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Teaching and Learning Research Methodologies in Education: A Systematic Literature Review

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Abstract: This study aims to contribute to understanding of the state of the art regarding the pedagogical cultures associated with teaching and learning research methods in advanced studies education through the identification of trends and pitfalls. The rationale behind this objective is the recognition that most of the research in education comes from academic programmes, in particular master's and doctoral programmes, which generally include research methods as components. A systematic literature review was adopted as the research methodology, following the PRISMA model. Three stages of article selection were implemented, resulting in the selection of 68 studies out of an initial set of 3631 articles found in the main journal databases. Three specific dimensions were addressed: (i) methodological knowledge, (ii) research competencies, and (iii) pedagogical practices in teaching research methods in education programmes. The results illustrate the complexity of the subject. Learners are constantly reported to hold negative attitudes towards research methods courses, apparently due to instructors' pedagogical difficulties, which translate into restricted understandings of methodological knowledge. Several misunderstandings between learners and teachers are identified which call for action towards the construction of a research-based scientific culture that will lead to inclusive pedagogical practices in which teachers and learners act as researchers.

Keywords: research methodologies in education; teaching research methods in education; learning research methods in education; systematic literature review; learning-centred course designs; pedagogical culture; scientific culture

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1. Introduction

Universities have played a key role in promoting research in education in Europe. Since 2007, with the Bologna Process, higher education institutions have reformulated their educational offers according to the commitment to the continuous promotion of research through the integration of research methods courses in the study plans of master's and doctoral programmes. Through international guidance 'discourses and local mentoring' practices, this has become a non-controversial topic. It has become clear that a solid preparation in the use of research methods provides important knowledge and methodological skills with which to undertake better research and thus significantly contribute to the education system. However, despite this apparent uniformity, there are several findings that suggest a variety of commitments and great differences in the types of offers made by higher education institutions in this field. Nind et al. [1] state that one of the main issues that creates controversies regarding research methodologies in education is knowledge dispositions. From learners' misconceptions to instructors' misapprehensions, there is little space for fostering the sharing of dispositions [2]. In addition to the heterogeneity in higher education institutions, the issue of methodological competence with respect to research

methods in education courses that are offered to postgraduate students in education also emerges. Llamas and Boza [3] argue that, in most cases, pedagogies that characterise the ways in which research is taught by instructors in relation to the research backgrounds of students create a platform for mismatches. Such mismatches of teaching and learning research methods in education add complexity to a challenging methodological scenario [1,3]. The third main issue identified in the literature is related to the connections between these two themes and concerns the contexts of research methods courses regarding management conceptualisation—beyond the topological spaces that research methods courses occupy in higher education institutions, in addition to the material resources for conducting research with expertise in terms of knowledge and advanced methodological approaches. According to the same authors, debate about environments' conceptualisations of courses on research methods enables a better understanding of the context of the problem, allowing a structured organisation of changes for improvement. This issue calls for a debate about what makes for quality research methods courses in education. The pedagogical–scientific constitution of knowledge dispositions and methodological competencies as main areas of research methods courses create an opportunity for the exploration and analysis of the research cultures within higher education institutions. Therefore, the construction of quality environments for teaching and learning research methods requires the development of a clear understanding of the complex relationships between the explicit pedagogical guidelines and the scientific orientations towards research. It is a great challenge to teach research methods in education, as the target population of students usually have diverse backgrounds and prior knowledge, interests, and expectations.

This paper is an output of the research project Research Methods in Advanced Studies in Education (ReMASE), which pursues the idea that teachers in higher education would benefit from the use of a conceptual framework as a tool to design and implement research methods courses in education. The project takes the idea that the quality of research in education impacts the quality of its results and therefore provides solid evidence that may inform decision makers and other stakeholders in education. This leads to the need for rethinking the design of research methods courses and the pedagogical approaches taken. The aim of the project is to identify and provide a research-based conceptual framework that includes principles and guidelines for the design of research methods courses in education. The research team is constituted of both experienced researchers teaching research methods in advanced programmes in education and young researchers, embracing the task of interrogating and improving the design and implementation of research methods courses. The key research question of the project is: What principles and guidelines are appropriate to constitute a framework for the design of research methods courses in advanced studies in education in Portugal? The ReMASE project is organised into three phases. Phase I is concerned with mapping the field (theoretical and empirical). Phase II involves data collection and analysis (through a survey questionnaire followed by focus-group interviews). Phase III takes the results of the theoretical mapping and the empirical results to produce a framework—constituted of principles and corresponding guidelines—for the design of research methods courses. This paper is a result of the work developed in Phase I (January to July 2022).

The aim of this article is to contribute to understanding of the state of the art regarding the pedagogical cultures associated with teaching and learning research methods in advanced studies education through the identification of trends and pitfalls. To achieve this objective, a systematic literature review was adopted as the research methodology. Since it is acknowledged that there is a link between the teaching and learning processes, between the learning process and personal interests, between personal interests and the research process, and between the research process and teaching, a systematic literature review allows for a better understanding of the research problem. This article is organised so as to reveal information about the methodology adopted and the objective and research questions that guided the research process. After the presentation of this information,

we uncover the specifications of the method used for the selection of the data sources, eligibility criteria, and search terms used.

The scientific intention behind the organisation of this article is to provide a structured vision of the ways in which it is possible to establish and develop a research methods course. This formulation, aiming to contribute to answering questions and building upon results from previous studies [4], is organised along four dimensions: (i) the methodological knowledge, mainly focused on learners' conceptions; (ii) the research competencies; (iii) the pedagogical practices; and (iv) the pedagogical cultures of research methods in education courses. The article closes with conclusions, limitations, and recommendations.

2. Methodology, Objective, and Research Questions

This study aims to contribute to understanding of the state of the art regarding the pedagogical cultures associated with teaching and learning research methods in advanced studies education through the identification of trends and pitfalls. The methodology adopted for the literature review was based on Preferred Reporting Items for Systematic Literature Reviews and Meta-Analyses (PRISMA) procedures or processes [5]. According to Snyder [6], this method is suitable for the proposed study aim. Therefore, we present the data sources and the eligibility criteria for selecting articles based on inclusion and exclusion criteria. The main research question addressed by this review is: What pedagogical cultures of teaching research methods can be identified in the literature? To contribute to answering this question, specific research questions were formulated: (i) Which research findings highlight the understandings and misunderstandings about what is methodological knowledge in learning and teaching research methodologies in education? (ii) Which research findings contribute to the discussion of indispensable skills for understanding and undertaking research? (iii) Which research findings contribute to the discussion of appropriate/inappropriate pedagogical practices for teaching research methodologies? (iv) Which research findings contribute to the problematization of a scientific culture (of teaching/ learning) in RME courses?

2.1. Methods: Data Sources, Search Strategy, Eligibility Criteria, and Selection Processes

The literature review was initiated with a scientific production screening of the EBSCOhost, SCOPUS, and B-ON databases. The EBSCOhost database selection was based on its recognition as one of the main resource centres in research in the social sciences. The SCOPUS database selection was justified by the number of studies with higher impact factors on research methods in education. The B-on database selection was due to the fact that this database is the most important resource created in Portugal offering unlimited and permanent access to full texts of thousands of national and international scientific journals and online ebooks. The full search strategies used for all databases, including the filters and limits used, were the following: (i) search type: title; keywords (as the main similar options across the used databases); (ii) access type: open access (creating possibilities in terms of accessing the required information); (iii) subject area: social sciences (due to the study object); (iv) document type: articles, conference papers, books, and book chapters (as the main documents in scientific productions); (v) limited years: the period 2007–2022 (due to the Bologna Process having been implemented in 2007 and given the purpose of obtaining an up-to-date overview); and (vi) language: English, French, Spanish, and Portuguese. The search equations used different logical combinations of the following keywords (with equivalents in all the languages previously mentioned): research, methodologies, methodology, methods, education, and teaching.

