and synthesizing information. However, they do not identify acquisition and evaluation as essential aspects of information literacy in this process. Although other similar studies exist,[18] no precedents were found in the context of Spain and Latin America.

In the United Kingdom, we find an interesting study, which points out the need to better understand the research preparation of doctoral students with respect to electronic formats, emphasizing the role played by dissertation directors and librarians, as well as the importance of self-directed learning.[19] There is another outstanding report in the UK published by *Research Information*.[20] It deals with INFOLIT education offered by universities to their researchers, and is focused on information competence training as indicated in the SCONUL model:[21] search, assessment, organization, management and transformation of the information. The relevance of the study lies in the suggestions it offers for analyzing each level. On a national level, the recommendations offered are directed at the organizations responsible for the preparation of researchers in the country. Within the institutional sphere, suggestions are provided for improved communication among those responsible for the process of planning, organizing and training students in the management and use of information. The study proposes collaboration among librarians, specialists and educators, with the goal of reflecting on the strengths of the strategies and techniques employed. In addition, university libraries are encouraged to use their databases in a more effective way to share and expand knowledge of best practices in research preparation. A sample of this can be found in the electronic guidebooks published by the University of York and the University of Newcastle; the interactive introductions to resources of information available; the organization of information careers fairs for doctoral students, such as that carried out by the University of Oxford and the online tutorials of the University of Manchester: Speed PhD, among other experiences.

In France, we have identified two unique initiatives. The first is developed within the framework of a course in research methods and, with the help of librarians, organizes a workshop focused on the following topics: introduction to sources, basic searches, advanced search techniques and management of references. Students had to hand in, as a final exercise, a portfolio with an explanation of the research plan, the strategies of the searches carried out, justification of the keywords selected and the bibliographical database generated with the Procite

program.[22] The other study shows in the form of a matrix the competences that masters and doctoral students should have, indicating at what point they should acquire them.[23]

In Spain and Latin America, a number of initiatives have been developed to incorporate the teaching of information competences at university level, but most of them have focused on undergraduate studies. In graduate studies, the integration of these competences as a part of student preparation is relatively recent, and has consisted in offering courses on "Advanced Information Skills," with a focus on methodology and with specialized content according to the doctoral program.[24]

Self-assessment in Information Literacy

A diagnosis of the perceptions of students regarding their own information literacy and its competences can be achieved through the application of self-assessment tests. It is a subjective method, since those individuals filling out the survey are evaluating their own competence. The results of these tests should be interpreted cautiously since there are some studies that have shown that students tend to overestimate their own information competence when asked to evaluate themselves.[25]

It has been used in combination with other more objective tools[26] and also as a principal or exclusive method of assessment.[27] The study carried out by Cole and Kelsey [28] among a group of 346 English students of a nursing degree to find out the level of information literacy, points out the structural and functional difficulties that must be overcome before carrying out a literacy plan.

Self-assessment is an integral part of many systems of evaluation, and needs to be used as a tool among other sources of feedback to offer a more complete understanding of competence.[29] In the United States and Australia self-assessment has frequently been used through detailed interviews with undergraduate students and doctoral students. It is obvious that when the information needs of students are known in detail, it is possible to better direct library preparation and INFOLIT programs.[30] A 2009 study in Greece addresses student perceptions to better understand what information skills need to be included in a course integrated into the curriculum. It was found that a significant percentage of those surveyed had never used the electronic sources available in the library such as electronic journals, databases and the online catalog.[31] In Ireland, another interesting study on self-assessment is based on the combination of instruments of self-assessment and diagnostic tests to determine some indicators of the areas that those responsible for information literacy should address, such as the generalized lack of confidence with respect to the use of techniques for advanced searches. In it, Patterson proposes the necessity for disassociating knowledge of ICT and competences in information literacy.[32]

