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Self-Efficacy for Research: Development and Validation of a Comprehensive Research Self-Efficacy Scale (C-RSES)

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Abstract

This study aimed to develop and validate a comprehensive research self-efficacy scale (C-RSES) to measure the research self-efficacy of both graduate students and academics in any discipline. Data were gathered nationwide in Turkey from 1301 researchers including graduate students and academics. Exploratory factor analysis revealed a 28-item C-RSES with six factors, namely Literature Review and Research Problem, Discussion, Data Analysis, Research Plan, Research Ethics, and Conceptual/Theoretical Framework. Confirmatory factor analysis supported the proposed factor structure. Factorial invariance of the C-RSES across males and females was shown. Cronbach's alpha reliabilities for the subscales ranged from .85 to .94, which indicates high internal consistency for the scores obtained from the scale. Additionally, using multivariate analysis of variance, researchers with and without a Ph.D. were compared regarding their research self-efficacy aspects. The findings of the study provided evidence for the validity and reliability of the C-RSES. It is suggested that C-RSES is promising to measure the research self-efficacy of graduate students and academics.

Introduction

Research self-efficacy is researchers' belief in their abilities to perform research-related tasks successfully (Forester et al., 2004; Kahn & Scott, 1997). Although research on this issue is not extensive, research self-efficacy is shown to be positively related to researchers' productivity (Hemmings & Kay, 2010, 2016; Swank & Lambie, 2016) and faculty's job satisfaction (Ismayilova & Klassen, 2019). Furthermore, among Ph.D. students, research self-efficacy was found to be positively linked to research interest and research knowledge (Lambie et al., 2014) while negatively linked to depression and anxiety (Liu et al, 2019). Daumiller et al. (2020) pointed out lacking attention towards the predictive power of motivation on faculty's performance and called researchers for investigating the motivation of faculty, as it is important for their cognition and behavior. Therefore, we believe that we first and foremost need to measure research self-efficacy comprehensively. The existing research self-efficacy scales, on the other hand, bear some deficiencies such as (a) addressing a specific discipline, (b) emphasizing a certain research paradigm, (c) referring to either academics or graduate students, and (d) addressing limited aspects of research. The purpose of this study is to develop and validate a comprehensive research self-efficacy scale (C-RSES) for both novice (graduate students) and advanced (academics) researchers in various disciplines, regardless of a particular research paradigm, and a range of research aspects.

Theoretical Framework

The concept of self-efficacy is derived from Bandura's Social Learning Theory (1971) where he underlined the influence of self-regulation on a person's behavior. Later, Bandura (1977) claimed that one's belief and confidence in his or her own ability would affect whether or not s/he would even try to deal with the problem and how he/she performs the action. This highlights that the outcomes of learning and performance depend on a person's own belief and confidence in his or her capability. Then, Bandura (1997) defined self-efficacy as "beliefs in one's capability to organize and execute the course of action required to produce given attainments" (p. 3).

Self-efficacy is one of the most studied topics in educational research and several studies pointed out the importance of self-efficacy in various educational areas. For instance, Kozcu Çakır (2020) found that preservice primary school teachers' self-efficacy beliefs towards science teaching were positively related to their learning strategies of elaboration, metacognitive self-regulation, effort regulation, and time and study environment management. Another study showed that preservice mathematics teachers' self-efficacy beliefs towards mathematics negatively predicted mathematics anxiety and self-efficacy beliefs towards mathematics teaching negatively predicted mathematics teaching anxiety (Unlu et al., 2017). Teaching self-efficacy was found to be positively correlated with attitudes towards the teaching profession among special education teachers (Vosough Matin, 2023) and pre-service music teachers (Kaleli, 2020). Furthermore, numerous studies pointed out that students' self-efficacy was associated with their academic achievement (e.g., Akturk & Saka Ozturk, 2019; Sarzhanova et al., 2023; Yusuf, 2011) and motivation (e.g., Aktan, 2019; Yusuf, 2011).

Researchers' belief in their own capability would influence their learning about research and performance in doing research. Implying the concept of self-efficacy in research, Kahn and Scott (1997) defined research self-efficacy as "one's confidence in being able to successfully complete various aspects of the research process" (p. 41). Later, Forester et al. (2004) defined research self-efficacy as "an individual's belief or confidence in his or her ability to successfully perform tasks associated with conducting research" (p. 4). With that respect, in this study, we define research self-efficacy as a researcher's own judgment about the confidence in his/her own ability to successfully perform research-related tasks in a research process.