The eligibility criteria were drawn up on the basis of elements of inclusion and exclusion of studies. Inclusion criteria: studies focused on designing, planning, or teaching research methods in the social sciences; focused on higher education advanced studies in social science courses; focused on course analyses that state the principles and aims, learning objectives, research competencies, teaching methods, and teaching–learning activities, as well as the resources used and the assessment strategies employed; focused on instruc-

tors and learners' methodological knowledge, research competencies, and pedagogical practices. Exclusion criteria: meta-analysis, editorial, and literature review study types; studies without sufficient theoretical information and/or methodological inadequacies (studies without information present in the methodology applied/adopted in the data interpretation; without the rationale of the study articulated with the research design and the interpretation of data; without a research design that ensured that the study objective was achieved; without the writing of the study being scientifically clear).

The selection process was carried out in three phases. In the first phase (initial screening), the work began by recording the total number of results presented according to the eligibility criteria. Afterwards, all the titles and keywords were read. The initial screening allowed acquaintance with their contents. At the end of this first phase of the search, the total number of selected studies was recorded (n = 242). In the second phase (comprehensive screening), the abstracts of all the selected studies were read. Cross checking was performed among all the selected studies to identify repetitions and enable eliminations. This work was undertaken independently by all of the authors, using the same grid, and a total number of 114 articles were retained. The third phase (final comprehensive screening) was then applied, which involved reading the full texts, and a total number of 68 studies were retained. The search strategy and selection process for the data collection was concluded by 1 April 2022.

2.2. Methods: Data Items Selection, Study Risks, and Study Selection and Characteristics

The selected studies were identified and grouped for further data analysis. A grid was completed with information that allowed the studies to be registered, including the following sections: Author(s); Title; Year; Journal/Book; Volume/Number; Pages; DOI; Peer-Review Type. For each study, a specific code number was defined. In the same grid, two more specific sections were defined. The first section reported the primary study characteristics, including the following subsections: Specific Area of Research in Education; Research Methodology Type; Location/Setting; Type of Environment; Problem/Context; Main Concepts; Objective; Research Questions; Methodology/Research Design; Instruments/Data-Collection Methods; Results & Conclusions.

To assess the risk of bias in the search strategy phase and in the selection process for data collection, the work was shared among all the ten project team members. The coding process was conducted independently by the authors following the criteria, after which the research team analysed the agreements and disagreements regarding codifications, and final decisions were made by consensus. The intercoder reliability calculated in terms of percentage of agreement was above 87%.

Figure 1 below shows the systematisation of the research process, organised according to the PRISMA statement.

Three databases were used to identify studies. The first database was EBSCOhost (including Academic Search Complete/Education Source/ERIC/Academic Source/Teacher Reference Centre Collections). The second database was Scopus, and the third database consulted was B-on. For all three databases, the selection process involved a set of seventeen searches, of the terms 'research', 'methodology', and 'teaching' and their combinations, in the three research languages. In the first phase, a total of 3631 studies were identified. After the first set of eligibility criteria were applied, 3389 records were excluded. With the remaining 242 studies, as total records identified, the screening process (Phase II) was initiated. After excluding repetitions, the final number of studies was 164. After this work, repetitions among the final results from each database were excluded, and a total of 114 studies was reached. The 114 papers were elaborated as passive materials for the third set of eligibility criteria. After applying the third set of eligibility criteria, we reached the final number of 68 studies. The 68 studies selected constituted the empirical material for the research literature review presented in this article.

The general information about the articles selected consisted of: the literature review, the year of publication, the country where the study was implemented, and the type of methodology adopted. The analysis represented in Figure 2 revealed the existence of papers published in all the years selected (except 2022), highlighting the years 2020 and 2021 as the years with the highest numbers of publications, accounting for 27% of the samples.

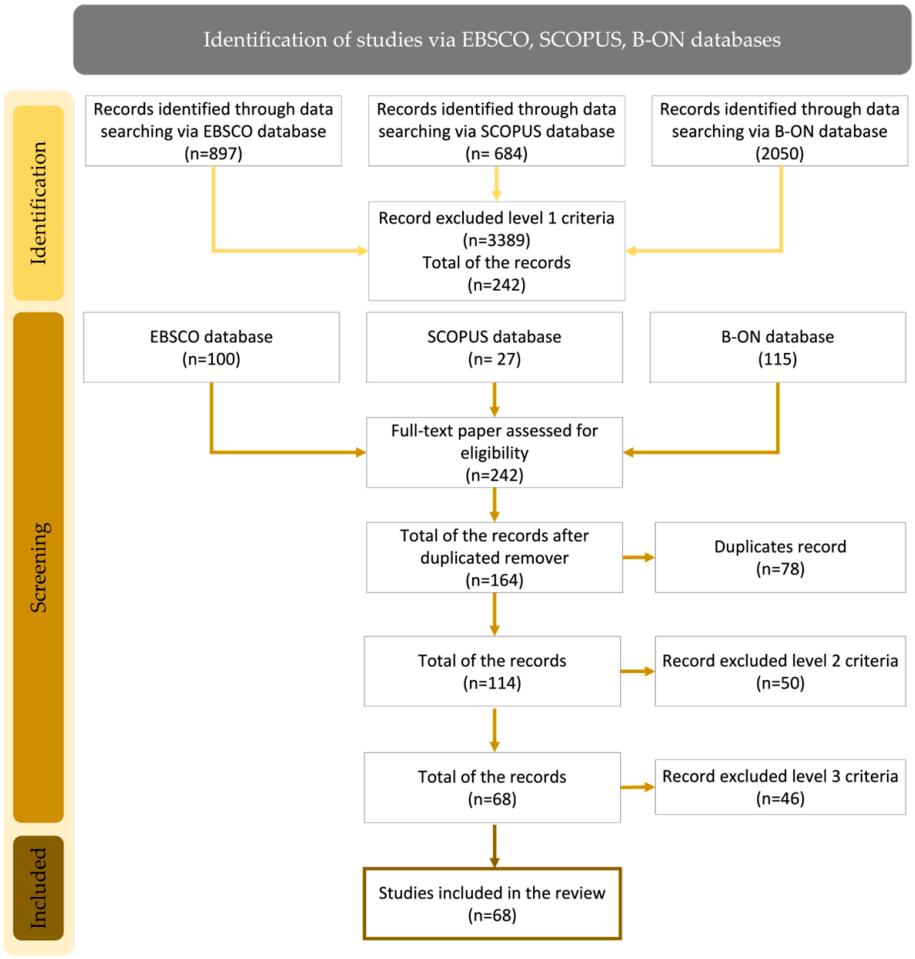

Figure 1. PRISMA flow diagram of the systematic review process (adapted from Page et al., 2021. [5]).

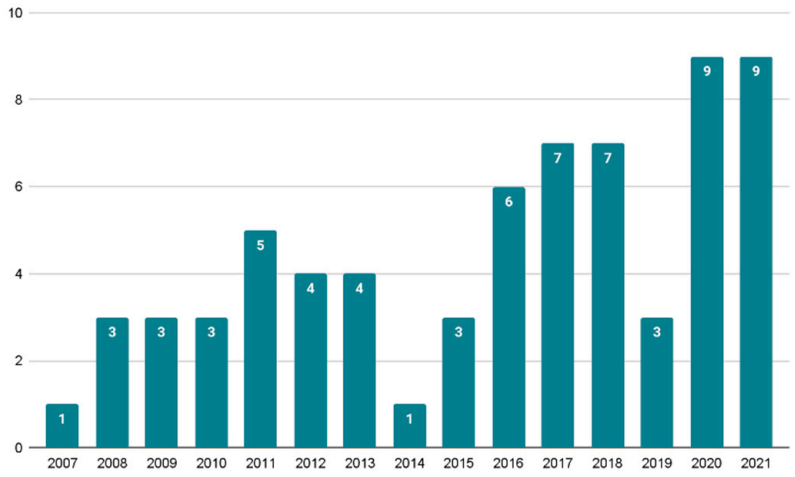

Figure 2. Number of articles published by year.