Most studies on self-assessment about doctoral students show a high rate of perception of their basic information competences, such as those about conducting simple information searches or the usage of electronic information resources. Nevertheless, they do show a much lower self-perception level when looking at more advanced information skills, like using databases, thesauri, or reference managers. For instance, Patterson[33] states that students show a high level of confidence in using search engines, library catalogs, and making an ethic use of information. However, they are less confident when performing advanced information searches, using thesauri, and using many library sources. This lack of confidence in complex skills is rather usual and can also be found in other studies, such as Cole and Kelsey's,[34] Hoffman, Antwi-Nsiah, Feng, and Stanley's,[35] or Perrett's.[36]

A similar behavior can be observed if we pay attention to undergraduates. Students show a certain level of confidence in the most general or basic competences, but this level drops considerably when focusing on more complex competences. Examples of this can be found in the works of Ferguson, Neely and Sullivan[37] or Korobili, Malliari and Christodoulou.[38]

Even though there are nuances in the degree of confidence presented in some studies, depending on the subjects undertaken by the students or their geographical origin, we believe this responds to a general tendency. We suppose that the students of Library and Information Science (LIS), who are familiar with the usage of information, should show a higher level of confidence in information competences, according to their expert training in information subjects. Nevertheless, very few works focus on this population of students and, although it seems that they do show a higher level of confidence ,[39] further research is needed to strengthen this hypothesis.

In Spain and Latin America, we have not found any study on self-assessment of information competences for graduate students or for LIS students. We do not think that there should be significant differences in comparison with other regions, since training received at universities is focused on developing their information competences and included specific programs and courses on information literacy. However, we do believe this should be corroborated by studies. Thus, we believe that the main differences between LIS students in Spain and Latin America and other students will mainly depend on their training on LIS, rather than on other factors.

Methodology

Design of the ALFINVES (Information Literacy for Research) Survey Instrument

In order to meet the objectives of this study, a survey instrument, named ALFINVES, was designed to obtain the data. It is a questionnaire created with the purpose of better understanding the perceptions of doctoral students about their own level and ability to manage information competences.

About the Survey

The first phase was based on the collection, discussion and evaluation of similar studies, taking into account the mastery of skills following the taxonomy of Bloom and Krathwohl[40] and the successful Knowledge, Skills and Attitudes (KSA) model of Kraiger, Ford and Salas.[41] Three areas of analysis were determined, and are shown as three principal categories:

- Cognitive (Knowledge). Malhotra defines knowledge as a constantly changing mixture that includes experience, values, contextual information and expert vision, providing a framework for incorporating new experiences and information. For knowledge to have value, it should include human additions to the context, culture, experience and interpretation.[42] In any case we are referring, not only to verbal, prepositional or declarative knowledge, but rather, also to the organization of knowledge and meta-cognitive strategies.
- Procedural (Skills). To refer to the skills of doctoral students is to bring together all the actions, behavioral patterns, cognitive resources and attitudes that are products of education, and are implied in any scientific activities. According to the definition of skill offered by the American College of Occupational and Environmental Medicine, a skill prepares an individual to adequately carry out other hierarchical and/or logically associated activities. On the other hand, competence is the possession of sufficient intellectual, physical and behavioral qualities (knowledge, skills and attitudes) to carry out a task or adequately take on a role in order to achieve a desired result.[43] This procedural section refers not only to the routine carrying out of a procedure but also to the ability to automatically and simultaneously carry out several tasks.
- Affective (Attitudes). Attitudes are individual differences that affect behavior and are considered to be the link that exists between the knowledge acquired by an individual and the actions that s/he carries out and will carry out in the present and the future.[44] But to these attitudes relative to the learning process, self-sufficiency or the establishment of objectives, we should add the degree of motivation that is always present in all individuals.

Additionally, some information literacy models were reviewed;[45] their characteristics were determined and they were compared to Bloom's taxonomy.[46] The decision was made to choose Kuhlthau's model of the Information Search Process (ISP)[47] to carry out this research, since it offered a holistic vision of information literacy, not only as a discreet group of skills, but also as a way of learning that describes user's experience in the process of information seeking as a series of thoughts, feelings, and actions. This model was the one used for organizing the categories of Initial Skills and Training Needs and Self-Assessment Skills, and was applied following the basic steps of any research process from the user's perspective: initiation, selection (items 1 and 2), exploration (3 to 5), formulation (6 to 10), collection (11 to 15) and presentation of information (16 to 22).

