



DOCENCIA - INVESTIGACIÓN

Effects of an educational training program on health science students' research capacity

Efecto de un programa de capacitación en competencias de investigación en estudiantes de ciencias de la salud

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ABSTRACT

The European Higher Education Area implies a change to the Health Science education in Spain. Spanish university system must promote the acquisition of competences in research habits, such as the information management or scientific dissemination. This article presents the findings of a study to evaluate the level of effectiveness and satisfaction of an educational training program on research skills geared towards Health Science students. A hundred and eight students of Physical Therapy degree, Occupational Therapy degree and Nursing degree were participated into a quasi-experimental study. Educational needs were first detected by a questionnaire based on different research skills. A semi-distance educational training program was designed and implemented after defining the above-mentioned needs. This program significantly improved the perception of knowledge and skills in research competences. As well as the level of theory and practical content assimilated by the students significantly increased after the program. These findings suggest that incorporation of specific training that allow for students to come in contact with research, are effective at improving research competences for Health Sciences students.

RESUMEN

El Espacio Europeo de Educación Superior implica un cambio en la formación universitaria de Ciencias de la Salud en España. El sistema universitario debe promover desde el grado la adquisición de competencias básicas en investigación, como la gestión de información y la comunicación científica. Este artículo presenta los hallazgos de un estudio cuyo objetivo fue evaluar el nivel de eficacia y satisfacción de un programa de capacitación educativa en competencias de investigación dirigido a estudiantes de

Ciencias de la Salud. Se diseñó un estudio cuasiexperimental en el que participaron ciento ocho estudiantes de grado de Fisioterapia, Terapia ocupacional y Enfermería. En una primera fase se detectaron las necesidades educativas en competencias de investigación a través de un cuestionario; a continuación se implementó un programa de capacitación semipresencial y se evaluó el efecto alcanzado en las necesidades antes detectadas. Este programa mejoró significativamente la percepción de los participantes en relación a su conocimiento y habilidad en competencias de investigación. Del mismo modo, las destrezas cognitivas y prácticas mejoraron considerablemente tras el programa. Estos hallazgos evidencian que la puesta en marcha de programas específicos de capacitación en investigación es efectiva para mejorar la adquisición de competencias a este respecto en estudiantes de Ciencias de la Salud.

INTRODUCTION

The incorporation of Health Science degrees to the European Higher Education Area (EHEA) implies a change to the traditional Spanish university system. Health Science education in Spain continues to focus on the creation of qualified health professionals but with deficits in the promotion of active research habits ⁽¹⁾.

A key requirement of the Bologna Declaration on which the EHEA is based is that teaching is centered on, and priority be given to, autonomous student work and acquisition of skills, learning methods based on capacity and ability of students to search relevant and scientific information, and the procedures to evaluate skills. The integration of life-long learning is one of the principal objectives as a strategy of global learning and to create a European research area ⁽²⁾. This way, training in research techniques for the different areas of Health Sciences is included as a generic competence.

In this context, healthcare-related clinical competences require not only the acquisition of skills, techniques, attitudes and values needed to carry out actions related with the prevention, diagnosis and treatment of diseases and interpersonal interaction (patients, family members, other professionals), but also the command of specific knowledge and the development of skills to reason from available scientific evidence ⁽³⁾. Thus, the acquisition of competences, such as the information management or scientific dissemination, becomes indispensable to develop clinical knowledge and consolidate a professional profile founded on evidence-based clinical practice in Health Sciences ⁽⁴⁾. Different studies show the positive effect produced by education/training in scientific competences at different education levels: bachelor degrees, post-graduate degrees and continued learning ⁽⁵⁻⁸⁾. These authors highlight the importance of the acquisition of these competences for good professional performance. Understanding the adequate sources of information to update existing knowledge on a specific topic and how to apply said knowledge in practice improves the quality of the interventions carried out in healthcare environments. Larkin et al. ⁽⁷⁾ reveals the difficulties that exist among healthcare professionals to use research in their clinical practice that include the lack of confidence to read, interpret and understand research findings and a lack of support to introduce said research findings into practice.

In addition, evidence-based decision-making is based on the findings of the most recent high-quality research, and there is wide agreement that the methodology required for this approach should be taught throughout university courses ^(9,10). It is thus important that an evidence-based model be regarded as adding dimension to the decision-making process rather than replacing the judgment and experience of clinicians ⁽¹¹⁾. Therefore, the existence of competent professionals to carry out research leads not only to

improvement in healthcare practice but also in producing original research that translates into an advancement in the different Health Science disciplines.