Regarding the countries in which the studies were carried out, 17 countries were highlighted. Most of the papers were related to work implemented in different states of the United States of America (n = 15) and in different countries on the European continent (n = 21). The other locations were distributed across the African continent, the North and South American continents, and the Asian continent (n = 32).

Regarding the type of methodology adopted (Figure 3), there were 44 (64.7%) articles that reported the use of methodologies based on qualitative data collection and analysis, 15 (22.1%) articles that adopted mixed-methods research, and 9 (13.2%) articles that used quantitative methodologies.

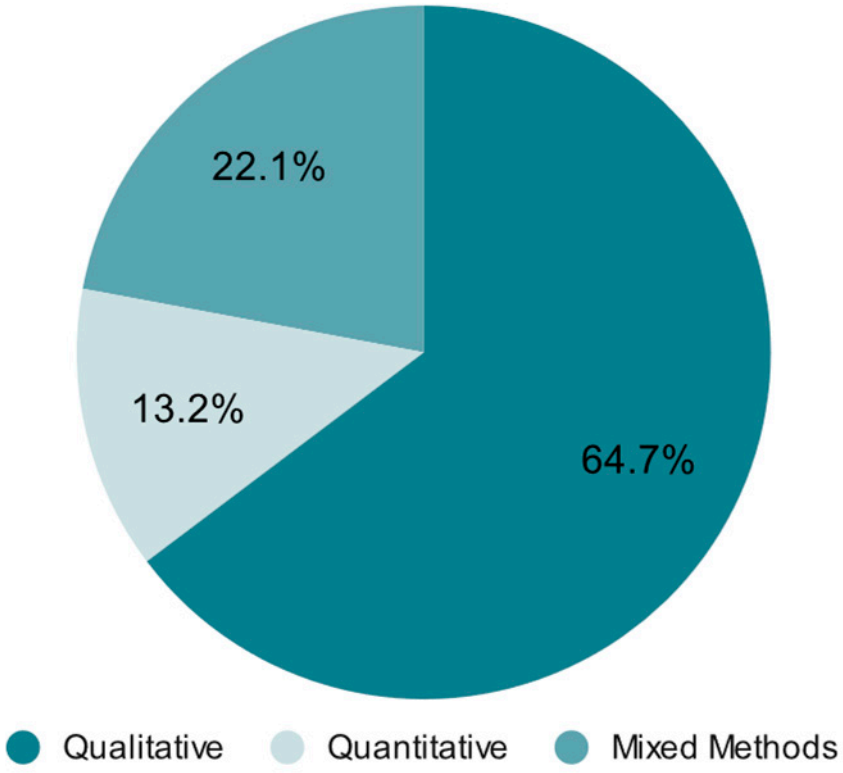

Figure 3. Types of research methodology used in the articles.

3. Results

The main findings of the systematic literature review are organised in order to provide answers to the research questions through data reduction carried out during the analytic process. Accordingly, for a better understanding of the results, the following three sections relate to each of the research questions.

3.1. On Scientific Encounters from Personal Emotions: (Mis-)Understandings about Methodological Knowledge among Learners and Instructors

The question that led to this section of the paper was: Which research findings highlight the understandings and misunderstandings about what is methodological knowledge in learning and teaching research methodologies in education? The main results revealed that there are several mismatches that emerge between students and courses in research methodologies in education (RME), even before the course starts and students get to know their instructors. Several papers report the existence of students' anxiety and horror in the face of learning RME. Ross and Call-Cummings [7] argue that the types of 'methods anxiety' stem from the failure of students to master the often-complex concepts and vocabularies associated with RME courses. Some studies [2,8,9] reflect on the specificity of learning anxiety being strongly related to quantitative methods learning in these courses. The deficits and weaknesses pointed out by the four papers are based on the premise of a lack of

preparation of students at the beginning of the course. It is important to highlight that there are different types of courses on RME in master's and doctoral programmes. Sometimes the courses are organised as general introductions, sometimes as introductions to specific areas of methodological knowledge (e.g., the design of questionnaires), and sometimes even as advanced courses (with a focus on deep knowledge of general or specific methodological approaches). Despite this wide educational range, the students' and instructors' experiences of these different courses can be appreciated as a whole.

According to quantitative methods instructors, students are unprepared, misinformed, fearful, and poorly motivated [2]. Saeed and Al Qunayeer [10], reaching the same results regarding students' perceptions, elaborate that preconceptions derive from poor research experiences and therefore weak and superficial understanding of what science is about and of the methodologies used for achieving knowledge. Some other papers report some reasons that lead to this situation. The results reveal a lack of a common language within the sciences, shared by those who teach it and those who learn it, in relation to the fundamental concepts of RME [11–13]. Talbott and Lee [12] and Ananth and Maistry [13] state that this could be due to the abstract nature of RME, which was identified in students' conceptions. Daniel et al. [11] confirm an association between quantitative methods and statistical knowledge, such that mathematics anxiety drives students away from quantitative methodologies. Orellana-Fonseca et al. [14] highlight this scenario based on the idea that courses on research methodologies are theoretical, with priority given to quantitative methodologies. This seems to be the issue that underlies the results of another study showing that there is a more pronounced tendency for students to prefer qualitative methodologies to undertake research over quantitative methodologies, due to the already stated challenges that they experience [15]. In addition, the problem is intensified by the idea that qualitative methodologies lack rigour and credibility [16]. It can be said that there is a perfect mismatch between students and RME courses, even before students experience the courses and meet the instructors and become acquainted with their pedagogical practices. King [17], on this possible characterisation, argues that this can be reflected in the idea that research methodologies is a 'dry subject'—a reference adopted by students, but also by those responsible for teaching research methodologies in education.

The perception of complexity is supported by evidence that students need to revisit philosophical conceptions, and this is a tricky business [4]. Thus, based on the reflection of Schweizer et al. [18], if the subject is already complex, the combination of incorrect and inadequate representations potentiates the obstruction of learning. It is understood that training in RME is fundamental to the understanding of the sciences that constitute the different subjects of the courses of master's and doctoral programmes; however, mismatches are anticipated. According to Vasquez-Colina et al. [19], it is important that instructors and even faculty organisations become aware of the emotions associated with learning research methods and that they offer support to students in harnessing their emotions in order to improve the quality of their learning experiences. In this regard, it is urgent to obtain descriptions of knowledge about RME.

It is possible to understand the first confrontation regarding understandings of methodological knowledge as a normative and political subject [7], as one about understanding the paradigms that exist and allowing involvement in the reading and production of science. (On this point, it is important to differentiate between reading science and writing science. Research consumers normally do not conduct their own research, and research producers are those who undertake their own research [19].) In this regard, it is fundamental to build a reflexive and contextualised language about the history of science, contributing to a solution to the aforementioned lack of a common language for sharing methodological knowledge [20]. Nind and Lewthwaite [8] explore an idea that derives from RME instructors' experiences, namely, that methodological knowledge is constituted by personal, situated, and local relationships. Ivankova and Piano Clark [21] argue that these factors shape research contexts, including personal and social contexts, involving philosophical presuppositions, theoretical frameworks, and methodological background knowledge. By

encouraging reflection as a fundamental step in promoting a more in-depth understanding of the methodological experience among students [20], one can begin to unravel the complexities of students' mismatches regarding RME courses and their instructors. Akyüz [22] highlights that RME courses that are organised on the basis of contextualised reflection lead students to develop a positive attitude toward methodological knowledge and to experience less anxiety about undertaking research. The basis of this discussion is the argument that emotions in the learning journey interfere with the understanding of methodological knowledge [1]. Therefore, this article takes into account the dimension of emotions in research methods as affective responses (both positive and negative) which emanate from learning and engaging with content, from assessment, and from the learning environment in RME courses [13].