Design of the Survey

The second phase of the design permitted the determination of the elements that were to be included in the categories that correspond to the process of doctoral-level preparation. In the category of *Knowledge*, aspects such as those factors considered in the selection of the dissertation director, the selection of the research topic and the level of applicability of the topic to professional environments were considered.

In the category *Skills*, all the stages proposed by Kuhlthau[48] in her model are present. In this category, the participant is initially offered the opportunity to think about the information skills s/he possesses, and in which skill areas s/he has needed more training. Subsequently, questions are formulated following each stage, focusing directly on those actions that a doctoral student should carry out. That is the case, for example, in the section of *Exploration* — third stage of Kuhlthau's model — where the participant is asked if s/he *uses indexes to locate information* or in the section of *Formulation* — fourth stage of the chosen model — where the question is *if the student uses the advanced search option as a retrieval strategy*.

The category *Attitudes* was divided into two sections with the purpose of showing the affective attitude of the doctoral student in relation to the research process and the recognition of mastery of information skills, emphasizing those that clearly require an affective and/or emotional component of the survey participant, for example, asking *if s/he selected the research topic based on an original idea* or *if s/he uses bibliographical citations to recognize the original source*.

In this phase of the design, the scale for measuring the items of the three groups of categories was discussed. It was apparent that it was necessary to find an equivalent distribution for all categories — that would serve to evaluate a skill or an attitude — that, in addition, would be understood with the same meaning by all doctoral students immersed in the study. Several examples of survey instruments were revised with attention to the way in which their scale was proposed; in this case the Libqual+[49] and the IL-HUMASS (Information Literacy in Humanities and Social Sciences) survey instruments [50] were a great help. It was decided to combine the models, using the scale of 1–9, and clarifications were used in some cases to provide a clearer interpretation of the category. The instrument was submitted to validation first by experts (professors and investigators with recognized experience) and afterwards by young researchers in a period of preparation. The main observations were collected and the survey questionnaire was adapted to its definitive form.

The final result was a survey instrument (Appendix A) that included, in addition to demographic questions (age, sex, university and category), 37 items, grouped in four principal categories; evaluation of knowledge (5), initial skills and training needs (2), evaluation of skills (22) and evaluation of attitudes (8). When asking about their category, we differentiated between the students who were not engaged in any professional activity ("students") and students who were also working as professors, researchers or professionals.

Selection of the Sample and Administration of the Survey

Four doctoral programs from the area of Information Science from Spanish and Latin American universities were selected through the process of convenience sampling. All four doctoral programs shared characteristics that made them suitable for our sample: we had access to these groups of students and some of the authors of this article had taught in the doctoral programs in more than one of the universities selected. Therefore, we had direct experience with the universities and their doctoral programs.

During the months of March and April of 2008, an online survey was sent to all students (total of 123) enrolled for the 2007/2008 academic year in the following doctoral programs:

- *Information Science*, offered by the University of Granada at the University of Havana (Cuba).
- *Administration: Knowledge Management, Innovation and Technology*, of the School of Higher Education of Cuautitlán (Mexico).
- *Information Science*, of the University of Granada (Spain).
- *Methodologies and Lines of Investigation in Library and Information Science* at the University of Salamanca (Spain).

These programs provide theoretical and methodological training about several fields and contents, including how to undertake research work leading to a dissertation, a process which is supervised by a mentor. Once students complete their dissertation and defend it through an oral examination successfully, they are enabled to start their doctoral research under the supervision of their PhD director.

In 2008, no specific course on INFOLIT was yet part of the syllabi of any of the doctoral programs surveyed or any other official programs in Spain and Latin America. That continues to be the case in 2012. Thus, the situation that existed when the data were gathered remains the same today for many doctoral programs in which students do not receive systematic preparation in information literacy as part of the syllabus. Thus, the data continues to be timely for those responsible of the curricular design of doctoral programs. Table 1 shows the distribution of completed and valid surveys for each doctoral program.

