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Mentoring and Research Self-Efficacy of Doctoral Students: A Psychometric Approach

Juan Antonio Amador-Campos [1,2,*], Maribel Peró-Cebollero [2,3,4], Maria Feliu-Torruella [5], Alba Pérez-González [1,6], Cristina Cañete-Massé [3,7], Adolfo José Jarne-Esparcia [1], Xavier Triadó-Ivern [8] and Joan Guàrdia-Olmos [2,3,4]

1 Department of Clinical Psychology and Psychobiology, Faculty of Psychology, University of Barcelona, 08035 Barcelona, Spain; albaperezgonzalez@ub.edu (A.P.-G.); ajarne@ub.edu (A.J.J.-E.)
2 Institute of Neuroscience, University of Barcelona, 08035 Barcelona, Spain; mpero@ub.edu (M.P.-C.); jguardia@ub.edu (J.G.-O.)
3 Departament of Social Psychology and Quantitative Psychology, University of Barcelona, 08035 Barcelona, Spain; cristinacanete@ub.edu
4 UB Institute of Complex Systems (UBICS), University of Barcelona, 08035 Barcelona, Spain
5 Department of Applied Didactics, University of Barcelona, 08035 Barcelona, Spain; mfeliu@ub.edu
6 Faculty of Psychology and Education Sciences, Open University of Catalonia, 08018 Barcelona, Spain
7 Psychology, Sciences of Education and Sport, Blanquerna, Ramon Llull University, 08022 Barcelona, Spain
8 Department of Business, Faculty of Economic and Business, University of Barcelona, 08034 Barcelona, Spain; xtriado@ub.edu
* Correspondence: jamador@ub.edu

Abstract: Effective mentoring is an integral component of the doctoral dissertation process. This study aimed to determine the psychometric properties of two questionnaires developed to assess research self-efficacy and the mentoring/supervision process. The sample comprised 1265 doctorate students (mean age = 32.36 years; standard deviation = 8.20). Items in both questionnaires had adequate discrimination indexes and principal component analysis supported the unifactorial structure of each questionnaire, with adequate percentages of explained variance (47.5% and 60%, respectively). Reliability was good or excellent: $\alpha = 0.71$ and $\alpha = 0.94$. In the research self-efficacy questionnaire, there was a significant interaction between gender and year of doctoral studies. Men had higher scores in the first, second and third years of their doctoral studies than women, but this ranking was reversed for the fourth and fifth years. In the mentoring/supervision questionnaire, PhD students in their first year had a higher score than those in the third, fourth and fifth years, and students in the second year had a higher score than those in the fifth year. Understanding students' perception of their research self-efficacy and the mentoring process is of great importance given the relationship between the mentoring process and students' academic performance and personal well-being.

Keywords: doctoral students; mentoring; research self-efficacy; questionnaires; assessment; psychometrics

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1. Introduction

The roots of the practice of mentoring are found in Homer's *Odyssey*. Mentor (from the Greek Μέντωρ), was the son of Alcimus and faithful companion of Odysseus. When the latter left for the Trojan War, he entrusted the care of his household in Ithaca and the education of his son Telemachus to Mentor. Mentoring is a personal relationship in which an experienced or more knowledgeable person helps a less experienced or less knowledgeable person. Mentoring has a long tradition in business, organizations, health and medical education [1–5] and in junior faculty training [6–9]. In the field of dissertation supervision, mentoring encompasses explicit training in research methods, ethics and procedures and active efforts aimed at ensuring that the supervised students acquire appropriate competences [10].

PhD mentors or advisors (the individual faculty member who directly supervises a student's doctoral research) provide students with personal and professional support and guidance during their doctorate programs and play a central role in the training of doctoral students as scientists and in their success [11,12]. Mentoring of doctoral students aims to prepare students for career success in academia or a related profession. PhD mentors provide students with important feedback on their performance, encouragement when they need it, pragmatic information on how to acquire the necessary skills to succeed in a given field and help open doors to career opportunities. Effective mentoring is an integral component of the doctoral dissertation process [4,13]. Successful thesis supervision is not solely contingent on what supervisors can offer their supervised students; doctoral students must be proactive, receptive to feedback and committed to sustaining the supervision/mentoring relationship. Tenenbaum et al. [14] described quality graduate mentoring as fulfilling three support functions: psychosocial, instrumental and networking. Li et al. [15] explored mentoring experiences and relationships from the mentees' perspectives in a sample of 103 nomination letters submitted for the 12 Jay D. Scribner Mentoring Award recipients who were honored between 2006 and 2016. They found several traits related to being a good mentor: relational (being approachable and accessible, demonstrating humility and genuine care, and being willing to tailor the experience to their mentees' specific developmental needs), instrumental (enrichment of research and writing skills and understanding of institutional rules and practices, including promotion and tenure processes) and psychosocial (helping to cope with the stress inherent in their roles). Creary et al. [16] reviewed 30 articles about mentoring relationships in doctoral nursing programs. PhD students value mentor attributes such as being approachable, respectful and supportive, content expertise and a good communicator.