Research Self-Efficacy Scales

Over the years, many scale development attempts have been made to measure research self-efficacy. In their recent meta-analysis, Livinti et al. (2021) indicated that the most used scales are Self-Efficacy in Research Measure (SERM) developed by Philips and Russells (1994), the short version of SERM developed by Kahn and Scott (1997), the Research Self-Efficacy Scale (RSES) developed by Greeley et al. (1989) and documented and reviewed in Bieschke et al. (1996). Livinti et al. (2021) also listed infrequently used ones as the Research Attitudes Measure (RAM) developed by O'Brien et al. (1998), the Research Self-Efficacy Scale (RSS) developed by Buyukozturk et al. (2011), and the Science Self-Efficacy Scale (SES) developed by Chemers et al. (2011). In addition to these, other researchers also developed scales to measure the research self-efficacy of certain groups of people. In this section, these scales will be reviewed in their structure and discussed in terms of usefulness to

measure researchers' self-efficacy in various degrees from different disciplines.

One of the most used scales is Research Self-Efficacy Scale (RSES, Greeley et al., 1989). The RSES aimed to measure doctoral students' research self-efficacy in various disciplines. The scale consisted of 53 items in line with the phases of a research process, which are from conceptualization and early tasks to implementation and presentation. With a comprehensive and general perspective, the scale did not make an emphasis on a certain research paradigm such as a qualitative or quantitative approach. Some of the items in the scale were as choosing an appropriate design for research, methods for data collection, and data analysis. In this respect, the scale is considered comprehensive to measure doctoral students' research self-efficacy. Bieschke et al. (1996) claimed that the scale is reliable and useful to measure the research self-efficacy of doctoral students based on the study they conducted with doctoral students from different disciplines including humanities, biological sciences, and physical sciences. They suggested a few items be removed from the scale and indicated that factors of conceptualization, early tasks, and implementation were significant predictors for doctoral students' research self-efficacy in addition to previous involvement in research. However, a scale designed specifically for doctoral students in certain disciplines may not be adequate to measure researchers' self-efficacy in other disciplines. This illustrates that we need a scale to measure the research self-efficacy of researchers from different disciplines regardless of their academic levels such as graduate students or advanced researchers.

Later, Philip and Russell (1994) developed Self-Efficacy in Research Measure (SERM) and collected data from 219 graduate students and interns in counseling psychology. This 33-item scale included dimensions of skills in research design, practical research, quantitative and computer use, and writing. As discussed in Greeley's scale, this scale was again developed to measure doctoral students' research self-efficacy in a specific discipline. While Greeley (1989) took a comprehensive and general perspective, this scale emphasized quantitative approach with the items such as being able to design experiments with traditional and non-traditional methods, being able to use statistics and so others. For this reason, it is discussed that this scale is not adequate to measure researchers' self-efficacy from different disciplines and of those who positioned themselves in different research paradigms.

Kahn and Scott (1997) took three items with the highest correlations on each subscale of Philip and Russell's (1994) SERM. Thus, out of a 33-item scale, Kahn and Scott (1997) got a 12-item scale that was used to measure doctoral students' research self-efficacy in counseling psychology. They applied the scale to 267 doctoral-level graduate students with other measures to find out the predictors for research productivity among counseling psychology doctoral students. As Philip and Russell's (1994) scale, Kahn and Scott's (1997) shortened version of SERM was lacking to measure the research self-efficacy of researchers at all levels from various disciplines. Being this scale to be designed to measure the research self-efficacy of doctoral students in counseling programs and to be validated in this certain discipline raises the question of whether this scale is valid to measure the research self-efficacy of researchers at various experience levels in other disciplines.