Methodological knowledge is promoted in students' conceptions when there is tutorial orientation from instructors [23]. Saeed et al. [24] argues that results show that, without instructor orientation, there was confusion in students' conceptions regarding methodological knowledge, whereas, when instructor orientation was present, the results showed that most students seemed to engage in re-considering their research assumptions [24]. However, most students had been engaged in research methods learning through individual tutorial meetings, leading to perceptions of research and the development of methodological knowledge as a solitary activity [25]. According to all three studies [23–25], instructor orientation promotes the transfer of a general understanding of research methods (with normative and political aspects) to support specific students' interests. Saeed et al. [24] even argues that student–instructor interactions promote, over time, an awareness that places scientific autonomy in higher positions. This transfer of methodological knowledge with instructor orientation allows understanding of the complexity and of the specific terminologies and nuances of methodological knowledge [26]. In this cooperative context, methodological knowledge can be quite challenging but interesting [24]. Saeed et al. [24] argues that students are often unsure about their understanding of methodological knowledge and uncertain about how to act given their unsettled state. Ross and Call-Cummings [27] present an argument regarding this uncertainty in students' methodological knowledge centred on the idea that they are moved from notions of 'what an investigation should look like'.

Courses that promote collaborative engagements between learners and instructors help students to understand methodological knowledge and increase their research experience by promoting methodological literacy [28]. Besides this idea, other results show that once supervisors (providing instructional orientation) have been assigned to students' research projects, students tend to follow only the research instructions provided by their supervisors [25]. In this case, the lack of independent thinking can lead to difficulties in understanding what research is. When it is possible to engage in a collaborative environment in which students can reflect on and discuss their work with research methods instructors, opportunities are created to improve and learn from failures [27]. On the other hand, failures may be due to obstacles to methodological knowledge that it may not be possible to address in individual students' research projects [27]. Therefore, we argue that a set of learning opportunities in RME courses organised on the basis of teaching opportunities that counteract isolation and uncertainty would favour partnership and productive modes of action. The kinds of knowledge descriptions that emerge from the literature can be addressed in a way that encourages staying on the 'safe side' of methodological knowledge, perpetuating mismatches, or the assumption of a 'critical turn' that allows reassessment of dispositions and the discovery of safe and confident ways to learn RME. According to Ross and Call-Cummings [7], this leads to framing research methods as inherently contested and political subjects.

Ways to Understand Methodological Knowledge in Education through 'Safe Sides' or 'Critical Turns'

São José [29] synthesises ways of proceeding with an understanding of methodological knowledge as taking paths that reveal choices according to established forms of knowledge organisation or according to particular intentions. In this regard, 'safe sides' and 'critical turns' can be perceived as methodological paths to understanding methodological knowledge. From the idea of self-service or 'menu a-la-carte', understanding research methods is always local and inherent to each individual project, making safe sides more appealing in the kind of relationships that can be constructed with methodological knowledge [29]. This makes it necessary to reflect on what constitutes a safe side and what comprises a critical turn in methodological knowledge. According to White [30], previous assumptions or political biases can lead to the creation of obstacles to question-led research approaches. In other words, safe sides can be limitations of critical-turn approaches. If methodological knowledge is situated according to previous knowledge, to understand the adoption of safe sides requires knowing what sorts of knowledge constitute information that enables decision making. What is at stake is whether the critical turn, as a renewal of the scenario of great complexity evidenced above, may be a constituent element of a safe side regarding methodological knowledge. From these arguments, several methodological knowledge descriptions can be elaborated.

According to Myers-Coffman et al. [31], for students considering a topic, it needs to be meaningful for them to study it as well as feasible to explore it in the academic calendar. Akyüz's [22] study shows that one of the most difficult experiences of students on RME courses is deciding on the research problem to be addressed. In this regard, Bell's [32] results show that students seem to have doubts and to be resistant to change and find it challenging to diverge from a linear research design and move beyond the methodological knowledge obstacles that might appear when they choose something 'unsafe'. This idea provides a way to understand a critical turn (in the terms described above) as a safe side with respect to methodological knowledge. This is because the literature shows that a fragile (individual) educational environment has an effect on research, impacting methodological knowledge in advanced studies in education, where there may be only a few hours in which to undertake research methods courses. The question is: Does it make sense that a critical turn in the understanding of methodological knowledge in response to students' misconceptions and poor research understanding means choosing a safe side?

Embracing a position, according to Guglietti [33], shows that to value knowledge as a point of view is an essential component in creating a relation to methodological knowledge. The same paper shows that different types of methodological knowledge are organised from specific standpoints (personal, professional, or even ones that adopt the instructor's perspective). The majority of the study participants favoured usefulness or practical value in their research methods activities [33]. This result is in line with other studies showing that understandings of methodological knowledge serve specific purposes, for example, completing specific curricular units or contributing to the planning, writing, and presentation of a master's dissertation or a doctoral thesis [14]. It is expected that in master's and doctoral programmes the students are aware of the complexity of research, which is why this type of subject features mainly in postgraduate courses; however, the philosophy of research or methodological knowledge (the basis of understanding research) is undervalued [34]. According to Orellana-Fonseca et al. [14], methodological knowledge is not orientated towards training in research as a fundamental component of education in master's and doctoral programmes. (Despite this result, this statement is promoted in a context of scarce empirical reflection at an international level in the curricular components of master's and doctoral programmes in education.) The question here is: What kind of methodological knowledge is being perpetuated in these types of relationships?

Stretching assumptions and ideas, according to the literature, is permitted when it promotes a collaborative (robust) educational environment with research and with methodological knowledge. According to Snelson et al. [35], when the instructor is open to rejecting

the conditions of safe sides (as mismatches regarding methodological knowledge) in research methods teaching, in order to promote critical turns in their pedagogical approaches with students a whole new curriculum can be designed and methodological knowledge can be amplified. When instructors reject the perpetuation of misconceptions that constitute safe sides in understanding methodological knowledge in collaborative ways, students are released from the anxieties and frustrations of understanding methodological knowledge [36]. When this takes place, the results show a change in students' methodological knowledge that privileges utility or practical value. When this environment is at the core of research methods courses, students acknowledge that knowledge of research methodology is required for advanced studies in education [11]. However, the common perception of students is still that learning about research methodologies is based on the acquisition of a set of isolated skills which does not necessarily involve gaining a more profound understanding of methodological knowledge [11]. In this scenario, the question is: What kind of methodological knowledge is inherent in the instructors responsible for the teaching of research methods?

According to Herman [37], there exists a methodological and epistemological hegemonic community of scholars who are responsible for teaching RME. An awareness of the complexity of some methodological topics that can be difficult to teach may provide a way to understand this statement. The results of Ivankova's [4] study show that it was more challenging for an instructor to teach methodological procedures. In fact, the idea of a safe side in understanding methodological knowledge perpetuates problems and invites solutions. The same study [4] shows that, although new qualitative methods were introduced by instructors in their activities, they were not followed by reflection and were not connected to a new understanding of methodological knowledge. In the research methods courses that follow a 'text-book teaching' model, the epistemological beliefs of instructors push towards traditional beliefs about research [38]. What are the implications for students' understanding of methodological knowledge? To raise awareness of this problem, Ekmekci et al. [39] elaborates some questions that, when answered, provide opportunities to mitigate the negative implications when teaching RME: Is it relevant to match students' experiences with future research goals? Should students become research consumers as well as producers of knowledge?

3.2. Undertaking Research with and without the Development of Research Competencies: Organising a Course on Research Methods in Education

The question that led to this section of the paper was: Which research findings contribute to the discussion of indispensable skills for understanding and undertaking research? The main results are concerned with the principle that undertaking research is associated with attending research methodologies courses. The acquisition of research competencies during a course in research methodologies in education should comprise the aspects (contexts, subjects, and issues) of selection, elaboration, application, processing, interpretation, and dissemination [40]. This insight underlies the assumption that an RME course is inextricably designed to produce a researcher with research competencies to understand methodological knowledge and undertake research projects [11]. The main research competencies required to undertake research are understanding of different scientific rationales, specific features of research designs and data collection, and analytic approaches, as well as the forms and contents of scientific communications.