There are different mentoring models in doctoral programs. Formal mentorship models are those that have become part of the infrastructure of a degree program and are incorporated into the core curriculum. A prime example of a formal mentoring relationship in a PhD program is between the student and their doctoral thesis supervisor. Informal mentoring models are often groups of students who come together to provide support, friendship and guidance during their doctorates. Pancheri et al. [17] noted that collegial support of students in their dissertation phase at a school of nursing provided both social and professional benefit. Lewinski et al. [18] implemented a peer-mentoring program for PhD students at a school of nursing. Students reported post-participation benefits such as getting to know faculty in an informal setting, socializing with students from other cohorts and developing a sense of camaraderie with other PhD students.

Several reports have demonstrated the tangible benefits of mentorship on academic success and the productivity of doctoral students [2,10,14]. In the Graduate Student Well-Being Survey of the University of California, San Diego [19], PhD students were less satisfied (24%) with their mentorship compared to other postgraduates. The satisfied students were more likely to complete their program on time (85%) compared to dissatisfied students (57%). Poorly satisfied students were less persistent and motivated by daily work (35%) compared to satisfied students (62%). In the University of California Graduate Student Well-Being Survey [20], 12% (n = 365) of doctoral students said their advisors did not provide advice and resources in support of their goals and ambitions, 18% (n = 562) said their advisors were not real mentors to them and 8% (n = 262) said their advisors were not an asset to their career or professional development. A 2017 graduate student survey by the journal *Nature* [21] drew responses from more than 5700 PhD students around the world. This survey found that mentorship contributed more to respondents' overall satisfaction with their PhD program than did any other factor. Specifically, guidance from and recognition by an adviser proved to be the top determinant. Evans et al. [22] found that the relationship between principal investigator or advisor and graduate students affects the quality of training in graduate education.

There is a lack of research on the formal mentoring process in doctoral students' supervision. Some instruments are dedicated to the evaluation of the mentoring process, but

most of them have been designed to assess general graduate student mentorship functions, roles, behaviors or activities involving undergraduate or general graduate students, but not PhD student mentorship specifically [23–25]. Busch [26] assessed mentoring relationships from the mentees' point of view in a sample of 177 students identified as mentees by their professors using the mentoring instrument Mentees Perceptions. She identified four components: psychological and professional mutual support, comprehensiveness, mentee professional development and research together. With increasing age, mentees reported a decrease in professional development activities. Neither the sex of the mentee nor the sex of the mentor affected these components. Rose [27] designed the Ideal Mentor Scale (IMS) to assess doctoral students' perception of and preferences for a good mentor. Factor analysis of 34 items of the IMS found three subscales: integrity, guidance, and relationship. Rose [28] examined the relationship between students' demographic and academic characteristics (age, gender, citizenship, academic discipline and stage of doctorate) and their preferences for styles of mentoring with the IMS in a sample of 537 students enrolled in PhD programs. She found significant differences for demographic but not academic variables: women scored higher than men did on integrity, international students scored higher than domestic students on relationship and age was inversely related to relationship scores. No group differences were found on the guidance scale. These findings indicate that graduate students' perceptions of the ideal mentor are influenced somewhat by major socio-cultural factors. Schlosser and Gelso [29] constructed the Advisory Working Alliance Inventory (AWAI), a 30-item questionnaire designed to measure the graduate advising relationship from the student's perspective. In a sample of 281 counseling psychology doctoral students, three factors (rapport, apprenticeship, and identification–individuation) were identified. The AWAI demonstrated excellent internal consistency ($\alpha = 0.95$) and test–retest reliability over a 2-week interval ($r = 0.92$). Gedamu [30] designed a survey aimed at exploring graduates' perceptions of the support and direction given by their thesis supervisors. In a sample of 70 Iranian TEFL graduates, he found that doctoral students were very satisfied with the support given by their supervisor (4.08 out of 5 points) and the provision of structure and direction to their thesis (3.93 out of 5 points). Henricson et al. [31] developed a 10-item questionnaire to evaluate expectations of the supervision process when writing a bachelor thesis in a sample of 327 nursing students at a university in Sweden. They found that five factors (the nature of the supervision process; the supervisor's role as a coach; the students' progression to self-support; the interaction between students and supervisor and supervisor competence) explained 74% of the variance. The internal consistency of the questionnaire was 0.68. Smith et al. [32] developed a 44-item instrument, the Collaboration for Leadership and Innovation in Mentoring (CLIM), to quantify important components of PhD student mentorship in nursing at a public state university in the USA. The instrument's overall content validity index (CVI) was 0.91. Test–retest correlations were high ($r = 0.91$) in a sample of 16 nursing PhD students. Ching et al. [33] presented an instrument to measure doctoral students' experiences in a sample of 94 Taiwanese participants enrolled in doctoral programs at two universities. The instrument is composed of three dimensions: career outlook and goal, doctoral experiences and academic identity. The doctoral experiences dimension consists of nine items that loaded in three factors: quality training (two items), career opportunity (three items) and quality advising (four items). Factor loading varied between 0.71 and 0.88; overall reliability was good (alpha = 0.83)