O'Brien et al.'s (1998) Research Attitudes Measure (RAM) consisted of 23 research tasks focusing on motivation, conceptualization, analytical skills, ethical considerations, and dissemination (cited in Forester et al., 2004). This scale was also utilized with students in certain disciplines and some questions arose about the usefulness of this

scale. Buyukozturk et al. (2011) constructed the Research Self-Efficacy Scale (RSS) to measure university students' research self-efficacy. They utilized the scale on 310 students (282 undergraduate and 28 graduate students). As a result of the validity test of the scale, Buyukozturk et al. (2011) proposed an 18-item scale in line with the research process (start with identifying the problem and move toward discussing the results and writing up the report). Unlike other scales, this scale has an item on "discussing the research findings within a conceptual framework", which is critical. On the other hand, as Philip and Russell's (1994) SERM, this scale emphasized a quantitative approach, which includes items about the ability of writing a hypothesis and choosing appropriate statistical methods to test the hypothesis. This highlights that measuring the research self-efficacy of researchers in other research paradigms has been neglected. In addition, while other scales were developed to measure doctoral students' research self-efficacy in certain disciplines, this scale was developed to measure university students' research self-efficacy and the sample used to validate the scale was mostly undergraduate students and their disciplines were not shared in the report. It is not clear that the scale is valid to measure the research self-efficacy of students in different disciplines and degree levels. Furthermore, it is still a question whether the scale is valid and useful to measure the research self-efficacy of researchers at all levels in various disciplines.

In addition to these, other discipline-specific scales have been developed to measure research self-efficacy such as for social workers (Social Work Self-Efficacy Scale [SWSE]; Holden et al., 1999), nurses (NURSES; Swenson-Britt & Berndt, 2013), librarians (Brancolini & Kennedy, 2017), physician-scientists (The Clinical Research APPraisal Inventory; Mullikin, Bakken, & Betz, 2007) and prospective teachers (Tuncer & Ozeren, 2012). The commonality among these scales is to be developed to measure the research self-efficacy of people in certain disciplines.

Since this study aims to develop a research self-efficacy scale that can be used by both novice and advanced researchers, those focusing on academics and both academics and graduate students were reviewed and analyzed. For instance, Hemmings and Kay (2009) developed a scale to measure academics' self-efficacy. Unlike others, this scale focused on measuring academics' self-efficacy and utilized the scale to 357 academics from various degree levels in different disciplines at two Australian institutions. However, the scale did not only measure research self-efficacy but also explored teaching and service self-efficacy. In the exploration of research self-efficacy items, it has been identified that the items are not only aligned with the research process but also incorporate research productivity and mentoring. This raises the question of being this scale effective to measure an academics' research self-efficacy or competence. Moreover, as with other scales, this scale takes only one section of the researchers' spectrum into account. Wester et al. (2019) recently stated the importance of measuring faculty's research self-efficacy and developed the 21-item Faculty Research Self-Efficacy Scale (FaRSES). They validated the scale with a sample of 138 social and behavioral science faculty nationwide. In the items of the scale, they took a general perspective toward a research process such as developing a research question, designing a study, selecting appropriate methodology, sampling strategies, data collection, and writing the report. Besides this general research process, they included items about implementing qualitative and quantitative research studies, utilizing appropriate data analysis and validity methods based on these research approaches. This highlighted their aim of developing a scale to measure faculty's research self-efficacy in detail. They further included items about modeling students in the research process and working on multiple research projects. When comparing this scale

to others, it seems comprehensive to measure research self-efficacy due to taking both research paradigms into account and validating with nationwide data. However, having the scale only focusing on the research self-efficacy of faculties in social and behavioral science may be seen as a weakness.

Finally, Swank and Lambie (2016) argued that the instrument to measure both faculty members' and doctoral students' research competence is lacking and developed the 54-item Research Competence Scale (RCS). The scale was utilized to 285 faculty members and 95 doctoral students in the counseling program. The scale consisted of six domains including (1) research inquiry/literature review, (2) general research processes/ methodology, (3) qualitative research processes/ methodology, (4) quantitative research processes/ methodology/, (5) research ethics, and (6) scholarly writing/dissemination of research (p. 100). Unlike other scales, Swank and Lambie (2016) took both researchers in the spectrum into consideration and had a detailed perspective by including competence in both qualitative and quantitative research methodologies. Despite this strength, validating the scale with researchers in a certain area of study (i.e., counselor education) raised the question about the usefulness of the scale in other disciplines.

The aforementioned reasons highlight the need for a scale to measure research self-efficacy regardless of the degree of research experience and area of study. Thus, this study attempts to develop a scale to measure the research self-efficacy of both academics and graduate students in various disciplines. We will seek answers to the following research questions:

1. What is the factor structure of the research self-efficacy scale with a sample of faculty and graduate students from different disciplines?
2. What is the internal consistency of research self-efficacy subscales?
3. Is there factorial invariance of the research self-efficacy scale across males and females?
4. Is there a difference between researchers with and without a Ph.D. degree in regard to their research self-efficacy aspects?