The response rate was high in all of the universities, except for Havana, where there were problems with access to the internet. The drop off rate was slightly high, around 10%, due to the fact that those survey questionnaires that were very incomplete were not included.

Table 1
Number of answers and valid answers

	Havana	Granada	Salamanca	Cuautitlán	Total
Students registered	60	12	21	30	123
Answers	35 (58%)	9 (75%)	20 (95%)	30 (100%)	94 (76%)
Valid answers	30 (50%)	9 (75%)	14 (66%)	29 (96%)	82 (66%)

Table 2
Demographic data from the sample

Variable	Specific variables	Havana	Granada	Salamanca	Cuautitlán	Total
Sex	Man	7 (23.3%)	3 (33.3%)	6 (42.9%)	14 (48.3%)	30 (36.6%)
	Woman	23 (76.7%)	6 (66.7%)	8 (57.1%)	15 (51.7%)	52 (63.4%)
Age	<35	14 (46.7%)	6 (66.7%)	9 (64.3%)	13 (44.8%)	42 (51.2%)
	35≥45	14 (46.7%)	3 (33.3%)	3 (21.4%)	11 (37.9%)	31 (37.8%)
	>45	2 (6.6%)	0	2 (14.3%)	5 (17.2%)	9 (11%)
Professional category	Professor	12 (40%)	1 (11.1%)	2 (14.3%)	1 (3.4%)	16 (19.5%)
	Student	7 (23.3%)	0	6 (42.9%)	6 (20.8%)	19 (23.2%)
	Professional	10 (33.3%)	3 (33.3%)	2 (14.3%)	15 (51.7%)	30 (36.6%)
	Researcher	1 (3.3%)	5 (55.6%)	4 (28.6%)	7 (24.1%)	17 (20.7%)

Data Processing

SPSS (17.0) software was used to process the data gathered. The reliability of the survey instrument was confirmed through the determination of the alpha coefficient of Cronbach ($\alpha = 0.951$) and the potential for replication using the *split-half* method ($\alpha_1 = 0.907$ and $\alpha_2 = 0.921$). Afterwards, once the high degree of reliability of the survey instrument was confirmed, a descriptive analysis of the data and the possible association among variables was carried out and the results were interpreted.

Results

The distribution of the demographic data of the sample indicates the characteristics of the individuals who responded to the survey (Table 2). We can see that in all of the doctoral programs a greater number of women than men responded, that most of those surveyed belong to the age group of below 35 years and that the majority of those who had another activity apart from being a doctoral student belonged to the category 'professionals'.

Self-assessment of Knowledge

The answers of those surveyed who were asked to do a self-assessment of their own information competence, show that, overall, they perceive themselves as holding a high level of competence. However, they recognize that it could be improved (Table 3). In contrast, responses to most of the questions about the research process (such as the selection of research topic, the role of the dissertation director, the information systems available to students, or the competences necessary to carry out research), showed self-perceptions of moderate competence, with average values ranging from 6.65 to 6.91. Responses to the question about the ability to apply individual projects to areas of work resulted in perceptions of greater competence (7.63 as average value), which suggests that the doctoral students surveyed have a considerably clearer vision of "why" they are going to do research than of "how" they are going to carry it out.

Self-assessment of Skills

Before asking students to evaluate their skills on a scale of 1–9, we asked them about the skills that they held upon starting the program and in which ones they needed most training. Among the responses collected, 63% stated that they had sufficient skills to determine in a precise way their own informational needs. It is an apparently high percentage, but since it is an essential issue in order to begin any subsequent search process or processing of information, this percentage should logically be even higher in students of Information Science. Nevertheless, only 23% of them stated that they needed greater training.

