



The Research Competence: Acquisition and Development Among Undergraduates in Education Sciences

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Known as one of the competences of the 21st century, research competence can help students navigate through the complexities of a continuously shifting world. This study aims to analyze the acquisition and development of this competence in a sample of 154 undergraduate students of two bachelor's degrees in Education Sciences (Social Education and Pedagogy) of the Universitat Autònoma de Barcelona (Spain). We conducted a three-phase study, in which (1) the learning outcomes related to research competences declared in the syllabi were identified and mapped through a content analysis of each syllabus; (2) students' perceptions about the development of these learning outcomes were gathered through a questionnaire; and (3) guidelines to foster research competences among these undergraduates were explored by a Delphi panel technique. The results show that communicative skills and state-of-art reviewing skills are the least present across the courses of both degrees. The design of research competency acquisition across courses is uneven and does not seem clearly articulated. The students' perception is consistent with the shortcomings, or disarticulation, observed in the curriculum analysis. They consider that the most poorly acquired competencies are the state-of-the-art reviewing, content knowledge, and communicative skills. Apparently, more emphasis is given to reflective thinking and communicative skills; but still, it is necessary to strengthen the acquisition of scientific content, the search for trustworthy information. These results were discussed with two panels of experts from which guidelines were defined to improve the acquisition, development, and evaluation of the research competence through university training in this field.

Keywords: research competence, scientific knowledge, higher education, Education Sciences, Pedagogy, Social Education

INTRODUCTION

Known as one of the key competences of the 21st century, students' research competence can help them navigate through the complexities of a continuously shifting world. In this respect, university students must understand the discipline in which they are becoming professionals and initiate scientific inquiry as a way of acquiring knowledge and innovation in their disciplinary field

OPEN ACCESS

Edited by:

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Specialty section:

This article was submitted to
Teacher Education,
a section of the journal
Frontiers in Education

Received: 15 December 2021

Accepted: 07 April 2022

Published: 18 May 2022

Citation:

Ciraso-Calí A,
Martínez-Fernández JR,
París-Mañas G, Sánchez-Martí A and
García-Ravidá LB (2022) The
Research Competence: Acquisition
and Development Among
Undergraduates in Education
Sciences. *Front. Educ.* 7:836165.
doi: 10.3389/educ.2022.836165

(Visser-Wijnveen et al., 2015; Gess et al., 2018; Murtonen and Salmento, 2019; Salmento et al., 2021).

Paradoxically, no formal pedagogical culture for research methods in the social sciences seems to exist (Wagner et al., 2011). In these disciplines, there are serious shortcomings in the search for scientific information and the analysis of data and its communication according to scientific standards (Lagunes Domínguez et al., 2019; Vázquez-Miraz et al., 2020; Salmento et al., 2021). Despite this, Gess et al. (2018) highlighted the relevance, and specificity, of the acquisition and development of research competence in Social Sciences. They pointed out the importance of mastering the disciplinary knowledge, the knowledge about what social research is, the publication rules, and quality standards. In addition, they reflect on the need to have instruments that are clearly oriented to the analysis of this competence in this field.

Likewise, we believe that when it comes to Education Sciences, the research competence should be one of the pillars of university education. We consider that the critical, reflective, and self-regulated thinking that education professionals must show should be fostered. In turn, this scientific knowledge must be based on the foundations of scientific language – knowledge about science – and this seems to be a tremendous handicap for university students (Kerlinger and Lee, 2002; Murtonen, 2015; Wilson et al., 2016). In this regard, Wessels et al. (2021) showed that in any case, the improvement of scientific knowledge and its language often affects negatively from an attitudinal and motivational point of view.

Even from high school onward, the curriculum clearly establishes for this stage of the educational system that students are expected to be introduced to scientific thinking. The reality, though, is that the acquisition of scientific competence at the end of high school is very limited (Aydeniz et al., 2011). Also, in the case of Education Sciences, studies show that education professionals are required more than others to have research competence as a key mechanism to face the continuous challenges of their work environment (Darling-Hammond and Bransford, 2005) and as a mirror to empower future generations to become aware that research is the rebirth device of any modern society (OCDE, 2011).

In this line, Munthe and Rogne (2015) highlighted that research competence in educators must be acquired in the initial university training. Yet, they stated that responding to this training objective is complicated when the approach to this learning is being developed implicitly in the different subjects, without a clearly agreed plan within the faculty itself and in line with other universities. Another issue to be resolved is “why” this research competence is necessary in these degrees; in this sense, there should be a direct link with educational practice but from a deep theoretical construction, which until now seems absent in students’ education (Salmento et al., 2021).

Based on this, the aim of this study was to analyze the acquisition and development of the research competence among Education Sciences students of the Universitat Autònoma de Barcelona, Spain. We have focused on analyzing two specific bachelor’s degrees: Social Education and Pedagogy. Both degrees have a duration of 4 academic years (240 ECTS). In the

case of Social Education, students are expected to become intervention professionals in the socio-educational field through a multidisciplinary training. Among other competences, they are expected to learn to organize and manage groups; to use mediation strategies; to design action plans and programs; to make use of the research competency in education; and to solve different practical problems, considering that their action takes place in centers such as adolescence residences, open community organizations, penitentiary institutions, centers for foreign minors, and other entities oriented to the reduction of the social exclusion risk. Meanwhile, the degree in Pedagogy is meant to prepare graduates to demonstrate theoretical and practical knowledge and skills linked to the analysis, organization, intervention, and evaluation of education systems. It also aims at deepening the analysis in the practices of academic institutions and in the formal and non-formal education organizations. Thus, students are asked to demonstrate competences to connect the analysis of social reality with educational action. Among others, some of their specific professional fields and skill areas are in educational policy and philosophy of education, adult education and continuing education, and social pedagogy. To this end, research competence is one of the cross-cutting areas to educational guidance and/or management and training in social-educational institutions.