Method

During the development of the research self-efficacy scale, we followed the guidelines DeVellis (2017) recommended. First, previous studies and existing scales on research self-efficacy were reviewed and examined, which guided us to identify key components of research self-efficacy. As a result of discussions held among researchers in this study, critical aspects were defined and the items of the scale were generated. The items were responded to on a five-point Likert scale (1= strongly disagree, 5= strongly agree) and there were 33 items in the initial item pool.

Next, items were examined by five researchers with diverse research expertise in three different fields from three universities. Three of these researchers are serving at the research methodology office in a large university as a research consultant and two researchers' area of study is on self-efficacy. They evaluated the items in terms of appropriateness for the content and clarity for the targeted group. Based on the feedback received, the items were revised (e.g., rewording items). An online questionnaire was created with research self-efficacy and demographic

information items. Ethics committee approval was obtained for the study. Then, through an electronic document management system, all universities in Turkey were informed about the study, and the faculty and graduate students in these universities were invited to participate by completing the online questionnaire.

Participants

Participation was on a voluntary basis and a total of 1301 researchers nationwide completed the online questionnaire form between May and June 2021. Researchers from 12 different disciplines participated in the study, with the most participants from Social, Humanities and Administrative Sciences (33.8%), followed by Educational Sciences (18.8%), Health Sciences (11.7%), and Engineering (10.4%). With regard to the academic position, the participants were 378 (29.1%) master's students, 182 (14.0%) doctoral students, 180 (13.8%) research assistants, 173 (13.3%) assistant professors, 148 (11.4%) instructors, 92 (7.1%) associate professors, 82 (6.3%) professors, 34 (2.6%) research assistants with Ph.D., and 32 (2.5%) instructors with Ph.D. 734 (56.4%) were female, 563 (%43.3) were male, and 4 (%0.3) participants preferred not to respond to this question. Participants' age ranged from 20 to 96, with a mean of 35.52 (*SD*= 9.49) years.

Instrument

An online questionnaire form was developed with the items of research self-efficacy and demographic information to collect data. Research self-efficacy items are explained in detail in the following section. Demographic information questions consisted of participants' gender, field of science, academic position, age, and academic experience since beginning graduate education.

Data Analysis

By using SPSS, the data were randomly divided in half approximately. The first half consisted of data from 667 participants while the second half included data from 634 participants. Exploratory factor analysis (EFA) was performed on the first half of the data set in order to identify underlying dimensions or factors (Hair et al., 2009). More specifically, EFA was conducted in order to identify the number of factors, factor loadings of the items, and the non-working items, if any (Thompson, 2004, as cited in Matsunga, 2010). Reliability analysis was conducted to examine the internal consistency of the items in each factor, as well. Then, in order to test the factor structure obtained as a result of EFA, confirmatory factor analysis (CFA) with maximum likelihood (ML) estimation method using the LISREL 8.80 program (Jöreskog & Sörbom, 2007) was conducted in the second half of the data set.

Besides, a reliability analysis was performed. Moreover, factorial invariance across gender was tested. Lastly, multivariate analysis of variance (MANOVA) was conducted in order to compare participants with and without a Ph.D. degree regarding their level of research self-efficacy. Prior to performing the statistical analysis, associated assumptions were examined. The steps followed in the scale development and validation process were demonstrated in Figure 1.