The instruments reviewed have some limitations. They were developed to evaluate mentoring processes in bachelor or in doctoral programs in education, psychology or nursing specifically. To our knowledge, no studies have evaluated the quality of the supervision of the doctoral theses of students from different doctoral courses and disciplines jointly and few studies have reported on the psychometric characteristics of the instruments used, except for the work of Ching et al. [33], although their sample size was small. The purpose of this study was thus threefold: (1) to determine the psychometric properties of two questionnaires assessing research self-efficacy and thesis-related work and the mentoring/supervision of doctoral students; (2) to analyze the mentoring process and its

relationship with the research self-efficacy and thesis-related work of doctoral students and (3) to analyze whether there are significant differences according to gender, year of doctorate and funding of doctoral studies regarding the scores for the research self-efficacy and thesis-related work and mentoring/supervision questionnaires.

This study was conducted as part of an institutional initiative, launched in 2018, aimed at assessing and launching an action plan for improving the mentoring and supervision process of doctoral theses and the emotional health and psychological well-being of doctoral students.

2. Materials and Methods

2.1. Sample

The sample comprised 1265 doctorate students (739 women, 414 men, 5 non-binary, 4 others, 22 who stated a preference not to respond and 81 who left the question unanswered), with a mean age of 32.36 years (SD = 8.20, range: 23–67), who were enrolled in one of the 46 doctoral programs in the arts and humanities, health sciences, sciences and engineering, or social sciences and law departments at a large university in Catalonia (Spain) and who completed a survey about emotional well-being, academic performance and the thesis supervision process. The population of doctoral students at this university is 5007. The final percentage of valid responses was 25.26%.

2.2. Instruments

2.2.1. Research Self-Efficacy and Thesis-Related Work

This questionnaire assessed the doctoral students' perceived ability to fulfill various research-related tasks, their work on their doctoral thesis and the availability of resources to carry it out. It consisted of five items rated on a 7-point Likert-type scale (1 = strongly disagree; 7 = strongly agree).

2.2.2. Mentoring and Thesis Supervision Process

The items in this questionnaire describe the characteristics of the mentoring relationship and assess the perception that students have of the mentoring and supervision process of their doctoral thesis by their supervisor. It consists of 13 items rated on a 7-point Likert-type scale (1 = strongly disagree; 7 = strongly agree).

The questionnaires were constructed by three members of the team specialized in the mentoring and supervision of doctoral students and based on the work of Amador et al. [6,34] on the mentoring of junior university professors. Item revisions required several iterations until unanimity by the three members was achieved. The final version of the two questionnaires was approved by all authors of the study.