Considering this, we conducted a three-phase study with three main goals: (1) to identify and map the research competences declared in all the syllabi of the two bachelor’s degrees in the field of Education Sciences (Pedagogy and Social Education), following the RMRC-K model by Thiel and Böttcher (2014); (2) to gather students’ perceptions about their acquisition and development of such competences; and (3) to explore guidelines to foster research competence among undergraduates in such degrees.

The RMRC-K model (Böttcher and Thiel, 2018) is inspired by a cross-disciplinary orientation that considers that the goal of scientific research is to generate new knowledge on the basis of empirical data, in a consideration of the research process as a systematic and operationalized action, and an understanding of competency development as a process based on five dimensions (Table 1). This model was created in order to evaluate research-oriented teaching at the university, transcending the individual disciplines. That is to say, it can be used to study the development and the activation of research competence throughout different subjects, using an evidence-based approach of teaching and learning.

In this way, based on this model which we believe to be pertinent to review the research competence in Education Sciences students, this study was developed.

MATERIALS AND METHODS

To achieve these goals, a research project with a case study approach was planned, in Yin’s (2014) connotation: to empirically study a contemporary phenomenon (development of research competence), occurring in a real-life context (degrees in Education Sciences) that is also somehow part of the

TABLE 1 | Dimensions and examples of the RMRC-K model (Böttcher and Thiel, 2018, p. 95).

Dimension of learning outcomes	Description	Example
State-of-art reviewing skills	Systematically reviewing previous relevant findings regarding a topic, evaluating the quality of previous relevant publications, identifying research needs.	<ul style="list-style-type: none"> • Systematically reviewing the state of research. • Evaluating relevant literature. • Identifying contradictory findings. • Identifying research need.
Methodological skills	Investigating the research question in a methodologically controlled and systematic manner, systematically operationalizing relevant aspects of the object of research, and systematically analyzing collected information.	<ul style="list-style-type: none"> • Formulating and operationalizing • Research questions/hypotheses • Planning the research process • Selecting appropriate research Methods • Applying adequate methods
Reflective skills	Reflecting on limitations, as well as theoretical, ethical, and practical implications on research findings.	<ul style="list-style-type: none"> • Reflecting on implications of research results • Reflecting on methodological limitations • Reflecting on practical implications • Reflecting on ethical implications
Communicative skills	Presenting (oral and written) research findings according to professional standards, in a way that makes the methodological approach transparent for the members of the scientific community.	<ul style="list-style-type: none"> • Writing academic publications • Presenting research findings
Content knowledge	Knowledge of central theoretical constructs, methods, and disciplinary standards for presenting research findings.	<ul style="list-style-type: none"> • Central/key theories • Central research methods • Previous findings • Standards of communication in academic research

phenomenon and which requires multiple sources of evidence. In this case, different methodological strategies were used: a content analysis, a survey study, and a Delphi technique.

Stage 1: Mapping of Research Competence Based on Content Analysis

To identify and map the research competence of the 4-year degrees of Pedagogy and Social Education at the Universitat Autònoma de Barcelona (Spain), all the teaching syllabi of each degree from first- to fourth year were analyzed and double peer-reviewed. In so doing, in the first place, all teaching syllabi were reviewed by a pair of experts to perform a first screening, aimed at deciding the unit of analysis. Based on this, they reached the agreement to use the intended learning outcomes connected with research competence instead of the research competence itself, due to their greater degree of specificity and coherently constructive alignment approach (Biggs, 2014). Learning outcomes, in this approach, are actions that students are supposed to be able to perform with what they have learned; they contain verbs, which describe these actions; and the content of learning that students need to use. Among these learning outcomes (LOs), 94 of them were identified as related to the research competence based on their content (for instance, when they mentioned research methods, strategies to gather information, or academic literature) or their verb (e.g., to hypothesize).

Next, these learning outcomes were subject to the scrutiny of new experts in the field to review the research competences identified and to classify them according to the five dimensions of the RMRC-K model. Each expert was matched to a pair, based on their expertise and in accordance with each of the courses of the two bachelors. Thus, one pair reviewed the first-year guides, another the second-year guides, and so on. In parallel,

the two initial experts reviewed each of the teaching guides for both degrees. As a result, the LOs were linked to one or more dimensions of the RMRC-K model (Böttcher and Thiel, 2018). In case of discrepancy, pairs reached an inter-judge agreement; if needed, the judgment of another expert was used. In cases where an LO could be classified with more than one category, both categories were assigned ordering them by the highest degree of relevance.