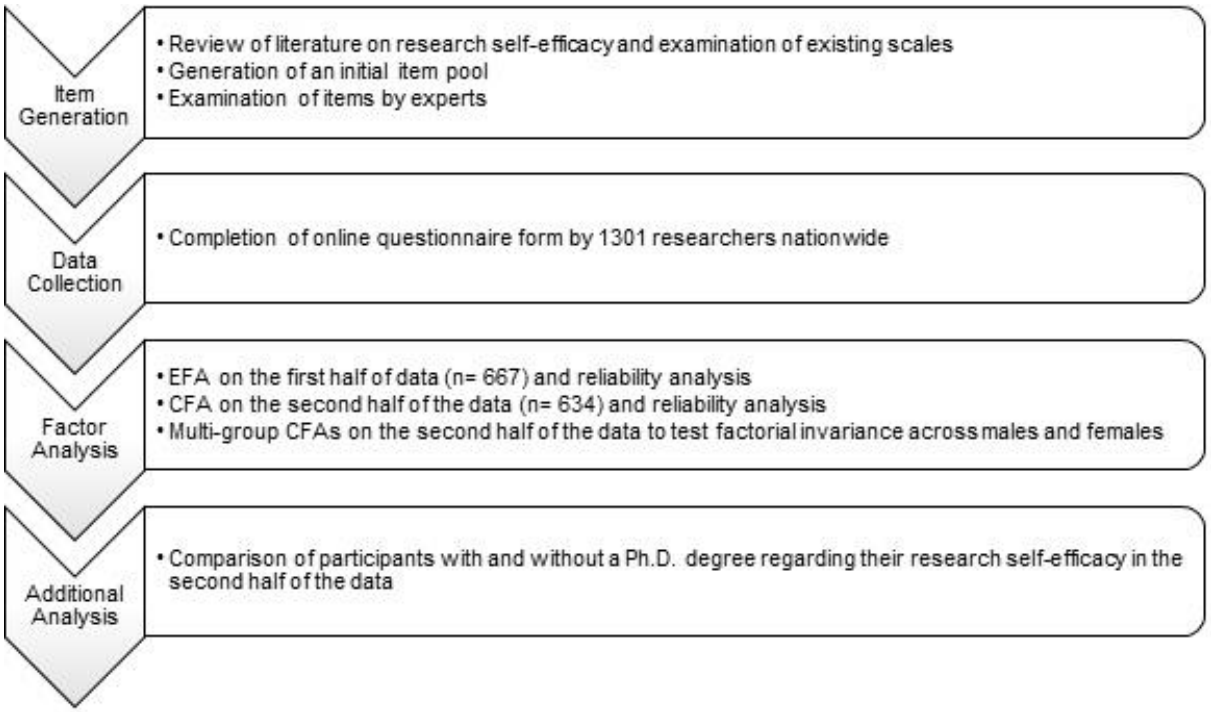

Figure 1. Scale Development and Validation Process

Results

Exploratory Factor Analysis

The data gathered from the first half included responses from 667 participants (57.6% females, 41.8% males, 0.6% missing; from 12 different fields of science). Participants' responses to the 33 items were subjected to EFA with the principle axis factoring method and Promax rotation. Promax rotation, which is one of the oblique methods, was selected since it allows for correlated factors (DeVellis, 2017).

There are 20 times as many observations as the number of variables (20:1 ratio) indicating an adequate sample size for EFA (Hair et al., 2009). The Kaiser-Meyer-Olkin (KMO) value was .95 and Barlett's Test of Sphericity was statistically significant, $\chi^2(528) = 17936.51$, $p < .001$, supporting the existence of statistically significant correlations in the correlation matrix and suitability of the data for factor analysis (Hair et al., 2009). Six interpretable factors with an Eigenvalue above 1 appeared in the scale which was also supported by the scree plot.

When factor loadings were examined, five items were decided to be removed from the scale. Three of the items had factor loadings lower than .4 and two of the items had a problem with cross-loading on more than one factor. While removing these items, only one item was removed at a time and after each item removal, the data was re-examined. By removing five items, we resulted in a 28-item research self-efficacy scale. During this process, the authors critically examined the items' content. It was evaluated that removing these items would not lead to a limitation in measuring the constructs, and the other items would be sufficient to serve the desired purpose. EFA with the 28-item research self-efficacy scale showed that the KMO value was .95 and Barlett's Test of Sphericity was statistically significant, $\chi^2(378) = 14726.41$, $p < .001$. For each item factor loading exceeded .4 and cross-

loadings were not significant. The EFA resulted in six factors and these factors explained 66.98% of the variance in the correlation matrix (See Table 1).

There were eight items in the first factor and these items were related to beliefs about reviewing relevant literature, identifying research problems, determining related theories, revealing the significance of the research and its place in the literature (e.g., "I can do a comprehensive literature review on the research problem I have identified." and "I can access electronic and physical resources to conduct a literature review on the research problem I have identified."). This factor was named Literature Review and Research Problem. The items' factor loadings ranged from 0.44 to 0.92.