2.3. Procedure

Participation in the survey was on a voluntary basis. The data were collected through an online version of the survey using the Qualtrics platform. All students agreed to participate in the study and signed an informed consent before answering the survey by clicking the "I agree" option to consent to participate. The whole process of participation in the study, preparation of the questionnaire and data processing complied with General Data Protection Regulation (GDPR) and was endorsed by the university ethics committee. The second- to fifth-year doctoral students received a link to the survey by means of an e-mail sent on 7 February 2022; on 21 February 2022 another e-mail was sent reminding them of the purpose of the survey and asking them to respond, if they had not already done so; on 7 March 2022, access to the survey was blocked. First-year doctoral students were emailed the link to the survey on the 10th of May and a reminder email on 15 June. This difference in timing of the emails was due to the fact that first-year doctoral students can enroll in their doctoral studies until March.

2.4. Data Analysis

The psychometric study of the research self-efficacy and thesis-related work and mentoring/supervision questionnaires involved obtaining the discrimination index for each item via Pearson's correlation coefficient, assessing reliability in terms of internal consistency via Cronbach's alpha coefficient and analyzing construct validity via principal component analysis. The discrimination index (DI) indicates the ability of the item to differentiate between people with low scores on a factor from those with high scores, i.e., people who score high on a particular factor or area should score high on the item and vice versa; if this is the case, the item has good discriminative power. Ebel [35] proposed the following interpretation for the discrimination index: DI < 0.20, the item must be deleted or completely modified; 0.20 ≤ DI ≤ 0.29, the item needs review; 0.30 ≤ DI ≤ 0.39, the item is acceptable but should be improved, and DI ≥ 0.40, the discriminatory power of the item can be trusted. These criteria were initially formulated by interpretation of the discrimination index based on differences, although they can be used for orientation in the event that the discrimination index is calculated from a correlation.

Construct validity was studied on the basis of a principal component analysis (PCA). The component extraction technique was fully explored and therefore the main component method was used. The adequacy of the sample size and the assumption of an identity covariance matrix were measured using the Kaiser–Meyer–Olkin index (KMO), Bartlett's test of sphericity (significant chi-square value, $p < 0.05$) and anti-image correlation matrix diagonals (values ≥ 0.05). The KMO values varied between 0 and 1, with higher values indicating a better fit: above 0.90, excellent; 0.80, great; 0.70, good; and less than 0.60, mediocre or unacceptable [36]. Kaiser's criterion (eigenvalue cutoff ≥ 1.0) and the scree test were used to determine which of the emerging factors should be retained. Items with factorial loading ≥ 0.50 were considered sufficiently strong [37].

Reliability (internal consistency) was interpreted as follows: inadequate: $\alpha < 0.60$; adequate but with some shortcomings: $0.60 \leq \alpha < 0.70$; adequate: $0.70 \leq \alpha < 0.80$; good: $0.80 \leq \alpha < 0.85$, and excellent: $\alpha \geq 0.85$ [38].

Pearson correlation coefficients were calculated to explore the associations between the scores of academic performance and mentoring/supervision questionnaires, using Cohen's guidelines to interpret the coefficients: r = 0.10 to 0.29, low; r = 0.30 to 0.49, moderate; r = 0.50 to 1.0, high [39].

Two separate 2 × 5 (gender × year of doctorate) factorial analyses of variance (ANOVA) were performed to test whether there were significant differences according to gender and year of doctorate in the scores for the research self-efficacy and thesis-related work and mentoring/supervision questionnaires. Two categories were used for gender, female and male, given the low number of participants who indicated other categories or who declined to respond. As the scores of these questionnaires did not follow a normal distribution, there was heteroscedasticity, and the group sizes were not the same; the factorial ANOVAs were performed with the Wald-type statistic (WTPS) using the GFD package of R [40,41].

Two *t*-tests for independent groups were performed to test whether there were significant differences between doctoral students with funding for their doctoral studies (grouping the options 'full-time predoctoral contract', 'part-time predoctoral contract' and 'industrial doctorate') or without funding in the scores for the research self-efficacy and thesis-related work and mentoring/supervision questionnaires. We chose to perform this analysis separately from the factorial ANOVA (gender x year of doctorate) to avoid unbalanced groups and groups with a small sample size.

3. Results

A total of 1265 students (25.26%) answered the survey; Table 1 shows the demographic characteristics of the sample.

Table 2 shows the items in the research self-efficacy and thesis-related work questionnaire, the DI and the factorial loading for each item. The DI of the items is good. The PCA analyses supported both sampling adequacy (KMO test = 0.773) and the factorability of

the correlation matrix (Bartlett's test of sphericity, $\chi 2$ (10) = 912.35; $p < 0.001$). The items' factorial loading was high, indicating the adequacy of a one-dimensional solution that accounted for 47.48% of the total variance. Reliability was considered adequate.