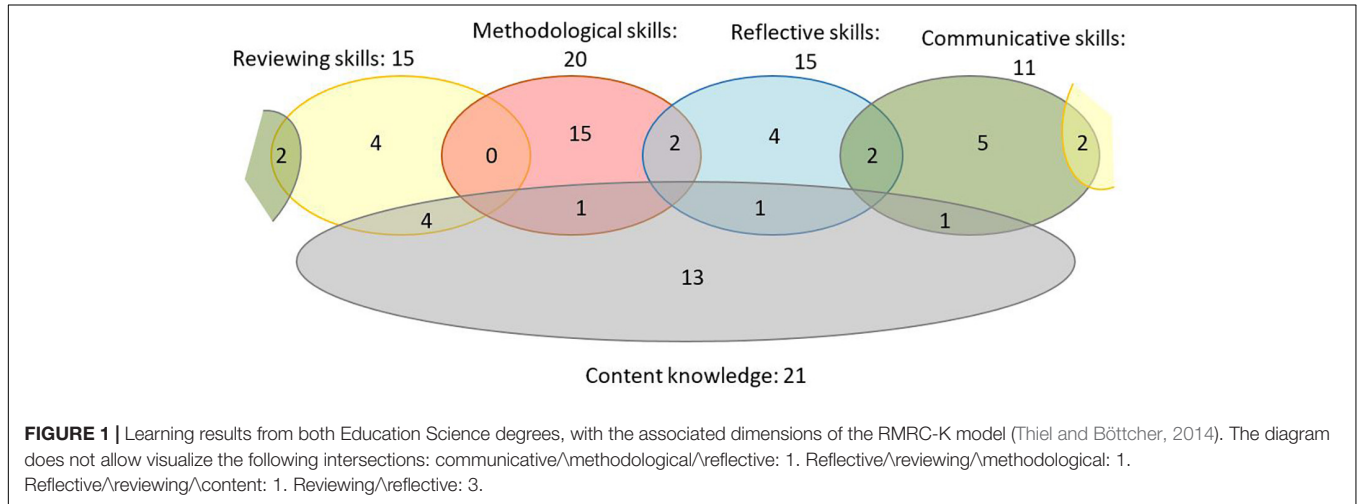
In the reviewing process of the 94 LOs that were initially identified, the following was found in the first round of analysis:

- In 21 cases (22.3%), there was a total agreement between the pairs of researchers.
- In 37 cases (39.3%), there was a partial agreement (pairs associated the same LO with more than one dimension, of which at least one was coincident).
- In 19 cases (20.2%), there was a total disagreement (the pairs of researchers associated the same LO with different dimensions).
- Seventeen of them (18.1%) did not appear in the teaching syllabus analyzed, corresponding to optional subjects that were not taught for the 2019–2020 academic year.

As a result of this, the initial pair of experts carried out a new joint and reasoned review of all the LOs with special attention to those where disagreements occurred. In this phase of analysis, congruence and total agreement were sought; that is, LOs were clearly associated with research competence and with one of the dimensions or skills of the RMRC-K model. From this, a final list of 60 learning outcomes was obtained, associated with one or more dimensions of the RMRC-K model. Of these results, 55 were identified in the degree of Social Education, whereas 36 were identified in Pedagogy's degree (31 LOs appeared to be common to both grades).

TABLE 2 | Description of sample.

Variable	Descriptive statistics
Age	Mean: 22 (SD = 5.5)
Gender	Women: 85.7%Men: 13%Other/do not wish to answer: 1.3%
Degree	Social Education: 51.9%Pedagogy: 48.1%
Grade	1st: 54.5%; 2nd: 16.9%; 3rd: 15.6%; 4th: 13%
Access to university	General high school: 61%Vocational Education and Training: 29.9%Other university degree: 5.2%Other pathways: 3.9%



Stage 2: Students’ Perceptions About Their Acquisition and Development of Research Competence: A Survey Analysis

Second, to gather students’ perceptions about such competences, a questionnaire was designed and applied to a sample of 154 undergraduate students of the two bachelor’s degrees already mentioned in Education Sciences (Social Education and Pedagogy).

In the first section of the questionnaire, students were asked to express (on a scale from 0 to 3) in which degree the different subjects allowed them to reach the LOs previously identified in the syllabi during the previous stage of the research. According to Biggs (2014), in the operational framework for teaching design in constructive alignment, the learning environment should be created using activities that require students to engage with the same intended LOs: the same actions described in the verbs should be performed, so as to activate these LO. Thus, it was pertinent to recall all the intended LOs and gather students’ perceptions about the activation of these actions.

In the second section, Böttcher and Thiel’s (2018) questionnaire was used, with 36 items divided into 5 dimensions, to be assessed on a scale from 0 to 4. The questionnaire was translated from English into Spanish and back translated into English to check word choices and phrasing, following the International Test Commission’s (2017) guidelines. The questionnaire was responded online, prior acceptance of the informed consent form, from May to June 2020. The link was

sent to students in both grades by their respective heads of studies. Final sample was composed of 154 participants who sent the whole questionnaire in the established time range (15 days).

In **Table 2**, a brief description of the sample is presented. It was quite balanced regarding the degree in which students were enrolled; however, it should be noted that first-year students were overrepresented.

Reliability analysis on the subscales of the RMRC-K questionnaire was carried out, considering the basic five-factor model (Böttcher and Thiel, 2018) without subdimensions. All subscales obtained satisfactory estimates of internal consistency: State-of-art reviewing skills $\alpha = 0.86$; Methodological skills $\alpha = 0.81$; Reflective skills $\alpha = 0.90$; Communicative skills $\alpha = 0.79$; Content knowledge $\alpha = 0.91$.

Descriptive analyses were carried out on both sections of the questionnaire separately, and disaggregating data by degree and year. Moreover, Jonckheere–Terpstra’s tests were performed to ascertain if the research competence skills improve as students make progress through academic courses (*post-hoc* analysis with Bonferroni correction was performed).

Stage 3: To Explore Guidelines to Foster an Improvement in Research Competence Based on Delphi Panel

The third stage seeks to define guidelines for training actions to foster the development and application of research competence in Education Sciences degrees. For the approach of this stage, we proposed a Delphi panel technique, which consisted of the

TABLE 3 | Learning outcomes with the main associated dimension according to degree.

Main dimension	Frequency of learning outcomes			
	Pedagogy		Social education	
Reviewing skills	3	8.3%	9	16.4%
Methodological skills	12	33.3%	14	25.5%
Reflective skills	8	22.2%	7	12.7%
Communicative skills	8	22.2%	11	20%
Content knowledge	5	19.2%	14	25.5%
Total	36	100%	55	100%

selection of a group of experts whose opinion was asked about the acquisition and development of the research competence in both Education Sciences degrees. In this sense, the collaboration of six PhD. teachers and researchers of the Autonomous University of Barcelona, experts in the field, was requested.