With respect to the identification of the sources, the percentage is higher, reaching 75.6%, and only 30% of those who needed more preparation. Almost 70% of those surveyed stated that they had sufficient skills for seeking information, which could be expected considering that most of the students had received previous training in

Table 3
Self-assessment of knowledge

Knowledge	Low (1–3)	Moderate (4–6)	High (7–9)	Average values
You understand the level of applicability of your project to your work area	0	12 (14.6%)	70 (85.4%)	7.63
You understand the role of the dissertation director within the overall process of doctoral research	10 (12.2%)	19 (23.2%)	53 (64.6%)	6.91
You have the information competence necessary to carry out your research project	3 (3.7%)	29 (35.4%)	50 (61.0%)	6.82
The selection of the research topic represented a crucial moment at the beginning of doctoral research	6 (7.3%)	20 (24.3%)	56 (68.3%)	6.72
You know scientific information systems in your work area	6 (7.3%)	27 (32.9%)	49 (59.8%)	6.65

Figure 1
Initial skills and training needs.

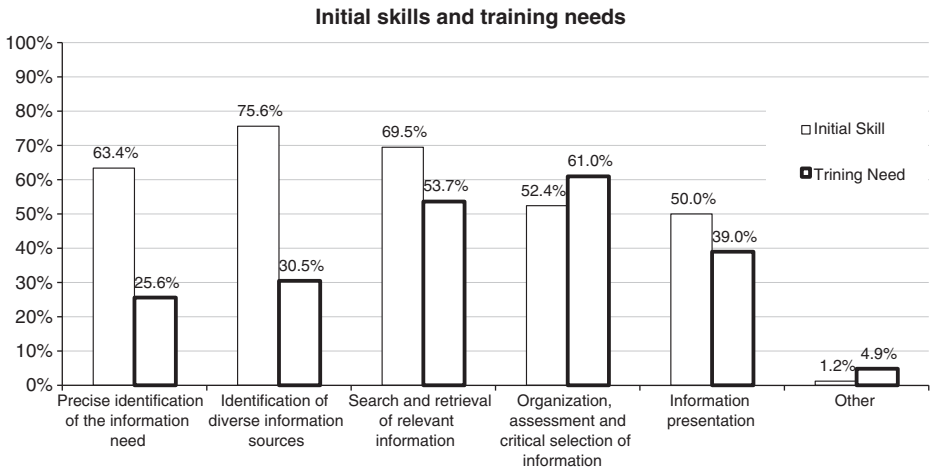

Table 4
Self-assessment of skills

Skill	Low (1–3)	Moderate (4–6)	High (7–9)	Average values
You contrast information recovered with information needs	1 (1.2%)	10 (12.2%)	71 (86.6%)	7.63
You check different sources of information regardless of the support format (electronic and/or print)	1 (1.2%)	15 (18.3%)	66 (80.5%)	7.57
You refine searches based on results found	1 (1.2%)	18 (22.0%)	63 (76.8%)	7.46
You know the terminology specific to the research topic	2 (2.4%)	18 (22.0%)	62 (75.6%)	7.34
You utilize the summary as an instrument to filter relevant information found	0	21 (25.6%)	61 (74.4%)	7.33
You utilize the advanced search option as a strategy for recovery	2 (2.4%)	20 (24.3%)	60 (73.2%)	7.3
You compare the content of the documents recovered (veracity, objectivity, authority, etc.)	2 (2.4%)	22 (26.8%)	58 (70.7%)	7.27
You can summarize the research topic in an exact sentence	2 (2.4%)	21 (25.6%)	59 (72.0%)	7.26
You find equivalent phrases (sentences) to express the same idea	2 (2.4%)	21 (25.6%)	59 (72.0%)	7.13
You know how to use different existing bibliography styles for references	4 (4.9%)	24 (29.3%)	54 (65.9%)	7.05
You communicate results orally in the time limit established	2 (2.4%)	26 (31.7%)	54 (65.9%)	7.02
You know how to identify authors or titles specific to the topic	4 (4.9%)	24 (29.3%)	54 (65.9%)	6.95
You use indexes to locate information	5 (6.1%)	23 (28.0%)	54 (65.9%)	6.87
You can summarize all of the research in 15 power point slides	8 (9.8%)	20 (24.3%)	54 (65.9%)	6.87
You know how to write an abstract of your research	6 (7.3%)	23 (28.0%)	53 (64.6%)	6.85
You can judge the value of a document by the information provided in its title, author, and summary if full text is not available	9 (11.0%)	22 (26.8%)	51 (62.2%)	6.71
You elaborate a personal data base with relevant information	6 (7.3%)	22 (26.8%)	54 (65.9%)	6.6
You know how to write an article for a scientific journal	10 (12.2%)	23 (28.0%)	49 (59.8%)	6.43
You elaborate profiles for searches	6 (7.3%)	38 (46.3%)	38 (46.3%)	6.37
You know how to disseminate research results on the web	11 (13.4%)	31 (37.8%)	40 (48.8%)	6.33
You know how to work with some bibliography management system	12 (14.6%)	33 (40.2%)	37 (45.1%)	5.99
You consult a thesaurus as a control instrument for terminology to carry out a search	20 (24.3%)	26 (31.7%)	36 (43.9%)	5.46