Table 1. Demographic characteristics of the sample.

Age, Mean (SD)	**32.36 (8.20)**	
	n	**Percentage**
Gender (*n* = 1184)		
Female	739	62.4
Male	414	35.0
Non-binary	5	0.4
Other	4	0.3
I would rather not answer	22	1.9
Marital status (*n* = 1185)		
Single	552	46.6
Married	225	19.0
Living with a partner	341	28.8
Divorced	23	1.9
Other	44	3.7
Do you have children? (*n* = 1184)		
Yes	192	16.2
No	992	83.8
Caregiving responsibilities (*n* = 1179)		
Yes, children and or parents or dependent people	253	21.5
No	926	78.5
Year of doctorate (*n* = 1116)		
1st	186	16.7
2nd	279	25.0
3rd	262	23.5
4th	199	17.8
5th	190	17.0
Dedication to PhD (*n* = 1141)		
Full time	852	74.7
Part time	289	25.3
Financing of doctoral studies (*n* = 1140)		
Pre-doctoral contract	668	58.6
Industrial doctorate	4	0.4
Without funding	378	33.1
Other	90	7.9
Do you have a paid occupation related to the thesis? (*n* = 1139)		
Yes	398	34.9
No	741	65.1

Note: Some ns do not match due to missing responses for some variables.

The total score of the research self-efficacy and thesis-related work questionnaire is the sum of the item scores. A higher score indicates better perceived self-efficacy. The research self-efficacy and thesis-related work questionnaire had a mean score of 23.12 (standard deviation: 6.23; range: 5–35).

Table 3 shows the items in the mentoring/supervision questionnaire, the DI and the factorial loading for each item. In general, the items had a good DI but the DI of item 1 was only classed as acceptable. The PCA analyses supported both sampling adequacy (KMO test = 0.951) and the factorability of the correlation matrix (Bartlett's test of sphericity, $\chi 2$ (78) = 10,522.71; $p < 0.001$). The items' factorial loading was high, with the exception of item 1, indicating the adequacy of a one-dimensional solution that accounted for 60% of the total variance. Reliability was considered excellent.

Table 2. Research self-efficacy and thesis-related work questionnaire, items, discrimination index and factorial loading (n = 1023).

I'm	DI	Factorial Loading
On track to complete my degree program on time	0.507	0.726
Well prepared for the work required to complete my program	0.602	0.799
Upbeat about my post-graduation career prospects	0.450	0.660
Very engaged by my day-to-day work	0.404	0.619
Equipped with the space and the resources I need in the university to succeed academically	0.422	0.625
KMO = 0.773; Bartlett test: $\chi 2$ (10) = 912.35; $p < 0.001$; explained variance = 47.48% α = 0.714		

DI = Discrimination index.

Table 3. Mentoring/supervision questionnaire, items, discrimination index and factorial loading (n = 992).

My Doctoral Thesis Supervisor . . .	DI	Factorial Loading
Expects my research project to be excellent	0.324	0.367
Allows me to set my own priorities	0.612	0.669
Cares little about my work (reverse item)	0.489	0.545
Provides me with advice and resources to support my goals as a doctoral student	0.841	0.877
Gives constructive criticism of my work	0.758	0.805
Is interested in my personal wellbeing	0.765	0.812
Actively participates in my academic and scientific training	0.859	0.891
Devotes time to me and takes my career development into consideration	0.870	0.900
Helps me in my search for opportunities in the academic and professional world	0.809	0.847
Is a support for my career and professional development	0.883	0.910
Impedes the development of my research career (reverse item)	0.537	0.589
Shares information with me about career opportunities inside and outside the University	0.680	0.733
Provides a satisfactory level of mentoring and advice	0.872	0.901
KMO = 0.951; Bartlett test: $\chi 2$ (78) = 10,556.35; $p < 0.001$; explained variance = 60% α = 0.941		

DI = Discrimination index.

The total score of the mentoring/supervision questionnaire is the sum of the item scores. A higher score indicates a good mentoring and doctoral thesis supervision process. The mentoring/supervision questionnaire had a mean score of 66.32 (standard deviation: 17.94; range: 13–91).