GECOSALUD is a teaching innovation intervention focused on promoting the acquisition of knowledge and skills in the search for information (SI) and scientific dissemination (SD) of students from the three degrees that are offered in the Health Science School (Nursing, Physical Therapy and Occupational Therapy) of the University of Granada (Spain). With this background, the aims of this study were to identify the training needs for specific research skills and to evaluate the level of effectiveness and satisfaction of an educational training program on said skills (GECOSALUD) geared towards Health Science students. The hypothesis is that the current education and support program has a positive effect on the perception and knowledge of students from all 3 degree programs in SI and SD.

METHOD

Design, Participants and setting

A quasi-experimental study was conducted between January and June of 2011 and 2012. The participants were 2nd and 3rd year students of the Nursing, Physical Therapy and Occupational Therapy degree programs of the University of Granada (Spain). To avoid any selection bias, all first year students were excluded as they belonged to a new study plan (bachelor's degree) that includes material on topics related with the search of scientific information and literature. When the study was conducted, the participating students belonged to the diploma program (equivalent to an associate's degree) according to the organization of university studies in Spain. Sampling was carried out with the population defined as the total number of students of the Health Science School that were studying all three degrees. The study was based on criteria that included the lack of skills related to research and that were considered as a generic competence in the EHEA bachelor's degree programs. Participation was voluntary and written informed consent was obtained from the students. The study was approved by the University of Granada and an external Spanish accreditation agency (ANECA: National Agency for Quality Assessment and Accreditation of Spain).

Educational needs were first detected by completing a questionnaire based on the existing knowledge on data management, databases and scientific text writing. A hybrid educational training program (GECOSALUD) was designed and implemented after defining the above-mentioned needs. The classroom-based portion was divided into three 2-hour sessions that included the following content: conceptual bases of Health Science research, scientific literature search strategies, accuracy sources of information and scientific paper writing. Teaching was carried out in lecture format. Along with the classroom-based section, the students also had a virtual classroom on the Teaching Support Web System platform (SWAD) that belongs to the digital campus of the University of Granada. The students had access in the virtual classroom to bibliographies that supplemented the content taught in the classroom-based phase, as well as didactic exercises and games to consolidate the acquisition of knowledge and skills. A support program was developed along with the educational training program to aid the students in carrying out the tasks that were required of them for the different classes that they took. This part of the program was carried out in both the classroom-based section as well as in the virtual section, with support sessions with the participating professors, and virtually by means of the SWAD. Thanks to the resources provided by information and communication technologies, both the learning and support

processes could be optimized by implementing a collaborative work mode where the students themselves also participated in finding answers to their own questions ⁽¹²⁾.

Lastly, the effectiveness of the program was evaluated based on a list of indicators that measured the perception, knowledge and skills developed by the students regarding the competences worked on as well as their degree of satisfaction.

Data Collection

The researchers designed a questionnaire that included four parts, in which 23 items served to measure indicators related to the perception of the students regarding their knowledge and skills to SI and SD, as well as their practical theoretical knowledge that they possess in this regard (Appendix 1).

The first part was composed of basic questions that allowed for us to situate the students based on demographic variables and others related with their previous academic education.

The second part was composed of six items that were meant to measure the perception of the student regarding the competences studied. A Likert scale was used with a scoring system that went from 1 (in strong disagreement) to 5 (strong agreement).

The third part focused on evaluating the theory and practical knowledge of the students. Eight multiple-choice responses were presented with only one correct answer.

Lastly, in the fourth part, three items, also regarding theory and practical knowledge, were presented. They were multiple-choice questions where students could choose as many answers as they wished. A greater number of correct responses led to greater results.

Another study variable was the students' satisfaction with the program. A questionnaire was used that had been designed by the researchers themselves that collected opinions on topics related with docent planning, infrastructure, the usefulness of content and the capacity of the professors. The measuring scale was a likert-type scale (Appendix 2).

Data Analysis

The response of the participants was graphed in a data matrix. The SPSS 19.0 statistics package was used for this and for the analyses carried out. First, a descriptive analysis of the data was carried out for all parts of the questionnaire. Later, to confirm the hypothesis, a t-test was used for related samples, that compared the mean score obtained by the participants before and after receiving the educational training intervention in the second and third part of the questionnaire. This test was performed by adding together the scores of the Likert scale. The maximum score that could be obtained was 30 and 8, for the second and third parts, respectively. A descriptive analysis of the data was carried out for the satisfaction questionnaire.