The experts' assessments were made in two successive rounds with their respective feedback: the first round from October 7 to 14 (2020), and the second round from October 16 to 21 (2020). The consensus was sought but allowing maximum autonomy and confidentiality for the participants. In the first Delphi round, the experts were asked about the major gaps in Education Sciences students' research competence, based on the findings of the second stage. In the second Delphi round, considering these gaps as the result of the first round, the experts were also asked to define guidelines to foster the acquisition and development of these learning outcomes related to the degrees' research competence based on their experience and knowledge.

RESULTS

Stage 1: Mapping of Research Competence Based on Content Analysis

In **Figure 1**, the count of intended LOs related to research competence is displayed, with the associated dimensions of the RMRC-K model. The absolute number of LOs that address exclusively one dimension can be observed: content knowledge (21), methodological skills (20), reviewing skills (15), reflective skills (15), and communicative skills (11). Likewise, the intersections in LOs that are linked to more than one dimension are appreciated.

Some of the LOs were very complex and involved up to three dimensions, such as: *“Recognizing the major educational problems and assessing the theoretical contributions and practices of educational renewal that have been adopted to deal with them in our country,”* which was categorized as related to reviewing skills, reflective skills, and content knowledge. Other LOs were more straightforward and related to one dimension, such as: *“Selecting and applying models, strategies, and instruments of educational supervision,”* which was connected with methodological skills.

Table 3 shows the count of LOs according to the degree (only the associated main dimension is displayed). In addition to the numerical difference between the total LOs in each degree,

TABLE 4 | Learning outcomes identified in Pedagogy degree according to course and main dimension.

Year	Learning outcomes	Main dimension of research competence	
1st	6	Reviewing skills: 0	0%
		Methodological skills: 1	16,7%
		Reflective skills: 2	33,3%
		Communicative skills: 0	0%
		Content knowledge: 3	50%
2nd	24	Reviewing skills: 3	12,5%
		Methodological skills: 7	29,2%
		Reflective skills: 5	20,8%
		Communicative skills: 7	29,2%
		Content knowledge: 2	8,3%
3rd	3	Reviewing skills: 0	0%
		Methodological skills: 0	0%
		Reflective skills: 1	33,3%
		Communicative skills: 1	33,3%
		Content knowledge: 1	33,3%
4th	13	Reviewing skills: 2	15,4%
		Methodological skills: 3	23,1%
		Reflective skills: 2	15,4%
		Communicative skills: 4	30,8%
		Content knowledge: 2	15,4%
Optional courses	8	Reviewing skills: 0	0%
		Methodological skills: 4	50%
		Reflective skills: 2	25%
		Communicative skills: 2	25%
		Content knowledge: 0	0%

TABLE 5 | Learning outcomes identified in Social Education degree according to course-year and main dimension.

Year	Learning outcomes	Main dimension of research competence	
1st	10	Reviewing skills: 0	0%
		Methodological skills: 1	10%
		Reflective skills: 2	20%
		Communicative skills: 0	0%
		Content knowledge: 7	70%
2nd	24	Reviewing skills: 3	12.5%
		Methodological skills: 7	29.1%
		Reflective skills: 5	20.8%
		Communicative skills: 7	29.1%
		Content knowledge: 2	8.3%
3rd	13	Reviewing skills: 1	7.7%
		Methodological skills: 5	38.5%
		Reflective skills: 0	0%
		Communicative skills: 4	30.8%
		Content knowledge: 3	23.1%
4th	25	Reviewing skills: 4	16%
		Methodological skills: 5	20%
		Reflective skills: 4	16.7%
		Communicative skills: 7	28%
		Content knowledge: 5	20%
Optional courses	12	Reviewing skills: 4	33.3%
		Methodological skills: 2	16.7%
		Reflective skills: 1	8.3%
		Communicative skills: 3	25%
		Content knowledge: 2	16.7%

the different distribution by dimension stands out: in Pedagogy, 33.3% of the results refer to methodological skills, followed by reflective and communicative skills, while in Social Education the

TABLE 6 | Achievement of learning outcomes, according to Pedagogy students (by course).

Learning outcomes	Courses			
	1st	2nd	3rd	4th
Produce reports based on results received	1.33 (0.86)	1.18 (0.98)	1.78 (0.94)	2.00 (0.85)
Produce evaluation reports	0.92 (0.94)	0.73 (0.90)	1.89 (1.13)	1.93 (0.80)
Relating research results to innovation processes.	1.06 (0.75)	0.82 (1.08)	1.56 (0.92)	1.80 (0.56)
Knowing the processes of interaction and communication to approach field analysis within observational methodology, using information, documentation, and audiovisual technologies.	1.42 (0.87)	0.91 (0.94)	1.78 (0.73)	1.60 (0.74)
Assessing the weaknesses and strengths of research reports and articles, based on their sections.	1.22 (1.07)	0.91 (0.94)	1.83 (0.79)	1.40 (0.74)
Elaborating technical reports.	0.56 (0.65)	0.45 (0.93)	1.33 (0.97)	1.33 (0.72)

TABLE 7 | Achievement of learning outcomes, according to Social Education students (by course).