The magnitude of the correlation between scores in the research self-efficacy and thesis-related work and mentoring/supervision questionnaires was moderate and statistically significant (r = 0.437; $p < 0.001$; $r^2 = 0.1916$; n = 986); thus, the greater the satisfaction with the mentoring/supervision process the greater the research self-efficacy in the doctoral thesis.

Table 4 presents the results of a 2 × 5 factorial ANOVA (gender × year of doctorate) of the scores for the research self-efficacy and thesis-related work questionnaire. As the scores did not follow a normal distribution and there was heteroscedasticity (Levene's test: F(9, 973) = 1.946; p = 0.043), the factorial ANOVAs were performed with the Wald-type statistic (WTPS). Year was a significant source of variation: students in the first year had a higher score in the questionnaire than students in the fourth or fifth years. But it is important to note that the interaction was also statistically significant, showing that men had higher scores in the first, second and third years of their doctoral studies than women, whereas the opposite was the case in the fourth and fifth years, although the effect size was very small (V = 0.104).

Table 4. Factorial ANOVA of scores for research self-efficacy and thesis-related work questionnaire.

Gender	Year	*n*	Mean (SD)	Source	*df*	*WTPS*	*pWTPS*	*Cramér's V*
Female	1st	112	24.63 (5.79)	Gender	1	1.25	0.267	0.036
	2nd	172	23.19 (5.87)	Year	4	22.56	<0.001	0.076
	3rd	152	22.15 (5.62)	Gender * Year	4	10.57	0.034	0.104
	4th	104	22.71 (6.30)					
	5th	93	22.40 (5.45)					
Male	1st	49	24.76 (6.74)					
	2nd	80	25.20 (6.12)					
	3rd	83	24.29 (6.66)					
	4th	72	21.88 (7.22)					
	5th	66	21.39 (6.78)					

SD: standard deviation; Year 1st … 5th: year of doctorate; *df*: degrees of freedom; *WTPS*: Wald-type statistic; *pWTPS*: significance of Wald-type statistic; *Cramér's V*: effect size.

Table 5 presents the results of a 2 × 5 factorial ANOVA (gender × year of doctorate) of the scores for the mentoring/supervision questionnaire. These scores did not follow a normal distribution and there was heteroscedasticity (Levene's test: F(9, 943) = 3.756; $p < 0.001$); as a consequence, the factorial ANOVAs were performed with the Wald-type statistic (WTPS). The only statistically significant source of variation was the year; students in the first year of their doctoral studies had a higher score for the questionnaire than those in the third, fourth and fifth years, and students in the second year of their doctoral studies had a higher score than those in the fifth year, although the effect size was very small (V = 0.097).

Table 5. Factorial ANOVA of scores for mentoring/supervision questionnaire.

Gender	Year	*n*	Mean (SD)	Source	*df*	*WTPS*	*pWTPS*	*Cramér's V*
Female	1st	102	71.23 (15.76)	Gender	1	0.01	0.934	0.003
	2nd	169	69.54 (16.40)	Year	4	36.1	<0.001	0.097
	3rd	149	65.09 (17.81)	Gender * Year	4	0.59	0.964	0.025
	4th	100	63.70 (17.70)					
	5th	93	61.92 (20.60)					
Male	1st	47	71.91 (14.30)					
	2nd	76	69.30 (15.74)					
	3rd	82	65.50 (17.29)					
	4th	70	64.49 (19.70)					
	5th	65	59.77 (20.83)					

SD: standard deviation; Year 1st … 5th: year of doctorate; *df*: degrees of freedom; *WTPS*: Wald-type statistic; *pWTPS*: significance of Wald-type statistic; *Cramér's V*: effect size.

Table 6 shows the mean, standard deviation and Student's *t*-test for independent groups for the research self-efficacy and thesis-related work and mentoring/supervision questionnaires, according to whether the doctoral students had funding for their doctoral studies: predoctoral contract (grouping the options 'full-time predoctoral contract', 'part-time predoctoral contract' and 'industrial doctorate') or without funding. No significant differences were found in the research self-efficacy and thesis-related work questionnaire. In the mentoring/supervision questionnaire, significant differences were found between the groups with a predoctoral contract and those without funding; the group without funding had higher scores ($p = 0.007$), although the effect size was very low (r = 0.003).

Table 6. Descriptive statistics of the groups of participants with and without funding for the research self-efficacy and thesis-related work and mentoring/supervision questionnaires.