RESULTS

The sample was of 108 students of which 21.3% were male and 78.7% were female. 19.1% belonged to the Physical Therapy degree program, 30.1% belonged to the Occupational Therapy program and 50.7% belonged to the Nursing degree program.

49.3% were second year students and 45.6% were third year students (5.1% did not response this item).

Depending on the objectives set at the beginning of the study, the perception of the students regarding the educational needs detected in SI and SD were translated into a lack of knowledge of the structure of scientific paper writing (52.8%), design and search for bibliographic references (40.2%) and reference citation systems in Health Sciences (60.2%) (table 1).

Table 1. Perception of knowledge and skills in SI and SD at baseline.

Items evaluated	Strongly disagree		Disagree		Undecided		Agree		Strongly agree	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
They possess knowledge of the structure of scientific writing	24	22.2%	33	30.6%	34	31.5%	16	14.8%	1	0.9%
They know how to design and execute a bibliographic search	6	5%	38	35.2%	43	39.8%	14	13%	4	3.7%
They know how to effectively organize their own bibliographic documentation, notes, references and citations	7	6.5%	30	27.8%	41	38%	26	24.1%	1	0.9%
They have the initiative to search for the information they need	1	0.9%	9	8.3%	27	25%	58	53.7%	13	12%
They know the principal standard systems to manage Health Science bibliographies	31	28.7%	34	31.5%	25	23.1%	15	13.9%	3	2.8%
They know how to write in a clear, concise and organized manner	4	3.7%	12	11.1%	43	39.8%	46	42.6%	3	2.8%

Categorical variables are expressed as absolute and relative frequencies (N=108)

Regarding the students' knowledge, the greatest amount of incorrect responses (over 50%) were found in items related with the correct bibliographic search techniques (92.5%), the search for key words (86.8%), the reference system for journal articles (77.8%), the logical sequence for the presentation of research results (63%) (table 2 and 3)

Table 2. Theory and practical knowledge of students at baseline (items with a single correct answer)

Items evaluated	Correct response		Incorrect response	
	Freq	%	Freq	%
Order that must be followed in structure of scientific writing	58	53.8%	50	46.2%
Correct search techniques	8	7.5%	100	92.5%
Correct journal article referencing	24	22.2%	84	77.8%
Section of book to be consulted to search for information	71	65.7%	37	34.3%
Where to search for specific terms that best adapt to their work	14	13.2%	94	86.8%
Search performed with a cited example	86	79.6%	22	20.4%
How to add clarity and simplicity to writing	58	53.7%	50	46.3%
The logical sequence to express research results	40	37%	68	63%

Categorical variables are expressed as absolute and relative frequencies (N=108)

Table 3. Theory and practical knowledge of students at baseline (items with various correct responses)

Item 1		CUIDEN		MEDLINE		PEDRO		CINAHL		SCOPUS	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Databases considered as important	YES	21	19.4%	95	88%	8	7.4%	31	28.7%	8	7.4%
	NO	87	80.6%	13	12%	100	92.6%	77	71.3%	100	92.6%
Item 2		Textual transcription of a paragraph of an article		Textual transcription of a paragraph of a chapter of a book		When I write with my own words that found in an article		When I write with my own words that found in a chapter of a book		Unknown	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Cases where it is necessary to include a reference to the source of information	YES	69	63.9%	50	46.3%	21	19.4%	18	16.7%	16	14.8%
	NO	39	36.1%	58	53.7%	87	80.6%	90	83.3%	92	85.2%
Item 3		They include a list of references		They describe the methodology		They have been evaluated by the editorial committee		They have been evaluated by peers		None of the previous	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%

Characteristics that best describe an article published in a scientific journal	YES	57	52.8%	42	38.9%	50	46.3%	10	9.3%	5	4.6%
	NO	51	47.2%	66	61.1%	58	53.7%	98	90.7%	103	95.4%

Categorical variables are expressed as absolute and relative frequencies (N=108)

Before the educational training program, the total score on the perception of the students regarding competences in SI and SD was 17.1 ± 3.30 . After the program, the mean score significantly increased up to 23.7 ± 2.97 ($p < 0.001$), due to the fact that there was improvement in all the items that made up said questionnaire ($p < 0.001$) (table 4).

Table 4. Differences within items and total score in perception of knowledge and skills in SI and SD before and after the training program.