Regarding the diagnostic evaluations of research methods instructors, Bayram's [41] study shows that students have false, incomplete, or mixed views about what research competencies are and what they are suitable for. One problem identified that restricts the development of research competencies is limited English proficiency. Studies show that most of the methodological knowledge that is published in academia is presented (in written or oral form) in English. This is perceived by students as one of the main challenges encountered when English is not their native language [36]. According to Roulston et al. [42], another problem is ignoring the understanding of digital technologies

as a key competence required for learning and teaching research methodologies. One implication regarding this topic is that competencies in using digital software and digital devices impact the teaching and learning of RME (e.g., when software is used to support data analysis). Wagner et al. [43] reveal that, despite this evidence, digital tools may be difficult to understand and to use without adequate and specific training. The complexities are amplified when it can be perceived that the prices charged by companies that provide such services sometimes mean that the products do not reach students [43]. Despite these specific characteristics that contribute to a diagnosis of fragility in the acquisition and development of research competencies, another study argues that, in general, students have limited research competencies [38]. Regarding this problematic scenario, several studies show optimism and have unveiled promising results of the provision of mandatory research methods courses to students in advanced studies in education.

Lovekamp et al.'s [28] study showed that students' research competencies grow after the completion of mandatory RME courses, especially in understanding research contexts and their specifications. Knipe et al. [26] generated results that showed that, after the completion of a research methods course, students' capacities to identify the reliability and authenticity of research grew, increasing their research competencies. On the same subject of course completion, Secret et al. [44] showed that many students noted an increased capability to read scientific texts, to develop research questions, and to think critically about research. Additional highlights included the understanding of differences between quantitative and qualitative methodologies and of research ethics principles and their specific terminologies, as well as of how to write research texts [26,28,44]. After course completion, the students felt more confidence in their own abilities to use the knowledge in appropriate and effective ways [45]. In line with Secret et al.'s [44] results, Luo [46] showed that there was a remarkable increase in student interest after course completion in relation to reading research articles and conducting research as well as disseminating it. After an intensive research methods course, students are more capable of understanding research methods as a specific subject and using the methodological knowledge in research practice [32]. In this line, Quitumba et al. [47] argue that students subjected to scientific research lessons have more success in writing compulsory documents for the completion of their programmes (such as academic dissertations) than those who are not so subjected. Therefore, it can be stated there is a set of research competencies necessary to undertake research (understanding different scientific rationales, specific features of research designs and approaches, and the forms and contents of scientific communications).

Taking onboard the results of the literature review, several questions emerge regarding the challenge of organising a course on research methods in education. For one: What is the best period in the academic calendar for RME courses to take place in master's and doctoral programmes? According to Daniel et al. [11], an overview of research methodology at an early stage in advanced studies in education is critical to engaging students with science and to motivating them to understand research methods as a subject and not merely as a research-competencies skill set. Some studies reveal that current research methods courses only take place at the beginning of programmes, and that represents a problem, while other courses are placed at the end, which is also a problem [9,22,46]. According to Ezer and Aksüt [48], a general recommendation is that research methods courses should be present in students' academic pathways and organised according to an annual scheme (two semesters treating of theoretical and practical issues) rather than on a semester basis (rejecting the placement either only at the beginning or only at the end of the educational programme).

Another question is how to prepare a research methods course, knowing in advance that the students will gain research competencies that can improve actual research? Writing and publishing students' research may be a challenge, with new implications for the previous scenario [49]. According to the same study, this is a new challenge, both for students and instructors, but one that can benefit the construction of the course [49]. For

example, the scientific publications of the individuals involved can be the targets of practical exercises as part of approaches to learning and teaching.

Another tendency to develop undertaking research with research competencies is to encourage students to be part of ongoing research projects. Lundahl [50] states that students reported that work on an ongoing research project (funded or not) with real data (collected by the students or already gathered) was more significant and meaningful than the undertakings they had in previous RME course experiences. Besides increasing research competencies, students also reported that their confidence in conducting research increased as a result of this approach [50]. Using real data that students can analyse and discuss contributes to increasing their learning, showing that there are benefits to including students as co-researchers [2]. Besides the opportunity to engage in research practice, one benefit is that it provides a space for students' voices to be heard and for the development of unique insights [35].

Adoption of Research Methodologies Courses and the Translation of Research Competencies Acquired into Knowledge Construction

To better achieve the indispensable skills for understanding and undertaking research, the efforts of those who teach should be focused on clear research competencies and the necessary stages in obtaining scientific information [38]. This is in line with the questions discussed above [39]. The essential skills for understanding and undertaking research rely on knowing more than terminologies about validity and reliability as research competencies [15]. Engbers [51] argues that good research design flows from the problem to the methodology. In this regard, Leston-Bandeira [52] claims that drawing up a research design from research questions enables the researcher to pinpoint any shortcomings and weaknesses in research at an early stage and to modify the research strategy in order to minimise their impacts. In this regard, the translation of research competencies into knowledge construction should derive from questions about the research design well before data collection and data analysis proceeds [30]. This means that the focus is on the research process, rather than the outcome. This means, in turn, that new learning opportunities in RME can emerge, such as the ontological dimension of the research process [33]. This aspect is then linked to the already mentioned epistemological one through the understanding of methodological knowledge as well as its operationalization.

Regarding the epistemological process as a research competence of students and instructors responsible for teaching RME, the literature is limited. According to Wagner et al. [43], ethical issues in research are surprisingly infrequent in the literature. This surprise is due to the fact that this dimension is associated with the other two mentioned dimensions (the theoretical and the methodological). The findings that can be drawn from the literature review papers indicate that when this dimension is present in RME courses, it is considered by students as one of the course areas where the perceived gain is higher [53]. Kara and Brooks [54] argue that innovative and playful activities (new forms) contribute to reflecting on power relations and ethical issues (old contents), facilitating the development of research conversations. One perceived consequence of this limited exposure can be found in Knipe et al. [26], according to which the category analysed in their study with the lowest number of correct responses from students who took a test on research methods was the capacity for identifying ethical issues in scientific texts.

According to the results reported in Aguado's [55] study, students found their fieldwork to be the most exciting part of a semester-long project and that it helped them to increase their research competencies. In specific studies regarding preservice teachers, the results showed that after the completion of a research methods course, the vast majority of future teachers thought they could potentially identify issues related to their future teaching activities [56]. In addition, they thought that the methodological knowledge and research competencies they had acquired in REM courses would give them the resources to undertake small-scale educational research projects.

From the assumption that students tend to associate research methods with statistical methods, as illustrated above regarding methodological knowledge, some studies give evidence of this tendency. Ross and Call-Cummings [7] consider the idea that educational phenomena need to be measured, through quantitative methods, leading to the assumption that knowledge can only come from direct measurement, which notion is translated into corresponding research competencies. In this regard, this makes it more difficult for students to apply appropriate research designs in addressing their research problems [19]. The snowball of mismatches between students and knowledge, even if connection with instructors in research methodologies is already established, seems to keep rolling and growing.

There are several papers that discuss the stigmas surrounding students' research skills. Aguado [55] reveals that there exists a stigma about students and their lack of research competencies in applying methodological knowledge. As previously mentioned, the critiques that characterise students' understanding of methodological knowledge come from students' perceptions as well as from instructors' perspectives and tend to rely solely on the views expressed by instructors responsible for teaching REM courses.