Research Self-Efficacy and Thesis-Related Work								
Funding of Doctoral Studies	***n***	**Mean (SD)**	**Homoscedasticity**		**Student's *t* Test for Independent Groups**			
			F	***p***	***t***	***df***	***p***	**r**
Predoctoral contract	596	23.32 (5.78)	24.75	<0.001	1.17	611.05	0.243	
Without funding	343	28.80 (6.97)						
Mentoring/supervision								
Predoctoral contract	577	65.48 (17.49)	2.01	0.157	2.72	907	0.007	0.003
Without funding	332	68.74 (17.28)						

SD: standard deviation; F: value of Snedecor's F statistic; *df*: degrees of freedom; *p*: significance; *t*: value of Student's *t* statistic for independent groups; r = effect size.

4. Discussion

The mentoring and supervision of doctoral students during the period of completion of their doctoral thesis is of great importance, both for the academic achievement of the students and for the quality policy of universities. Preparation of doctoral students needs to be multifaceted and these students can benefit from ongoing guidance during their doctoral research [42,43]. Evaluation of the quality of the mentoring/supervision process is important for the quality policy of doctoral programs, so instruments with good psychometric properties that allow such evaluation are needed.

The first objective of this work was to determine the psychometric properties of two questionnaires that were developed to assess doctoral students' perceived ability to fulfill various research-related tasks and the mentoring/supervision of doctoral students. The items in the research self-efficacy and thesis-related work and the mentoring/supervision questionnaires had adequate discrimination indexes and the PCAs supported the unifactorial structure of both questionnaires, with adequate percentages of explained variance. There are few previous instruments for evaluating the quality of the process of mentoring and supervising doctoral students. Factor analyses of these instruments have found three [26,28,33] or five factors [30] The Henricson et al. [31], Ching et al. [33], Rose [27] and Schlosser and Gelso [29] questionnaires consist of 10, 12, 30 and 34 items, respectively; our questionnaire consists of 13 items that exhibit sufficiently strong saturation on a single factor that explains an adequate percentage of variance [37]. From a practical point of view, a unidimensional measure is important for assessment processes, as its items would reflect a specific construct (in this case the quality of the mentoring process) rather than other specific components, which may have more or less weight in the process. In addition, unidimensional measures allow for the assessment of specific constructs with few items, which is valuable for large-scale research as it reduces the time and effort required from participants. Instruments for the assessment of the doctoral thesis supervision process, such as the one presented in this paper, can be useful both for monitoring doctoral students and for detecting needs and areas for improvement, which could help doctoral programs to train mentors in order to improve the doctoral thesis supervision process.

Several studies have shown the relationship between the quality of mentoring and supervision, the performance of doctoral students, their academic output and their personal well-being [10,19,42,44,45]. The second objective of this work was to analyze the relationship between the mentoring process and the research self-efficacy and thesis-related work of doctoral students. Regarding this objective, it is important to consider that several investigations have shown that the quality of the supervision of a doctoral thesis, the support of mentors, and the style of PhD supervision are key components for a successful doctoral experience and have an impact on the academic performance of doctoral students [10,16,19,42,44,46]. In this work, there was a moderate and positive correlation be-

tween the mentoring of the doctoral thesis and the research self-efficacy and thesis-related work of the students.

The third objective of this work was to determine whether there were differences in the students' perceived ability to finish their doctoral thesis and in their evaluation of the mentoring process according to gender, year of doctorate and funding of their studies. We found that first-year students rated their research self-efficacy and their work on the thesis better than those in the fourth or fifth years. However, there was a differential effect according to gender. In the first three years of the doctoral program, men felt better prepared for their work and were more confident about finishing their doctoral thesis on time than women; in the fourth and fifth year of doctoral studies this pattern was reversed such that the women felt more prepared for their work and were more confident than the men about finishing their doctoral thesis on time. One possible explanation for this phenomenon is that students in the final years of their PhD studies feel increasing pressure to publish the results of their research, as the deadline for the completion of their doctoral thesis approaches, and this influences their research self-efficacy and self-confidence in finishing their doctoral thesis within the established deadlines. Different studies have found that men publish more than women over the course of their career, which has inspired different possible explanations for these differences, such as family, sociocultural and academic variables directly related to gender roles. Thus, it is common for women to have family responsibilities [47,48]; greater difficulties in job development and promotion [49]; a greater burden derived from emotional labor [50]; a greater gender gap in productivity during their doctoral studies, which limits their early career stages [51,52] and higher gender-specific dropout rates [53].