The second factor consisted of five items related to interpreting the findings of the study, comparing and contrasting the findings with the existing literature, making suggestions for future research, and determining the limitations of the study (e.g., "I can discuss the findings of my study by relating it to the existing literature." and "I can make suggestions for future research based on the study findings."). This factor was called Discussion. The items had factor loadings ranging from 0.83 to 1.01.

The third factor incorporated three items about analyzing the data in the research, determining and using appropriate computer software for data analysis (e.g., "I can analyze the collected data with the determined data analysis method in order to find an answer to the research question I have formed." and "I can identify appropriate computer software that can assist the data analysis process to answer the research question I have formed."). This factor was called Data Analysis and factor loadings of the items ranged from 0.61 to 0.94.

In the fourth factor, there were six items related to forming the research question, determining the appropriate research method, sample and data collection tools to find an answer to the research question, and managing the data collection processes (e.g., "I can identify appropriate data collection tools to answer the research question I have formed." and "I can identify an appropriate and sufficient number of participants/sample groups to answer the research question I have formed."). This factor was given the name Research Plan and the items' factor loadings ranged from 0.42 to 0.94.

The fifth factor consisted of four items about ethical rules (e.g., "I know the ethical rules about the storage, use, and protection of data collected from individuals." and "I know the author's rights in the studies conducted with more than one researcher."). This factor was titled Research Ethics and factor loadings of the items ranged from 0.46 to 0.90.

In the sixth and last factor, there were two items related to the theoretical and conceptual framework (e.g., "I can identify an appropriate theoretical or conceptual framework for my research." and "I know the difference between theoretical and conceptual frameworks."). This factor was called Conceptual/Theoretical Framework and the factor loadings of the items were 0.93 and 0.86. The items of the scale were used in Turkish and English translations of the items of the whole scale are presented in the Appendix.

Table 1. Factor Loadings Based on EFA

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Item 5	**0.92**	-0.02	0.03	-0.11	0.07	-0.08
Item 7	**0.86**	-0.08	0.03	0.02	-0.09	0.01
Item 6	**0.81**	-0.08	0.09	-0.09	0.02	0.07
Item 8	**0.68**	0.04	0.11	-0.10	-0.13	0.24
Item 9	**0.65**	0.15	0.00	0.02	-0.06	0.11
Item 4	**0.65**	0.07	-0.01	0.06	0.13	-0.18
Item 2	**0.50**	0.11	-0.13	0.09	0.03	-0.06
Item 3	**0.44**	-0.08	-0.19	0.19	0.05	-0.11
Item 24	-0.09	**1.01**	0.04	-0.08	-0.04	0.03
Item 25	0.05	**0.88**	-0.02	0.00	0.03	-0.04
Item 26	0.02	**0.86**	-0.06	0.10	-0.02	-0.04
Item 27	0.02	**0.85**	-0.05	0.03	0.06	-0.05
Item 23	-0.01	**0.83**	0.16	-0.11	-0.04	0.05
Item 22	0.03	0.00	**0.94**	-0.07	0.03	-0.06
Item 21	-0.08	-0.01	**0.83**	0.15	0.06	-0.05
Item 20	-0.03	0.11	**0.61**	0.25	-0.02	0.01
Item 17	-0.04	-0.05	0.06	**0.94**	-0.01	-0.02
Item 15	0.03	0.01	-0.01	**0.77**	0.00	0.06
Item 18	0.08	-0.01	0.16	**0.73**	-0.01	-0.07
Item 16	-0.05	0.00	0.14	**0.71**	-0.03	0.07
Item 14	0.24	0.22	-0.05	**0.45**	-0.05	0.06
Item 12	0.11	0.22	-0.05	**0.42**	0.04	0.16
Item 33	-0.04	0.02	-0.05	0.04	**0.90**	-0.05

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Item 32	-0.02	0.02	0.09	-0.17	**0.85**	0.12
Item 30	0.06	-0.12	0.08	0.04	**0.62**	0.11
Item 31	0.18	0.20	-0.05	0.16	**0.46**	-0.06
Item 11	-0.02	0.01	-0.04	0.03	0.03	**0.93**
Item 10	-0.05	-0.01	-0.07	0.05	0.09	**0.86**

Note. Items included in each factor were written in bold. Factor 1: Literature Review and Research Problem; Factor 2: Discussion; Factor 3: Data Analysis; Factor 4: Research Plan; Factor 5: Research Ethics; Factor 6: Conceptual/Theoretical Framework.