3.3. Critical Engagements through Pedagogical Practices of Peer Collaboration: Developing Research Methods in Education Courses, Taking into Account All Specificities

The question that led to this section of the paper was: Which research findings contribute to the discussion of appropriate/inappropriate pedagogical practices for teaching research methodologies? According to the section of the paper reflecting on research competencies, appropriate pedagogical practices can be organised into five main areas. This notion is based on research results showing a lack of practical and pragmatic guidance in the literature for research methods instructors to rely on [4]. The five main areas are organised into paradigmatic concepts of active-student-centred learning processes [57] through research-based and learning-centred approaches [15,58] and learning through training, reflecting, and doing [1]. This open paradigmatic approach aims to make research methods understandable, learnable, and applicable to students [10], promoting student self-awareness and confidence in research methods courses. The first main area concerns the pedagogical practice trends in teaching research methods in education. The second area regards the pedagogical relationships between students and instructors. The third main area regards the involvement of instructors and students in ongoing research projects. The last area (the fourth, which is related to the third area) concerns autonomy and ownership of lived experience in research. In addition, according to this paradigmatic framework with these five specific dimensions, also required are an enthusiastic and skilled instructor, an active and friendly learning environment, and an effective and supportive course organisation [32].

Before going into the details about each category, it is important to refer to the result of Nind's [2] work, informing a comparative approach to instructors' pedagogical practices and strategies distinguishable in accordance with the nature (quantitative or qualitative) of the research methods they teach and their particular contexts. Instructors in quantitative methods were found to be especially interested in working with practical and operational data sets [2]. On the other hand, qualitative methods instructors frequently reported that what was relevant to them was to communicate to students through reflection on the different stages of research [2]. Another aspect that is scarcely treated of in the studies identified in the literature review concerns formal teacher education in RME. According to Wagner and Maree's [59] study, a lack of expertise in a certain methodological area can sometimes lead to courses concentrating on specific subject areas of research methodology and disregarding others. According to Nind's [2] study, the absence of this specific academic training in teaching methodologies translates into experiences that can be arduous for instructors. In this regard, the incompetence of instructors affects students' learning in serious ways [41]. This scenario can be understood from two points of view. The first draws on the idea put forward by Wagner and Maree [59] that instructors believe that their many

years of experience with students qualifies them to design a research methodology course and to respond to students' learning needs. The other perspective is the decentralisation of the instructor as the only specialist and the increasing notion of the learner as an expert [4,31,39].

According to Nind and Lewthwaite's [8] study, there is a clear continuity between learning difficulties as the student's responsibility and pedagogical difficulties as the instructor's responsibility. It is within this context that collaboration between instructors emerges in pedagogical practices. It is suggested that the RME courses should be taught by two expert instructors (ideally with different expertise, interests, and knowledge in research methodologies) [49]. By this means, the pedagogical challenges that one instructor can encounter in their practices will be minimised because they will have peers to support them. The same results are highlighted by other studies claiming that the co-teaching of pedagogical practices can enhance students' learning [60]. Co-teaching [60] or peer collaboration in teaching [49] in RME has been revealed as a valuable learning tool for students [60] as well for instructors in their professional development [49].

Student-Centred Approaches in Active Collaborative Environments

Regarding pedagogical practices in RME, the literature review was organised into four main areas. Beginning with the first area concerning the trends in pedagogical practices in the teaching of RME, it was possible to identify the following main results. It was clearly stated in the literature that it is important to reflect on the ways of investigating and understanding research [47,56]. From this perspective, concerning the understanding of different scientific rationales as a research competency in RME, the literature shows that it is important to be aware of how students can be involved in real data collection, both in the field as well as through accessing online repositories [8]. These practices are related to the specific features of the research designs regarded as research competencies to be developed. In addition to field and desk research practices, a direct fundamental aspect of fostering discussion of the challenges that students might face in fieldwork is the use of role-play to simulate situations that students are likely to encounter and writing about them [27,61]. The practices encountered with regard to the third set of research competencies needed to undertake research concern the form and content of scientific communication. This kind of pedagogical practice can be achieved through question-led approaches, meaning that RME teaching should focus on research questions that engender curiosity and surprise and not providing answers to questions that are not posed by students [30]. According to the same study [30], this is a matter of emphasising a question-led approach as a pedagogical practice to teach RME, instead of providing a series of 'traditional pedagogical practices' for students to choose from. The lack of attention given to research questions when conducting research is connected to the neglect of research design as a research competency [30]. Despite the wide range of methods that already have been established in RME courses, most instructors use traditional teaching methods [4]. Although the syllabuses of RME courses show a greater tendency towards the acquisition of technical and operational skills, instructors tend to employ more 'traditional' forms of assessment, such as reports and essays, in their evaluations [15]. How, then, to mitigate the contradictions between what are proposed as learning objectives and what is practiced in order to promote innovative pedagogical practices in RME?

Hands-on exercises in group activities can be included in pedagogical practices. The pedagogical strategies used by instructors can include 'real-life' experiences and laboratory experiments, in addition to group projects, research presentations, and reports of results. According to Pfeffer and Rogalin's [57] study, inviting a researcher with specific expertise to act as a discussion facilitator encouraged open dialogue among students. For instance, according to Luo's [46] study, instructors might not be qualified in specific research themes, so inviting practitioners, especially experienced researchers with work published in scientific journals, could also help to illustrate the nexus of research and practice. Seminar-group assignments are appreciated by students, as they offer a comfortable opportunity to apply

their knowledge [33]. Students' peer collaborations can help them to undertake research exercises [36,62]. They are also an opportunity for instructors to witness interactions between students, making it possible to engage in new RME pedagogical approaches [62]. In this same direction, Mekonnen's [36] study argued that, in the experience of instructors, students strongly agreed that the group teaching approach was very conducive to their learning. Hands-on approaches and group projects enhanced students' confidence in understanding and undertaking research. The students valued opportunities for exchanging ideas, where they can learn from each other and see their own issues through their peers' eyes [49]. In these discussions, peer collaboration encourages a new and deeper research understanding, but also helps to demystify the theoretical and social complexity that is commonly associated with conducting research [52].

Playfulness and creative experiences, as new trends in pedagogical practices, were also identified in the literature. Students indicated that anecdotal feedback from instructors is useful, as it assists them in understanding the various aspects of research [26]. According to Ehiyazaryan-White [23], results show that providing visual, narrative, and interdisciplinary contexts (through open educational resources) is likely to be successful in the teaching of RME. The use of playful tasks as a pedagogical practice might not necessarily deliver an understanding of research before it is carried out [17]; however, the same authors [17] reported that, once an assignment was completed, the students believed that playful methods were just as valuable as more traditional, non-playful methods. According to Matusiak and Bright's [9] study, 'having fun' is highlighted as a pedagogical practice that increases students' interest in RME courses. Kara and Brooks's [54] study refers to comics as useful tools for supporting learning of different aspects of research methods. However, this approach may require the instructor to move out of their pedagogical comfort zone and at the same time require students to be receptive to a different learning experience. In the same scenario, Akyüz [22] argues that, from the idea that 'research is like a treasure hunt', students engage in the treasure hunt and feel its excitement, practising the skills that provide clues and actually experiencing the excitement of finding a clue. Facing the problem of relationships between students, and between students and instructors in relation to understanding and undertaking RME courses, how can courses be designed, presented, and implemented?

Face-to-face and/or online platforms and digital tools improve pedagogical environments and can be appropriated by learners and instructors. Regarding online approaches, studies have revealed major implications for the teaching of RME. The use of online resources that allow co-writing provides opportunities for instructors to read and make revisions or changes, thus contributing to the ongoing progress of scientific writing [24]. However, as already stated above, the use of customised or adaptable online resources to support learning remains limited and is not well-addressed in the development of students' research competencies [25]. Secret et al. [44], revealing results from an RME course developed in an online format, argue that providing a variety of learning opportunities translates into students experiencing confusion and frustration. This is due to the fact that they feel overwhelmed by the multiple technological formats. The sense of being overwhelmed was also experienced by instructors, who felt that the use of different technological formats created more demand for instructor-led guidance. In convergence with these results, Ivankova [4] elaborated on several disadvantages of online RME learning, such as a lack of good interaction between students and instructors and the fact that procedural methodological aspects were seen as difficult to understand. Despite these results, one study revealed that face-to-face and online pedagogical environments were equally effective in teaching students about research design and methods [63]. According to Ivankova and Piano Clark [21], no significant differences were found in their study between the learning achievements reached with both RME course formats (face-to-face and online). The authors attributed this result to the fact that it involved a careful choice of teaching and learning strategies for the different learning environments. The major difference described in the same study was that only very few face-to-face students thought that this format would be

more time-consuming than online learning. On the other hand, most time-consuming for instructors were online teaching methods [4]. This could be because the instructors were under considerable work pressure given the increasing demand for student supervision, leading to questions about how the current supervision models could be adjusted to put less pressure on individual teachers.