Gender and year of doctoral study are other variables that have been related to the assessment of the mentoring or supervision process. Tenenbaum et al. [14] found that women received more psychosocial mentoring and men more instrumental mentoring, while Curtin et al. [10] found no gender differences in the different types of mentoring. In our work we found no significant differences according to gender in the assessment of the mentoring process, although the unifactorial structure of our questionnaire did not allow us to differentiate between different types of mentoring. In relation to the year of doctoral study, students in the first two years of the doctoral program were more satisfied with the mentoring and supervision of their doctoral thesis than students in the last year of their doctoral program. These results are consistent with a report from the University of California [20] in which the percentage of doctoral students who had advanced to candidacy but were dissatisfied with the mentoring process (28%) was somewhat higher than that of doctoral respondents who had not advanced to candidacy (20%). Future research should explore whether dropout rates may be somehow related to these differences found in satisfaction according to year of doctorate study, with the aim of determining whether those students who do not drop out are precisely those who have higher satisfaction with the mentoring process.

The relationship between student funding and academic performance or success is unclear. Some studies have found a positive relationship between student funding and academic success [53], while in others the opposite was found to be the case [54,55]. We are not aware of studies that have analyzed whether having or not having funding for doctoral studies can influence students' assessment of their research self-efficacy and the mentoring process. In this work, we found that students who did not have funding for their doctoral studies gave better evaluations of their mentors and the process of supervising their doctoral thesis than those who had funding. Future research should explore possible relationships between this result and student motivation. It is possible that those students with more intrinsic motivation give a better evaluation of the supervision process and that the supervision itself is a very important aspect of their interest in the doctorate [56].

This work has some limitations. It was a cross-sectional study, and thus provides a snapshot of a process that is longitudinal in nature and may vary over time. The university's quality policy takes this aspect into account and, based on the results of this study,

longitudinal monitoring of the personal well-being, mental health, academic performance and doctoral thesis supervision of doctoral students has been implemented, with the aim of promoting policies that favor the personal well-being of students, the quality of supervision processes and the improvement of academic performance.

Regarding the sample, although the sample size was large, it only represents 25.3% of the university's doctoral student population, which forces us to be cautious in interpreting the results since it is possible that those who responded to the survey were the most motivated or most in need of help, which we could not differentiate in our study. Likewise, the percentage of students who have a pre-doctoral contract is higher than usual (58.6%), but they are not all doctoral students at the university. The majority of the PhD students that answered the questionnaire have a PhD contract. This may have influenced the perception of self-efficacy, since it may be related to the availability of time and dedication spent working on the doctoral thesis. A longitudinal follow-up, as mentioned above, which will provide the first data during the 2022–2023 academic year and beyond, may respond to these limitations in the future.

5. Conclusions

The doctoral students' assessment of their research self-efficacy is important for the university; their responses can be used to understand the involvement of these students in their doctoral thesis and thus contrast the information collected through other sources of information within the internal quality assurance system of the doctoral programs. The responses of doctoral students also inform the institution about their assessment of the available resources in the context in which they work on their doctoral thesis and can thus guide policies for the improvement of resources and equipment necessary for research.

Mentoring and supervision processes are important for both doctoral students and supervisors at the university. Our study found that the higher the satisfaction with the mentoring/supervision process, the greater the research self-efficacy in the doctoral thesis.

Gender and year of doctoral studies are other variables relating to research self-efficacy and the mentoring or supervision process. Our results indicate that women feel more confident and prepared than men in the last stages of their doctoral studies (fourth and fifth year). It remains unclear whether this increased research self-efficacy is related to scientific productivity and research career development or could be related to the patterns of their resistance to stress, especially when it has been sustained over time, having to face more stressors throughout their thesis and therefore being better able to withstand the last stages.

Relating to the year of doctoral study, our data indicate that as doctoral studies progress, students are less satisfied with the mentoring by their thesis supervisors, which could influence performance and dropout.

In summary, to our knowledge, this is the first study of the psychometric properties of two instruments that allow the assessment of doctoral students' perception of their research self-efficacy and thesis-related work and the quality of the mentoring/supervision process of their doctoral thesis. Understanding students' perception of the mentoring process is of great importance given the relationship between the mentoring process and students' academic performance and personal well-being.

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