Items evaluated	Baseline	Six Month Post-learning phase	CI (95% confidence interval)	t	p Value
They know the structure of scientific writing	2.28 ± .93	4.20 ± .65	-2.15, -1.67	-15.84	<0.001*
They know how to design and execute a bibliographic search	2.68 ± .94	3.89 ± .67	-1.44, -.97	-10.29	<0.001*
They know how to effectively organize their own bibliographic documentation, notes, references and citations	2.74 ± .89	3.93 ± .75	-1.39, -.99	-11.84	<0.001*
They have the initiative to search for the information they need	3.68 ± .83	4.25 ± .71	-.76, -.37	-5.77	<0.001*
They know the principal Health Science standard systems to manage bibliographies	2.29 ± 1.14	3.77 ± .91	-1.77, -1.17	-9.75	<0.001*
They know how to write in a clear, concise and organized manner	3.24 ± .86	3.85 ± .63	-.78, -.42	-6.64	<0.001*
Total score	17.1 ± 3.30	23.77 ± 2.97	-7.5, -5.86	-15.52	<0.001*

*p < 0.05

Values are expressed as mean ± SD for baseline and post-learning phase and as 95% confidence interval (CI) for within variable.

Similar results were obtained for the theory and practical knowledge, where the total score before the program was 3.27 ± 1.3 , which rose significantly up to 6.2 ± 1.47 ($p < 0.001$) after the program ended (table 5).

Table 5. Differences within items and total score in theory and practical knowledge of students before and after the learning program

Items evaluated	Baseline	Six Month Post-learning phase	CI (95% confidence interval)	t	p*
Order that must be followed in structure of scientific writing	.53 ± .50	1.01 ± .51	-.63, -.33	-6.27	<0.001
Correct search techniques	.07 ± .25	3.89 ± .67	-3.98, -.67	-9.63	<0.001
Correct journal article referencing	.19 ± .39	.40 ± .51	-.33, -.081	-3.28	0.001
Section of book to be consulted to search for information	.64 ± .48	.86 ± .35	-.33, -.10	-3.78	0.001
Where to search for specific terms that best adapt to their work	.15 ± .36	.81 ± .39	-.76, -.55	-12.07	<0.001
Search performed with a cited example	.78 ± .41	.94 ± .23	-.25, -.07	-3.46	0.001
How to add clarity and simplicity to writing	.54 ± .50	.92 ± .27	-.49, -.26	-6.39	<0.001
The logical sequence to express research results	.36 ± .48	.55 ± .52	-.34, -.047	-2.62	0.010
Total score	3.27 ± 1.3	6.21 ± 1.47	-3.32, -2.56	-15.41	<0.001

*p < 0.05

Values are expressed as mean ± SD for baseline and post-learning phase and as 95% confidence interval (CI) for within variable.

Lastly, the degree of satisfaction of the students regarding the education training program was high where 94.6% confirmed that the content was adapted to the objectives, 94.5% considering it as a useful activity with a high level of acceptance of the interactive web environment developed (74.8%) (table 6).

Table 6. Results of the student satisfaction survey

Items evaluated	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Clear and adequate objectives	0%	0%	2.2%	40.2%	57.6%
Content adjusted to objectives	0%	0%	5.4%	26.1%	68.5%
Useful content	0%	1.1%	4.3%	31.5%	63%
Adequate methodology	0%	2.2%	5.4%	35.9%	56.5%
Adequate time schedule	0%	2.2%	4.3%	20.7%	72.8%
Easy-to-use Web environment	0%	1.1%	24.2%	36.3%	38.5%
Useful Web environment	0%	2.2%	17.6%	48.4%	31.9%
Professors adequately prepared	0%	0%	1.1%	13.9%	85%
The professor explains in a clear and concise manner	0%	1.1%	3.3%	20.7%	75%
The project coincides with expectations	0%	2.2%	3.3%	34.8%	59.8%

DISCUSSION

In this study, the GECOSALUD program identified the lack of knowledge of the scientific paper writing structure, design, search and organization of scientific literature as well as the use of the primary reference citing systems in Health Sciences as the principal educational deficiencies. In addition, this program significantly improved the perception of knowledge and skills regarding the SI and SD competences, as well as the level of theory and practical content assimilated by the students from the three degree programs.