Acknowledging the variation in the educational needs of students emerges as a necessary educational commitment for instructors and students. Luo [64] argues that appropriate pedagogical practices for teaching RME need to recognise student background diversity in order to make the curriculum accommodating and flexible for them. It is from this perspective that Aguado [55] reported his results, revealing that students appreciated the frank discussions that they had with their instructors regarding research issues. Nind and Lewthwaite [8] argue that having prior knowledge of the interests and experiences of students makes demands on instructors in terms of their pedagogical practices. The best way to improve learning is to be aware of students' backgrounds (personal interests and academic experiences) [7]. Monteiro and Branco's [65] results show that, despite the inclinations of instructors and their personal preferences, they should recognise that their role requires that they do not induce or determine the choices of methodologies that students make in their research work. One way to pursue this idea is to carry out an initial survey of the student's interests in different research types [46]. Such input would potentially result in a more directive curriculum design and provide a range of research methods activities that match students' needs, which raises the question: What needs are revealed by students in master's and doctoral programmes in education regarding research methods courses?

Student engagement with ongoing research projects of scholars as a suitable approach to incorporate into pedagogical practices in teaching RME is one desire of students. In order to improve the relevance of students' learning, the curriculum should include more hands-on practice and use more real-world examples [64]. This is also a demand of students [3,8]. According to Luo's [64] study, this enables students to understand how different research methods can be used to address practical problems in the professional field. The same results were revealed in other studies [3,8], as suggestions for improving student engagement in RME courses. This involvement creates a tangible link between RME courses and student practices [28].

Regarding autonomy and ownership of lived experience in research, while creating their own instruments, students revealed colorful stories about their experiences with research [55]. Lewthwaite and Nind's [20] study results show that when instructors mobilise their pedagogical practices to encourage students' reflections on their own practices, they become more aware of research procedures.

3.4. Pedagogical Culture of Learners and Instructors: Learning-Centred Course Designs Aiming at Scientific Cultures

The question that led to this section of the paper was: Which research findings contribute to the problematization of a scientific culture (of teaching/ learning) in RME courses? Regarding anxiety over research methods, previously portrayed as a significant element in learning opportunities that might limit methodological knowledge and restrict the acquisition and development of research competencies, the literature shows different ways to reverse such tendencies in the approach towards a scientific culture. According to Wagner et al. [43], creating a closer relationship between instructors and learners, in addition to alleviating this issue, contributes to better research understanding. This, according to the same authors [43], promotes a more attentive and more engaging RME pedagogy. The need for a personalised pedagogical commitment can then be argued for [25]. In line with this idea, according to Wagner et al. [66], it can be said that it is necessary to create a pedagogical environment of 'freely speaking' between instructors and learners. Against the notion of RME as a 'dry' knowledge area, following these ideas can lead to a situation in which RME may be perceived as a relaxed field. From robust pedagogical cultures

(complexly constituted, as they involve so many dimensions and specificities with respect to learners, instructors, and knowledge itself) of RME, the creation of scientific cultures is enabled.

The sense of immediacy in a pedagogical culture, as indicated by the research results presented, leads to senses of trust, motivation, and autonomy increasing students' capacities for research understanding. In this regard, one way of promoting scientific cultures in RME is to challenge learners to identify real-world problems and to go to specific research contexts [64]. Schulze's [67] study, which reached the same results, develops the idea that research contexts may be seen as authentic learning contexts necessary to the constitution of a scientific culture. According to Luos's [64] study, providing learners with real opportunities to practise RME contents learned in class contexts enables them to engage in research. One example was revealed by Turner et al. [15], whose results showed that collaborative partnerships in class contexts in higher education institutions and engagement with various research contexts in society could allow a more intensified scientific culture. In this regard, according to Hoidn and Olbert-Bock's [58] study, instructors are encouraging pluralism in the methodological knowledge-production forms of learners as well as instructors. These results point to the idea that the construction of a scientific culture in RME teaching presupposes a departure from the classroom context. Going into other real contexts in society is, therefore, a constitutive element of the creation of scientific cultures. Another possibility to promote scientific cultures is derived from the previous debate concerning the question-led approach. A strengthened pedagogical relationship between instructor and learner as part of a pedagogical culture is also an opportunity to create scientific cultures when the alliances are constituted from the beginning of RME courses through question-led approaches [20,55]. This engagement allows instructors to integrate learners' research interests into their own pedagogical practices [55]. These results are amplified by the idea that if this could happen in pedagogical cultures, learners would be directly engaged in an active research agenda [55]. This pedagogical culture concept fosters the cultivation of a scientific culture.

From the contents of scientific cultures of pedagogical cultures (based on pedagogical relationships) to the forms in which they can be experienced, the literature shows that online platforms and digital tools are a way to increase scientific cultures. This idea differs from the one above, because it is not focused on the substance but rather on the shape of RME. Online interactions allow research environments to be created. This allows the understanding that scientific-culture settings can permit different formats of living and experience [24]. However, to achieve this, according to Ivankova's [4] study, it is necessary to organise high-quality online interactive-learning environments, taking into account several elements that constitute online activity, namely, the issues related to the time and space of interaction. Online platforms for learning and teaching should give opportunities to reflect, share work, discuss, and collaborate in constructing knowledge [19]. Concerning these contents and forms of scientific cultures as pedagogical cultures of RME, the Nind and Lewthwaite [8] study summarises the concepts that are being discussed regarding the notion that a scientific culture can be put on the pedagogical agenda of instructors when RME courses are learning-through-doing-orientated, student-orientated and active- or problem-based-learning-orientated.

Learning-centred course designs (focusing on students' pedagogical experiences and on active and practical pedagogical approaches) aiming at scientific cultures provide opportunities for learners to improve their research knowledge and competencies [32,46,68]. According to Luo's [46] study, an RME course should constantly evolve in response to student needs, and learning-centred course designs allow this to happen. This kind of RME course design also enables learners' personal satisfaction with RME to grow, reducing methodological anxiety [32]. According to Neves et al.'s [69] study, learning-centred course designs also enable learners to be better prepared to respond to current research challenges. In this way, according to the same authors, this type of pedagogical culture allows engagement in collaborative work in intercultural environments. It can then be

understood that one way to consolidate scientific cultures is to strengthen ties with research contexts outside higher education institutions. This leads to a growing focus on preparing students for the workforce rather than solely preparing them for graduate school [15,20,70]. This outside experience enables and promotes the engagement of students as real-world researchers [70].

Learning-centred course designs lead to students being interested in and considering pursuing scientific research after their postgraduate studies [50]. According to Lundahl's [50] study, the development of academic training in doctoral studies also increases when teaching methodologies are student-orientated and active- or problem-based-learning approaches are applied. This success is guaranteed because learners feel that they can choose their own research topics and are able to actually conduct their work in an active research environment [52]. These results showing improved academic experience in RME courses based on these methodologies suggest an opportunity to counterbalance the results of poor academic experience when learning-centred course designs are not applied. The change in pedagogical culture through these approaches may be difficult due to the existence of an institutional culture.