Information Science. Nevertheless more than half needed more preparation, which indicates to us that the needs of searching for information at doctoral level are much greater than at undergraduate level, since graduate students need to perform more comprehensive and accurate searches.

With respect to the organization, evaluation, and presentation of information, the students stated a lower initial skill level, with percentages around 50%, which could show certain deficiencies in the training received in these areas. Of those surveyed, 61% stated that they had needed training on organization and evaluation of the quality of information and 39% needed more training on presenting information (see Fig. 1).

The results with respect to how students perceived their skills on a scale of 1–9 are similar, in general, to those of knowledge, with an average value around 7.

In Table 4 we can observe, from greater to smaller values, how respondents assessed their skills, noticing how they state to have greater skills in the basic aspects of seeking and contrasting information (the use and preparation of summaries, contrasting information, use of different sources…). This shows us that, despite their training in how to use of information, in graduate school they face greater and more sophisticated needs when it comes to informational skills, and that perhaps their training should be strengthened in order to carry out more significant research projects.

Self-assessment of Attitudes

The self-assessments with perceptions of the highest levels were obtained in the area of attitudes, with an average value of 7.32 out of 9. Those surveyed have stated to maintain a receptive attitude toward their dissertation director and a critical attitude toward the sources and systems of information they used. They are also aware of the terms and regulations on author's rights and the ethical aspects regarding the use of information, as can be seen in the item "use of bibliographic citations as recognition of the original source", the item with the highest grade on the survey (7.76 as an average value) (Table 5).

Differences among Students

Although the main objective of the study, due to the design and the limitation of the sample, is not aimed at establishing comparisons among the different groups according to the independent variables (sex, age, professional category and doctoral program), an analysis of homogeneity (ANOVA one way) was done among the groups to see if some dependent variable could be related to the independent ones.

At a level of significance of $\alpha = 0.05$ no significant differences were found between the self-perceptions of men and women with respect to any variable. Neither significant differences were found among the age of the three groups established, with the exception of two items about the use of advanced electronic tools to search for information: "utilizes the option of advanced searches as a strategy for retrieval" and "refines the search carried out in view of the results found," where we could see a lower value in the self-perception of level on the part of those over 45 years old.

Quite a few differences in the self-assessments were found among the different professional categories, with professors and researchers obtaining better scores than students and professionals, especially in more academic aspects such as "is capable of summarizing the topic in a single exact sentence", "is capable of finding equivalent phrases to express the same idea", "contrasts information recovered with information needs", "utilizes the summary as an instrument to filter relevant information found", "makes critical evaluations of information systems and services", "maintains a receptive attitude with respect to the indications of the dissertation director", "maintains a self-critical attitude with respect to information competence", "uses bibliographic citations as an instrument of recognition of the original source", or "is knowledgeable regarding the bases established with respect to author's rights and intellectual property."