Confirmatory Factor Analysis

According to EFA performed in the first data set, the research self-efficacy scale consisted of 28 items with six factors, namely Literature Review and Research Problem, Discussion, Data Analysis, Research Plan, Research Ethics, and Conceptual/Theoretical Framework. This factor structure was tested through CFA in the second data set (n= 634; 55.2% females and 44.8% males; from 12 different fields of science). Preliminary analysis in the second data set indicated two cases as outliers and they were removed. Therefore, 632 cases were included in the analysis. The Goodness of fit indices obtained as a result of the CFA showed a good model fit (SRMR= 0.05; RMSEA= 0.08; IFI = 0.97; NNFI= 0.97; CFI= 0.97). All items statistically significantly loaded on the intended factors indicating the appropriateness of the proposed factor structure. Standardized pattern coefficients are presented in Table 2.

Table 2. Standardized Pattern Coefficients in CFA

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Item 2	.47					
Item 3	.37					
Item 4	.69					
Item 5	.73					
Item 6	.76					
Item 7	.77					
Item 8	.79					

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Item 9	.79					
Item 23		.78				
Item 24		.87				
Item 25		.89				
Item 26		.86				
Item 27		.86				
Item 20			.80			
Item 21			.94			
Item 22			.91			
Item 12				.72		
Item 14				.73		
Item 15				.80		
Item 16				.79		
Item 17				.85		
Item 18				.81		
Item 30					.73	
Item 31					.79	
Item 32					.78	
Item 33					.86	
Item 10						.87
Item 11						.96

Factorial Invariance of the C-RSES across Males and Females

In order to test the factorial invariance of the research self-efficacy scale across males and females, multi-group CFAs were performed. Initially, the configural invariance was tested in order to inspect whether males and females

conceptualize the constructs similarly. Then, the invariance of factor loadings across males and females that is metric invariance was tested. Next, besides factor loadings, models in which factor variances, factor covariances, and individual item error terms were invariant across gender were tested respectively. To test factorial invariance, changes in CFI (ΔCFI) are used (Cheung & Rensvold, 2002). As seen in Table 3, ΔCFIs between constrained and unconstrained models are less than 0.01 supporting the factorial invariance of the research self-efficacy scale across males and females.

Table 3. Factorial Invariance of C-RSES across Males and Females

Model	Hypothesis test	χ^2	df	χ^2_{diff}	df_{diff}	RMSEA	CFI	ΔCFI
1[a]	Overall fit	2078.546	670			0.0831	0.971	
2[b]	2-1	2107.294	692	28.748	22	0.0823	0.971	0.000
3[c]	3-2	2110.643	698	3.349	6	0.0819	0.971	0.000
4[d]	4-2	2123.141	707	15.847	15	0.0816	0.971	0.000
5[e]	5-2	2181.749	720	74.455	28	0.0823	0.970	-0.001

[a]Baseline, [b]Factor loadings invariant, [c]Factor loadings and factor variances invariant,
[d]Factor loadings and factor covariances invariant, [e]Factor loadings and individual item error terms invariant

Reliability Analysis

Reliability analysis was conducted in both halves of the data set. For each research self-efficacy aspect, Cronbach's alpha reliability coefficient was calculated (see Table 4). The research self-efficacy aspects had Cronbach's alpha reliabilities ranging from .85 to .94 which indicates high internal consistency. This shows that the subscales of the C-RSES yield reliable scores.

Table 4. Reliability Estimates of Subscales

Subscale	Number of items	Cronbach's alpha in the first data set	Cronbach's alpha in the second data set
Literature Review and Research Problem	8	.88	.87
Discussion	5	.94	.93
Data Analysis	3	.90	.91
Research Plan	6	.92	.90
Research Ethics	4	.85	.86
Conceptual/Theoretical Framework	2	.90	.90

Descriptive Statistics and Bivariate Correlations

In the second data set, research self-efficacy aspects were computed by averaging responses given to the items in each subscale. Table 5 presents descriptive statistics and bivariate correlations for the research self-efficacy aspects. The participants reported the lowest self-efficacy in the analysis of data whereas they felt efficacious in

discussing study findings, identifying limitations of the study, and making suggestions for further studies. Correlations between self-efficacy aspects (ranging between .41 and .75) show that the variables are positively related.