Learning outcomes	Courses			
	1st	2nd	3rd	4th
Design quantitative and qualitative descriptive studies based on given problems or needs.	2.08 (0.91)	1.36 (0.67)	2.39 (0.78)	2.20 (0.68)
Construct valid evaluation instruments for measuring and obtaining data.	1.58 (0.94)	1.45 (0.93)	2.22 (0.81)	2.07 (0.70)
Preparing reports based on the results obtained.	1.33 (0.86)	1.18 (0.98)	1.78 (0.94)	2.00 (0.85)
Elaborating evaluation reports.	0.92 (0.94)	0.73 (0.90)	1.89 (1.13)	1.93 (0.80)
Designing evaluation plans for institutions and teaching staff.	0.75 (0.77)	1.55 (0.82)	1.78 (0.88)	1.87 (0.52)
Relating research results to innovation processes.	1.06 (0.75)	0.82 (1.08)	1.56 (0.92)	1.80 (0.56)
Using observational methodology, applying information, documentation, and audiovisual technologies.	1.42 (0.87)	0.91 (0.94)	1.78 (0.73)	1.60 (0.74)
Proposing improvements based on published studies or research.	1.08 (1.00)	1.18 (0.87)	1.44 (0.86)	1.53 (0.74)
Applying participatory research techniques (Participatory Action Research) to community diagnosis.	0.64 (0.80)	0.73 (1.01)	0.94 (0.94)	1.47 (0.64)
Elaborating technical reports.	0.56 (0.65)	0.45 (0.93)	1.33 (0.97)	1.33 (0.72)

most frequent LOs are associated with methodological skills and content knowledge dimension (Table 3).

Next, the LOs identified in the degree of Pedagogy by course are shown (Table 4). An uneven distribution is observed among the courses; specifically, the low number of LOs linked to research competence found in third-year subjects is striking. On the contrary, in the second year, the highest number of research-related LOs appears, mostly related to methodological and communicative skills. Finally, the need to enhance the literature review dimension is evident.

Table 5 shows the count of intended learning results in the degree of Social Education, also by course. In this case, the high number of LOs in the second- and fourth-year subjects stand out. In this degree, it seems more necessary to increase the LOs that optimize the dimensions of reflective, reviewing, and communicative skills.

TABLE 8 | Descriptive results (mean and standard deviation) of Böttcher and Thiel’s (2018) dimensions (by degree).

	Social education	Pedagogy
Reviewing skills	1.63 (0.79)	1.86 (0.75)
Methodological skills	1.92 (0.65)	2.06 (0.57)
Reflective skills	2.05 (0.78)	2.12 (0.72)
Communicative skills	1.63 (0.80)	2.01 (0.77)
Content knowledge	1.32 (0.71)	1.56 (0.65)

The complete spreadsheet with all the learning outputs and associated dimensions of the RMRC-K model (Thiel and Böttcher, 2014) is available as **Supplementary Table 1**. It is possible to explore data by degree, course-year, Los, and dimension.

Stage 2: Students’ Perceptions About Their Acquisition and Development of Research Competence: A Survey Analysis

In the first part of the questionnaire, students were asked to express in which degree the different subjects allowed them to reach the LOs that were identified in the previous stage of the research. As the whole list of LOs would be too long to report here, we chose to present only those LOs that were identified as the most important ones to be improved, according to the experts who participated in the third phase of this project.

In Table 6, Pedagogy students’ perception is presented. The LO that obtains overall the highest score is: “*Produce reports based on results received*,” which is valued by fourth-year students with 2 (on a scale from 0 to 3), followed by: “*Produce evaluation reports*.” In the case of Social Education students, the LO “*Design quantitative and qualitative descriptive studies based on given problems or needs*” is the learning result with the highest score. However, “*Produce reports based on results received*” and “*Produce evaluation reports*” are also very well assessed (in third and

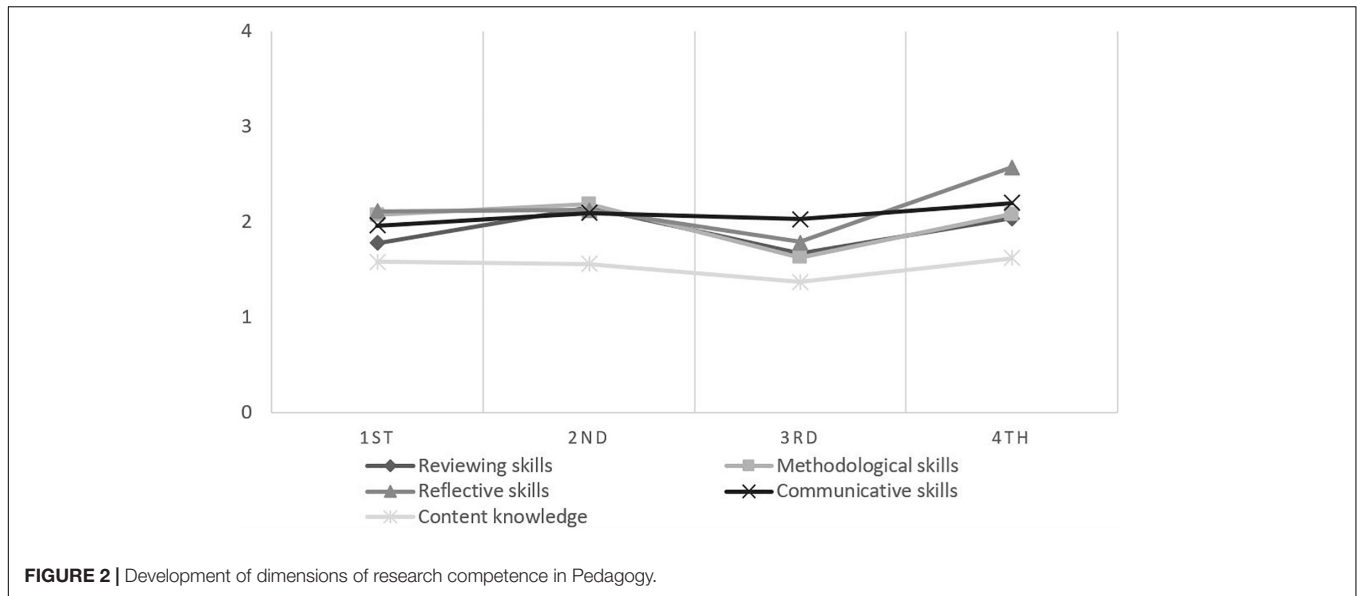


FIGURE 2 | Development of dimensions of research competence in Pedagogy.