Conclusions

The results of the self-assessments of this segment of the doctoral student population provide first-hand information, although subjective, of students' perceptions of their own competence in relation to knowledge, skills, and attitudes toward information, which are the three main cornerstones of their present, and especially their future, as information-literate professionals and researchers. One of the potentials of this study is to provide a diagnosis from the doctoral student perspective, a methodological perspective which is a pioneer approach in the sphere of influence of Spain and Latin America and, undoubtedly, in other areas of the world. We are aware that this is an initial "X-ray view", which should be contrasted with objective assessments that measure *what students know how to do* as a complement to the measurement of *what they perceive that they are able to do.*

Overall, the study shows self-assessments of high levels of information competence among those surveyed. Although there are

Table 5
Self-assessment of attitudes

Attitude	Low (1–3)	Moderate (4–6)	High (7–9)	Average values
You employ bibliographical citations as recognition of original sources	1 (1.2%)	12 (14.6%)	69 (84.1%)	7.76
You selected the research topic based on an original idea	0	13 (15.9%)	69 (84.1%)	7.6
You maintain a receptive attitude with respect to the indications of the dissertation director	3 (3.7%)	15 (18.3%)	64 (78.0%)	7.51
You evaluate in a critical way the sources consulted	0	17 (20.7%)	65 (79.3%)	7.45
You know the bases established with respect to authors' rights and intellectual property	3 (3.7%)	24 (29.3%)	55 (67.1%)	7.11
You maintain a self-critical attitude with respect to information competence	3 (3.7%)	17 (20.7%)	62 (75.6%)	7.34
Approval of the selection of the topic with the dissertation director	5 (6.1%)	20 (24.3%)	57 (69.5%)	6.91
You make critical evaluations of information systems and services	4 (4.9%)	24 (29.3%)	54 (65.9%)	6.88

differences about the degree of perception among the different items, we can see that, with respect to almost all the topics, the majority of respondents perceive their levels of competence to be high (values between 7 and 9 on the scale) and there are very few information competences in which those surveyed recognize a low level of competence. It is obvious that, in a doctoral program of Information Science we would expect to find students with a higher level of information competence than we might find in students of other degree programs since they should have a high level of expertise in the specialized environment of the use and treatment of information.

Despite the limitations of the study and the use of a self-assessment test, the results give us relevant information that provides us to have a clearer understanding of the student perspective. Students' perceptions of their own levels of information competence are undoubtedly important in the *affective* aspect of their academic development in areas such as motivation and self-confidence. Their self-perceptions will affect the way they approach research and other scholarly activities throughout their careers. For that reason we believe that it is important to have data that reflects this subjective aspect of student information competence, as seen from the perspective of doctoral students.

Although it is difficult to establish comparisons of the results with other studies, mainly due to the differences in the questionnaires used to collect the data, we can see a higher self-perception among the students surveyed for this study than among the graduate students in other fields.[51] In such research, students acknowledge to be rather confident with more general competences, like in the study undertaken by Hoffman, Antwi-Nsiah, Feng, and Stanley [52] or in Perrett's;[53] however, the degree of confidence drops when focusing on advanced search techniques, database-related knowledge and access to collections. In our view, this can well be due to the previous training in LIS of the graduates surveyed in this research, as also evidenced by Indira Irawati's study,[54] where graduate students of the Department of Information and Library Science at the University of Indonesia who were interviewed acknowledged a good degree of confidence in their information competence for the vast majority of the surveyed items. Nevertheless, in the same fashion as Islam,[55] who also researched LIS graduates self-perception in Bangladesh and found out more cautious self-perceptions, we also believe that the information competence of graduate students in this field should be improved.

If we compare our results with those of studies looking at undergraduates, the differences in self-perceptions are even greater, especially in those questions about more advanced skills in the use of information. Thus, in the studies of Patterson;[56] Ferguson, Neely and Sullivan;[57] and Korobili, Malliari and Christodoulou,[58] we see average or moderate confidence levels in elementary questions about the use of information, but a fairly low levels of confidence in more advanced questions such as the use of thesaurus, advanced information searches or accessing non-library materials. We suppose that this divergence is due as much to the graduate/undergraduate difference as to the specific training in LIS.