The Health Science students perceived a university education deficit in research competences, focused on the lack of knowledge of scientific paper writing design, management of databases and bibliographic references. It should be mentioned that the students had no knowledge of the existence of the specific databases for each specialty, with MEDLINE as the principal reference source. These findings suggest that the traditional Spanish education system is going through a process of transition toward the European educational model, where learning continues to be focused on professional clinical qualifications whereas evidence-based practices fall into a second plane ⁽¹³⁾. Various factors may underlay this deficit; funding for research in these disciplines remains limited due to the fact that economic resources are directed towards topics developed in other knowledge areas and for research groups and departments that already have extensive experience ^(1,13). Another primary reason is the commitment to academic competences. The Health Science professors of Spanish universities have to effectively manage the competing demands of teaching and research. These disciplines, unlike others, require the continuous update of clinical knowledge and the new techniques being used that hinder the development of exhaustive, high quality research ⁽¹³⁾. As long as there is a theoretical and practical education deficit in research among university staff, it is nearly impossible that this competence can be transferred successfully to the student sector ⁽¹⁴⁾. All of this explains how there has been no “research culture” in Health Sciences as many professionals in this area who are now at a senior clinical or educational level have not acquired the use of these skills as a natural part of their work ^(13,15). This change therefore requires additional efforts in the Spanish health and university sectors.

GECOSALUD improved the Health Science students’ self-perception regarding the competences dealt with. In this sense, Fuentelsaz et al. ⁽¹⁶⁾, in their study with nursing students, showed that priority competences included stimulating a critical, ethic and analytical attitude toward scientific documentation at the bachelor, master and doctorate levels. Larkin et al. ⁽⁷⁾ detected important deficiencies in research competences among

hospital staff and they obtained positive results by implementing a Nursing Research Committee that provided these resources to the volunteer participating staff through the creation of posters, discussion groups, etc., fomenting the acquisition of knowledge, theory and research skills in an environment that supports critical thinking. The intention of university programs such as GECOSALUD is to improve said detected deficits before the students join the work force. The strengthening of these competences from university education thus provides the student and future professional with the basic tools to carry out quality clinical practice. On the other hand, other authors have highlighted the importance of including students in actual research contexts where they can participate in the different phases of the development of a project, directed and counseled by an experienced researcher, to develop their research capacity in a real and collaborative environment ⁽⁶⁾. Future research should include practical training activities aimed at achieving this goal, along with the educational program designed.

Although this educational training program produced overall improvement of knowledge regarding research resources, one of the principal difficulties perceived, like the use of standard systems of bibliographic references, the "Correct reference of a journal article" remained the least modified item after the intervention. This suggests that formatting aspects are those that least concerns the students, when this is one of the relevant variables without SD. Therefore, future research should reinforce and place special emphasis on this aspect. Along these same lines, a lack of knowledge of the characteristics that best define a scientific journal article persisted after finishing the program. However, this is not an alarming finding as the priority objectives of the project were focused on improving critical reading and comprehension of scientific articles, while this aspect remained secondary due to the fact that it is a very specific editorial issue that varies according to the norms of the source consulted.

Investigating students' initiative to research was not a focus of this study, however, the importance of the search for information for the Health Science students becomes obvious given that the percentage of self-perception for this characteristic was high (65.7%). Wyer ⁽¹⁷⁾ evaluated the effect of a training program on evidence-based practice developed with North American junior faculty and residents of various specialties, concluding that the most deficient area is the capacity to initiate original research. In our study, the surveyed students are aware of the importance that research has in Health Sciences and they show initiative in the search for information, but they perceive themselves as having insufficient knowledge to correctly carry out said research.

The GECOSALUD project is an example of the effective incorporation of specific training in the management of scientific knowledge with significant results regarding student learning and with a transversal projection to courses that are included in different degree programs. Therefore, the incorporation of teaching methodologies that allow for students to come in contact with research, fomenting self-learning and clinical reasoning skills, is necessary from the bachelor degree level ⁽¹⁸⁻²⁰⁾.

Study limitations

Post-evaluation of indicators was performed only after the intervention. Therefore, one long-term reassessment of the acquired research skills would be needed to objectify if students have incorporated this knowledge into their usual work context.

CONCLUSIONS

The GECOSALUD project has shown a significant influence on the improvement of the perception held by Health Science students regarding their capacities for SI and SD. Similarly, the indicators of knowledge and skill for these two generic competences have also significantly improved their scores. The adequate management of scientific information and communications is an essential axis to promote the autonomous work by students in the framework of the EHEA and we therefore consider the handling of said competences to be a priority not only in a transversal manner but with specific support programs that enable them to be strengthened as demonstrated with GECOSALUD.

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