TABLE 9 | Descriptive results (mean and standard deviation) of Böttcher and Thiel's (2018) dimensions in Pedagogy (by course-year).

	Course-year			
	1st	2nd	3rd	4th
Reviewing skills	1.78 (0.75)	2.15 (0.73)	1.67 (0.52)	2.04 (0.94)
Methodological skills	2.07 (0.56)	2.19 (0.63)	1.63 (0.43)	2.08 (0.55)
Reflective skills	2.11 (0.77)	2.13 (0.55)	1.79 (0.48)	2.57 (0.92)
Communicative skills	1.96 (0.79)	2.09 (0.54)	2.03 (0.85)	2.20 (1.11)
Content knowledge	1.58 (0.65)	1.56 (0.57)	1.37 (0.79)	1.62 (0.83)

fourth position, according to descending order of fourth-year students) (Table 7).

The second section of the questionnaire was based on Böttcher and Thiel's (2018) dimensions. Among the students of both degrees (Social Education and Pedagogy), the most accomplished dimension of research competence, according to their perception, is the one related to reflective skills. On the contrary, content knowledge is the dimension that gets the lowest scores in both degrees (Table 8).

In order to deepen the understanding on how the research competence evolve throughout the whole degree, students' answers were analyzed by their course-year. In Figure 2, this evolution is displayed for Pedagogy students. It is noteworthy that the process appears to be different among the five dimensions, while content knowledge and communicative skills barely change. For instance, there seems to be a slight positive tendency in reflective skills. However, we must look at these data with great caution and in an exploratory way given the size of the sample and the dispersion observed (that standard deviations are relatively high), and this shows a certain heterogeneity in terms of the perception of the students. In Table 9, all means and standard deviations are presented by course-year.

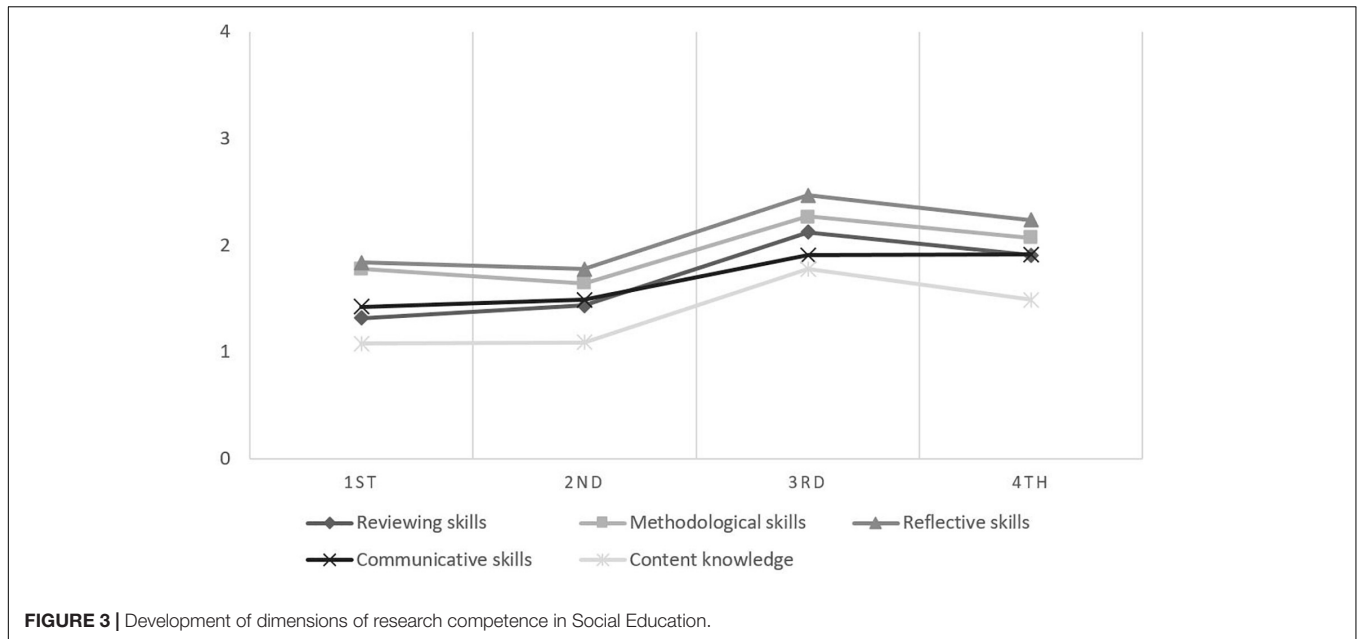
As for Social Education students, the evolution seems to be clearer (Figure 3), and all dimensions follow a more consistent pattern, with a peak at the third year. In Table 10, means and standard deviations are displayed, by course-year.

Finally, to verify these trends that were observed through descriptive statistics and graphics, Jonckheere–Terpstra tests for ordered alternative hypothesis were performed. As far as it involves Pedagogy students, the null hypothesis could not be rejected ($p > 0.05$); which suggested that data do not indicate a positive trend. In the case of Social Education students' data, the test suggested to accept the alternative hypothesis, that is, an existing positive evolution, in all dimensions of the research competence (see Table 11).