Other studies about undergraduates, such as the ones done by Susan Vickery and Heather Cooper [59] or Hadimani and Rajgoli,[60] show high levels of confidence in information literacy, but we believe that they cannot easily be compared to our results since they did not ask questions about complex skills, knowledge or attitudes suitable for graduate students.

Although the results of the self-assessments are encouraging, the authors of this article, as a result of their extensive experience in training doctoral students and directing doctoral dissertations, believe that the real world reality is not, however, as encouraging. Thus, the study represents a first step toward focusing on the systematic training of students in information literacy through program planning and syllabus. A subsequent step will be to conduct objective assessments of specific competences in order to identify areas for improvement more accurately.

The combination of subjective and objective methods of assessment to evaluate in a more complete way the perspectives, attitudes, and specific levels of information competence of doctoral students should help those responsible for program planning to better meet students' needs. As a future research, we may consider expanding the study to other doctoral programs in other scientific areas and the use of complementary techniques in order to compare the results and their implications for the mastery of knowledge, skills, and useful attitudes in the access, management and use of information for research purposes.

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Appendix A. Survey

Survey of doctoral students' information competence

Demographic data

Sex: ___
Age: ___
Professional category:
Professor Student Professional Researcher
University: ___
Program: ___

Evaluation of knowledge

Acknowledgment of the relevance of the activity or process dealt with. Value your skill from 1 to 9. The minimum is 1 and the maximum, 9.

1. The selection of the research topic represented a crucial moment at the beginning of doctoral research.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

2. You understand the role of the dissertation director within the overall process of doctoral research.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

3. You know scientific information systems in your work area.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

4. You have the information competence necessary to carry out your research project.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

5. You understand the level of applicability of your project to your work area.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

Initial skills and training needs

1. Which information skills do you consider you had at the beginning of the research (You can choose more than one.)

Precise identification of the information need
Identification of diverse information sources
Search and retrieval of relevant information

Organization, assessment and critical selection of information
Information presentation
Others

2. For which skills have you needed more training? (You can choose more than one.)

Precise identification of the information need
Identification of diverse information sources
Search and retrieval of relevant information
Organization, assessment and critical selection of information
Information presentation
Others

Self-assessment of skills

Control of the activities that should be carried out. Value your skill from 1 to 9. Minimum is 1, and maximum is 9.

1. You can summarize the research topic in an exact sentence.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

2. You find equivalent phrases to express the same idea.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

3. You check different sources of information regardless of the support format (electronic and/or print).

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

4. You know how to identify authors or titles specific to the topic.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

5. You use indexes to locate information.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

6. You know the terminology specific to the research topic.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

7. You consult a thesaurus as a control instrument for terminology to carry out a search.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

8. You elaborate profiles for searches.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

9. You utilize the advanced search option as a strategy for retrieval.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

10. You refine searches based on results found.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

11. You can judge the value of a document by the information provided in its title, author, and summary if full text is not available.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

12. You compare the content of the documents recovered (veracity, objectivity, authority, etc.).

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

13. You contrast information retrieved with information needs.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

14. You utilize the summary as an instrument to filter relevant information found.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

15. You elaborate a personal data base with relevant information.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

16. You know how to work with some bibliography management system.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

17. You know how to use different existing bibliography styles for references.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

18. You can summarize all of the research in 15 power point slides.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

19. You know how to disseminate research results on the web.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

20. You know how to write an abstract of your research.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

21. You know how to write an article for a scientific journal.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

22. You communicate results orally in the time limit established.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

Self-assessment of attitudes

Value your attitude toward the activity. Value your skill from 1 to 9. The minimum is 1 and the maximum is 9.

1. Approval of the selection of the topic with the dissertation director.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

2. You maintain a receptive attitude with respect to the indications of your dissertation director.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

3. You make critical evaluations of information systems and services.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

4. You maintain a self-critical attitude with respect to information competence.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

5. You selected the research topic based on an original idea.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

6. You evaluate in a critical way the sources consulted.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

7. You employ bibliographical citations as recognition of original sources.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

8. You know the bases established with respect to authors' rights and intellectual property.

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9

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