Institutional cultures, according to Herman's [37] study, can affect the creation and development of scientific cultures in pedagogical cultures of RME (in the terms described above) if an institution has for decades ignored social and political problems, for example. According to the same authors [37], an RME course will not be able to quickly reshape the research culture in an institution by itself because scientific cultures of higher education institutions have 'habits of thought'. An RME course can contribute to the reshaping of research understanding; however, this is a complex and slow process. In this regard, and according to the same paper [30], this panorama affects the 'search for the new', which is the basis of learning-centred course designs in RME [32,46,68]. In this context, it is crucial to understand how learners and instructors can develop as practitioners of scientific research.

Enabling Students and Instructors to Develop as Research Practitioners

Beginning with instructors' research practices, the literature shows results from different scholars based on reflective case studies and based on extensive inquiries involving other RME instructors. From this broad swathe of gathered information, some characteristics can be elaborated. It is important that instructors' research practices begin by changing the status of knowledge–power retention such that instructors assume the role of facilitator [4]. In this sense, knowledge becomes the bridge between the instructor and the learner. This changing of 'roles' in RME teaching, as according to Ekmekci et al.'s [39] study, ensures that learners can become the major stakeholders in their own RME learning. The RME instructor assumes that this decentralisation in the teaching process will encourage learners to become research producers rather than only research consumers [52]. The literature shows that in order to achieve this change in status it is necessary to engage in peer collaboration, in the terms previously argued in this paper.

Instructors' research practices increase when they have peer support (when they work alongside peers), leading to the creation of new senses of self in RME teaching [2,13,44]. This broadening of research horizons and practices facilitates the recognition of new methodological debates and self-reflection for the forging of new research directions [59]. These results are particularly relevant in view of the research findings of Nind and Lewthwaite [8], who have discussed the lack of pedagogical dialogues among RME instructors. The authors [59] caution, however, that the need for change does not mean that the instructor's current modes of thinking and research teaching are not the most appropriate, but the openness of knowledge does (as a general notion) encourage the development of practices. Following this line of thought, Wagner et al.'s [43] study revealed that junior RME instructors responsible for RME teaching may be enthusiastic and inventive; however, their experience may be limited to what they were taught. On the other hand, instructors with more experience may be inflexible in their research conceptions [43]. Instructors' research

practices are therefore to be based on an open and critical attitude [68], such that students' inputs are valued [31].

Concerning the specific role students' RME instructors undertake in their pedagogical practices, the literature presents some considerations regarding research practices. According to Schulze's [67] study, it is necessary that the research practices of RME instructors be as clear as possible when they are giving students guidelines or instructions for undertaking research. This is the main aspect of the supervisor's role [25], in addition to directing their engagement with students towards making decisions about the different research steps [22].

Regarding the learners' research practice characteristics in the learning of RME, the literature contains only a few studies concerning this topic of research. In line with results from Leston-Bandeira's [52] study about learners becoming research producers, Ekmekci et al. [39] argue that learners' research practices must have a direct link to RME teaching, such that they can act as instructors. The main characteristics of these practices are the opportunities for learners' self-discovery in understanding research as well the gaining of self-confidence in undertaking research [44,48].

4. Conclusions

This study aimed to contribute to understanding the state of the art regarding the pedagogical cultures associated with teaching and learning research methods in higher education through the identification of trends and pitfalls. Specifically, we aimed to find answers to the following research question: What pedagogical cultures of teaching research methods can be identified in the literature? To answer this question, specific research questions were formulated: (i) Which research findings highlight the understandings and misunderstandings about what is methodological knowledge in learning and teaching research methodologies in education? (ii) Which research findings contribute to the discussion of indispensable skills for understanding and undertaking research? (iii) Which research findings contribute to the discussion of appropriate/ inappropriate pedagogical practices for teaching research methodologies? (iv) Which research findings contribute to the problematization of a scientific culture (of teaching/ learning) in RME courses?

The article has considered a number of specific issues related to the proposition of actively contributing to a framework for RME, including principles for the imagination and design of an RME course to organise and structure it and to develop it through innovative pedagogies. Three specific dimensions were addressed: (i) methodological content knowledge, (ii) research competencies, and (iii) pedagogical practices. The results presented along each of these three dimensions suggest the need for an articulation of the three via an inclusive collaborative-research-based practice that gives both instructors and students key participatory roles.

Regarding methodological knowledge, the literature shows that learners of research methods are constantly reported to hold negative attitudes, particularly with regard to statistical and quantitative methods in general. The complexity that learners associate with and assume to be essential to research methods courses, connected to their lack of preparation in several domains, seems to create anxiety and originate negative affective dispositions. As shown in this article, these negative attitudes are reported in the literature on students' perceptions prior to their involvement in research methods courses or at the beginning of these courses. In addition, a notorious lack of preparation on the part of students was clearly identified in many studies, representing a mismatch between instructors' expectations and the real knowledge that students hold.

The literature shows other difficulties, reinforcing learners' misconceptions about the courses. Learners feel nervous as they gain access to course information, namely, course contents, learning objectives, and expected outcomes. At stake is the understanding of different scientific rationales, specific features of research designs and data collection and analysis, as well as the form and content of scientific communication through writing. However, we should consider the possibility that students seldom acquire a realistic concept

of research when they are not engaged in the practice of research. This may represent a serious challenge for scientific writing in the absence of hands-on experience.

Since methodological knowledge is situated in the context of research practices and necessarily incorporates previous knowledge, student understanding of methodological material requires their participation in research practices. When facing the need to design a strategy and procedures to research a specific problem, students tend to adopt the 'safe side', evading the principle of 'fit to purpose' when defining a certain research approach and relying on their own capabilities within a safe territory. This will certainly have implications for the quality of research outputs.

Understanding research methods requires knowing what sorts of knowledge constitute information that enables decision-making processes when dealing with a research problem. What is at stake is whether a critical turn, as a way of addressing a scenario of great complexity, as evidenced above, may be a constituent element of a safe side in students' methodological knowledge. As pointed out in several studies in the literature, the epistemological beliefs of instructors tend to push towards traditional views about research, which separates modes of interrogation and creates a sort of menu 'à-la-carte' list of options for research methods according to the type of problem formulated.

The notion that preparing students for research means creating conditions for students to develop research competencies is also present in the literature and relates to both the competence to read and make sense of research results as well as design and undertake research. However, we can question the very notion of competence which seems to be assumed in general in the literature reviewed; in fact, most of the studies address competence outside the practice of research instead of competence in action. This is reflected, for example, in studies that report issues such as English proficiency or software knowledge as barriers to the development of research competencies. Certainly, this becomes problematic regarding the translation of research competencies into research knowledge construction.

Concerning the training of instructors in research methods courses, the literature points to different issues that apparently are seen as problematic: (i) the lack of pedagogical innovation in teaching research methods (e.g., textbook-based teaching); (ii) the relatively frequent biases that teachers convey when teaching, adopting more positivist or more radical interpretivist views of educational phenomena, and thus risking inducing in students a lack of criticism towards different research approaches; (iii) the limited knowledge about research methods based on individual efforts and lack of formal training. This represents a crucial problem in the design and teaching of research methods courses that higher education institutions should properly address.

The main conclusion arrived at through the literature review is that it there is clearly a variety of options that can be taken in designing and teaching research methods courses. A detailed analysis of the literature shows that the apparent variety reflects a lack of clarity about what constitutes the methodological knowledge necessary to read, interpret, design, and implement research in education. Research methods courses seem to adopt descriptive pedagogies based on the idea of putting students in contact with a variety of methodological possibilities and processes and subsequently forcing them to make a choice to develop a thesis or a dissertation.

Finally, one may question the role of the formulation of research problems in teaching research methods courses. No matter what heuristics one may think of in teaching research methods, the process of the formulation of a research problem creates the conditions for students to ask the proper questions and interrogate what research in education is about. This interrogation is at the kernel of understanding research methods and thus deserves a place in the design of research methods courses. The literature shows the apparently different pedagogies implemented by research methods instructors as well as the difficulties students face in dealing with research methods concepts and processes. The macro-scenario clearly points to the need to organise research-based principles and guidelines to constitute a framework that can be used as an inspiration and reference by research methods course designers.

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