In order to ascertain between which course the positive change occurs, *post-hoc* analysis with Bonferroni correction of the p -value was performed. These analyses showed a significant change between the first and third year in reviewing skills ($T_{JT} = 517.50, p_{adj} = 0.001$), methodological skills ($T_{JT} = 465.00, p_{adj} = 0.028$), reflective skills ($T_{JT} = 460.50, p_{adj} = 0.036$), and content knowledge, and a significant change between the first and fourth year in reviewing skills ($T_{JT} = 386.50, p_{adj} = 0.046$) and content knowledge ($T_{JT} = 386.50, p_{adj} = 0.047$). On the contrary, no pairwise comparison indicated a significant, positive change in communicative skills, even if overall its trend showed a positive trend.

Stage 3: To Explore Guidelines to Foster an Improvement in Research Competence Based on Delphi Panel

Finally, a Delphi expert panel was conducted to explore guidelines oriented to foster the research competence among education science undergraduates. For this stage, a group of teachers who are experts in the training of educators in higher education was convened. In addition, the group of experts has an extensive teaching and research career in the area. In the



first Delphi round, the experts highlighted that the main gaps about research competency in our students are critical thinking, data interpretation, and theoretical grounding. In addition, they considered an issue that is specifically problematic for the Pedagogy degree: statistical knowledge and bibliographic management. In the case of the degree in Social Education, they highlighted the research identity as a problematic area. Also, and within the first round, they were presented with a list of learning outcomes linked to the research competence that the students identified as low acquisition during university studies. With the list, and considering their previous considerations as well as the representation they have of the research competence of our students, the experts had to select the seven most important LOs

to be developed in the next 5 years. In relation to the Pedagogy degree, the following LOs were selected:

1. Knowing scientific methodology and promoting scientific thinking.
2. Relating research results to innovation processes.
3. Elaborating reports based on the obtained results.
4. Knowing the theoretical and methodological foundations of education.
5. Knowing the processes of interaction and communication to approach field analysis within the observational methodology, using information, documentation, and audio-visual technologies.
6. Assessing the weaknesses and strengths of research reports and articles, based on their sections.
7. Elaborating technical reports.

In relation to the Social Education degree, the following LOs were selected:

1. Applying participatory research techniques (Participatory Action Research) to community diagnosis.
2. Knowing the processes of interaction and communication to approach field analysis within the observational methodology, using information, documentation, and audio-visual technologies.
3. Preparing reports based on the results obtained (evaluation reports, technical reports, socio-educational context reports, among others).
4. Proposing improvements based on published studies or research.
5. Knowing the scientific methodology and promoting scientific thinking.
6. Designing quantitative and qualitative descriptive studies based on given problems or needs.

TABLE 10 | Descriptive results (mean and standard deviation) of Böttcher and Thiel's (2018) dimensions in Social Education (by course-year).

	Course-year			
	1st	2nd	3rd	4th
Reviewing skills	1.32 (0.68)	1.44 (0.80)	2.12 (0.71)	1.91 (0.81)
Methodological skills	1.78 (0.61)	1.64 (0.65)	2.27 (0.74)	2.07 (0.48)
Reflective skills	1.84 (0.73)	1.78 (0.66)	2.47 (0.83)	2.24 (0.68)
Communicative skills	1.42 (0.76)	1.49 (0.77)	1.91 (0.89)	1.92 (0.64)
Content knowledge	1.08 (0.56)	1.09 (0.53)	1.78 (0.94)	1.49 (0.56)

TABLE 11 | Jonckheere–Terpstra tests' results in Social Education students.

	T _{JT}	z	p
Reviewing skills	1,482.50	3.32	0.001
Methodological skills	1,366.00	2.28	0.023
Reflective skills	1,380.50	2.41	0.016
Communicative skills	1,359.00	2.22	0.026
Content knowledge	1,427.00	2.82	0.005

7. Constructing valid evaluation instruments for measuring and obtaining data.

In the second Delphi round, the data from stage 2 of this study and the lists of LOs that should be further promoted in the different degrees analyzed were discussed. In this way, and based on this information, the experts were invited to debate and reflect on possible training actions that could contribute to this necessary improvement. In this round, and after a week of reflections, the following proposals were obtained:

1. To propose examples and learning activities based on action research.
2. To increase the use of scientific articles as part of the mandatory references in the different subjects, in order to promote critical thinking and scientific methodology.
3. To increase the number of assignments based on data analysis, reflection based on data, and discussion based on a theoretical frame of reference.
4. To allow students to propose improvements and resilience actions, based on the results obtained and/or the research consulted.
5. To organize workshops related with final-degree projects, internships, among others, with scientific methodology content.
6. To promote the elaboration of scientific reports rather than descriptive reports.
7. To foster discussion sessions in which improvements for education settings and processes are proposed, based on readings related to published studies and research.
8. To offer examples of research items by the university's own research groups.
9. To analyze scientific reports from different methodological perspectives.
10. To develop video training capsules with content and practices on the theoretical and methodological bases of research.
11. To solve prototypical cases or problems in research from different methodological traditions and emerging approaches.
12. To review current innovation projects and analyze the research processes involved.

DISCUSSION

The results of the content analysis carried out on the syllabi of both degrees show an unequal distribution of the intended LOs associated with the acquisition and development of research competence in Education Sciences. Thus, the required LOs are aimed at enhancing the methodological, reflective, and communicative skills in the case of Pedagogy students. In the degree in Social Education, the LOs on methodological skills and content knowledge also stand out. In this way, one of the most relevant skills (state-of-art reviewing skills) is relegated, at least by what is declared in the syllabi.

In addition to offering unequal opportunities for the acquisition and development of research competence [in terms of Thiel and Böttcher (2014)], the distribution throughout academic years is also uneven. Most of the LOs, in both degrees, are grouped into the second and fourth courses. In this sense, apparently the development of research competence is not drawn in an articulated and transversal way in the training of Education Sciences, but rather seems to be part of isolated subjects that are not coordinated for the acquisition, development, and promotion of the much-needed research competence in university students of this field.

In the second phase of this study, the perception of the students was analyzed. The data indicate that there is adequate progress in the acquisition of research competence. However, in the case of Pedagogy students, the acquisitions that they stand out are producing reports based on results received and producing evaluation reports. It is worth noting the low assessment of basic competencies, such as state-of-art reviewing skills [similar to the data from Vázquez-Miraz et al. (2020) in Colombia]. In the case of Social Education students, the assessment of the acquisition of competences for the design of descriptive studies (quantitative and qualitative) and the design of tools stands out, as well as the connection between research and innovation. In general, the students' perception is consistent with the shortcomings, or disarticulation, observed in the analysis of the declared curriculum. Thus, the assessment of reflective and communicative skills is positive; as observed in phase 1 of this study, where a great presence in the syllabi was appreciated. However, a low assessment is perceived about the competence for content knowledge and the review of the state of the art, being this one of the most relevant bases in the construction of research competence, in line with Murtonen and Salmento (2019).

From the results of this research, it can be inferred that a stimulus for the design of investigations, tools, and the preparation of reports is observed in the curricula. But there does not seem to be a clear basic knowledge (content knowledge) about what it means to do research in Education Sciences, the importance of doing so, the systematic review of the literature as a source of knowledge, and as a basis for quality research and education. In this sense, the statements of Munthe and Rogne (2015), as well as Gess et al. (2018) are supported when they point out the clear need to connect the research competence of education professionals with educational practice and all this in a coordinated action from the training curriculum and from the initial training courses.

In short, and in a phrase, when more emphasis is being given to reflective thinking and communicative skills ahead of literature reviewing, methodological skills, and content knowledge, *we seem to be putting the cart before the horse*. Therefore, it is necessary to strengthen the acquisition of scientific content, the search for trustworthy information and also the development of scientific communicative skills, and all this connecting theoretical knowledge with practical knowledge in educational contexts from the initial moments of training (Gess et al., 2018).

In the third part of this study, the two panels of experts allowed us to discuss the previous results from which the main shortcomings of these students were identified: critical thinking, data interpretation, and theoretical grounding. More specifically, experts said that in the case of Pedagogy students, more statistical knowledge and literature review skills are required, whereas in the case of Social Education students, identification with the research role is a problem to be solved. Along with this, in the definition of the guidelines for optimizing research competence in students of education, the transfer of improved reflection and inquiry skills becomes crucial to develop since it is not yet a given. Also, this can be gained through doing research into daily teaching practice (Willegems et al., 2017).

This research allowed us to identify some implications for educational practice. First of all, since the curricula are designed to be outcomes, based rather than content, and teacher-centered (as we can observe in the syllabi by the use of intended LOs), some suggestions stemming from the constructive alignment approach (Biggs, 2014) can be formulated. In this sense, some of the intended LOs in the syllabi should be reviewed, in order to make them clearer and more easily transformable into teaching/learning activities and assessment tasks; in this way, it would be more feasible to really align these goals within research competence, with both authentic learning and assessment tasks.

On the contrary, and following what was proposed in Stage 3, learning activities should be designed following some of the research processes that social educators and pedagogues will be performing in their professional life, such as action research. Moreover, a variety of different strategies of data gathering can be used both as learning activities and as self-, peer-, and hetero-evaluation: interviews, observation grids, checklists, focus groups, critical incidents review, etc., all adapted to the particularity of each course. This could be a more constructive and thoughtful way to improve assessments and to actively involve students in the process. However, a more globalized way to design learning and evaluation activities would pose some challenges for professors: since a great coordination among disciplines would be needed, so that the learning contents could be addressed throughout a comprehensive research process by students.

The authors of this study consider that research competence is a frontier that students of Education Sciences do not dare to cross firmly. In the case of Social Education students, the need to stimulate this role and to make scientific research a clear base competence of social knowledge and of the improvement actions that are designed from this professional field seems even more evident. In this study, we followed Wessels et al. (2021) to point out that it is also necessary to attend to the negative motivational effects that seem intrinsic to the acquisition, development, and recognition of research competence, in addition to increasing theoretical knowledge about what it means to do science, build theories, and improve practices from scientific knowledge as highlighted by Salmento et al. (2021).

Clearly, further research is needed to deepen our knowledge of the research competence of students of Education Sciences. In

this future path, the first limitation of this study that should be considered is to cover a larger sample of students and universities which will facilitate more robust analyses. Besides, a longitudinal design will surely shed more light on this path of acquisitions, successes, and failures in research competence.

DATA AVAILABILITY STATEMENT

Data from stage 1 are available in the supplementary material. Data from stages 2 and 3 can be available for researchers, under request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Facultat de Ciències de l'Educació, UAB. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AC-C: introduction, methodology stages 1, 2, and 3, data analysis, and results. JRM-F: introduction, data analysis stages 1 and 2, discussion, and general revision. GP-M and LG-R: review of the introduction and data analysis stage 3. AS-M: methodology and data analysis stages 1 and 2 and English proofreading. All authors contributed to the article and approved the submitted version.

FUNDING

This research was developed within the Teaching Innovation Project “Energizing the development of research competence as a transverse axis throughout the degrees of Pedagogy and Social Education,” funded by the Faculty of Education Sciences of the Universitat Autònoma de Barcelona (Spain) and coordinated by JRM-F.

ACKNOWLEDGMENTS

We would like to acknowledge the participation of Valeska Cabrera-Cuadros, Antonio Martínez-Vega, Antoni Navio, Carla Quesada-Pallarès, and Paloma Valdivia-Vizarreta in the research. The involvement of the first author in this research was part of their training activities within the Ph.D. program in Psychology of Communication and Change (UAB-UB).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2022.836165/full#supplementary-material>

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