Table 5. Descriptive Statistics and Bivariate Correlations

			Pearson correlation				
Research self-efficacy aspect	*M*	*SD*	1	2	3	4	5
Literature Review and Research Problem	4.20	0.58					
Discussion	4.22	0.65	.63				
Analysis of Data	3.67	1.00	.41	.51			
Planning the Research	4.09	0.65	.67	.75	.61		
Research Ethics	4.12	0.82	.51	.55	.42	.61	
Theoretical and Conceptual Framework	3.83	0.89	.50	.53	.48	.62	.46

Note. All correlations were significant at .01 level of significance.

Comparison of Participants with and without a Ph.D. Degree

Previous studies claimed that doctoral education is critical for a researcher to develop skills and confidence for research and research self-efficacy increases with the level of education (Bailey, 1999; Hemmings & Kay, 2009; Lambie et al., 2014; Vera et al., 2011). With that respect, in order to validate the developed research self-efficacy scale and investigate whether it measures researchers' self-efficacy as expected, the research self-efficacy of researchers with and without a Ph.D. degree were compared by using the second data set. MANOVA was conducted for this purpose. Inspection of univariate and multivariate outliers revealed 16 cases as outliers and these cases were deleted. Examination of scatterplots indicated a linear relationship between research self-efficacy aspects within each group. Bivariate correlations between the variables within each group ranged between .35 and .75 indicating no serious problem with multicollinearity. However, according to the results of Box's test and Levene's test, there were some violations regarding the homogeneity of variance-covariance matrices and variances assumption, respectively. In this situation, the use of Pillai's criterion instead of Wilks' lambda is recommended (Olson, 1979, as cited in Tabachnick & Fidell, 2007, p. 252). There was a statistically significant difference between participants with and without a Ph.D. degree on the combined self-efficacy aspects, $F(6, 609)= 12.02$, $p= .000$; Pillai's Trace= .11; partial eta squared= .11. When the results for the self-efficacy aspects were examined separately, using a Bonferroni adjusted alpha level (.05/6= .008), there was a statistically significant difference for all self-efficacy aspects, other than Data Analysis. An examination of the mean scores showed that researchers with a Ph.D. degree reported higher levels of Literature Review and Research Problem, Discussion, Research Plan, Research Ethics, and Conceptual/Theoretical Framework than researchers without a Ph.D. degree. Estimated marginal means are presented in Table 6.

Table 6. Estimated Marginal Means

Dependent variables	Without Ph.D. degree		With Ph.D. degree	
	M	*SE*	*M*	*SE*
Literature Review and Research Problem*	4.14	.02	4.43	.04
Discussion*	4.19	.03	4.45	.04
Data Analysis	3.65	.05	3.85	.07
Research Plan*	4.05	.03	4.31	.04
Research Ethics*	4.03	.04	4.48	.05
Conceptual/Theoretical Framework *	3.75	.04	4.14	.06

Note * $p < .008$

Discussion and Conclusion

Regardless of the level of education or experience in research, researchers need to select a research method in congruence with the research problem (Rutkiene & Tandzegolskiene, 2008). In addition, regardless of research paradigm or discipline, the research process requires identifying the problem, formulating a research question, reviewing the existing literature, collecting adequate and appropriate data, analyzing the data, reporting the results, discussing the findings, and considering ethical aspects. This highlights the need for strong research abilities not only for advanced researchers (academics) but also for novice researchers (graduate students). Scales were developed to measure research self-efficacy (Bieschke et al., 1996; Buyukozturk et al., 2011; Greeley et al., 1989; Kahn & Scott, 1997; Lambie et al., 2014; O'Brien et al., 1998; Philip & Russells, 1994). However, these scales were designed for and tested with a certain group of people in a specific discipline. This made us question the validity and usability of the scale to measure research self-efficacy of both graduate students and academics in other disciplines. Therefore, in order to identify the current level of researchers' beliefs about their abilities to perform research, a valid and comprehensive research self-efficacy scale was needed.

This study explored the psychometric properties of the 28-item C-RSES with the data collected nationwide from graduate students and academics in various disciplines. In the first half of the data set, EFA results yielded six factors: Factor 1: *Literature Review and Research Problem* (8 items), Factor 2: *Discussion* (5 items), Factor 3: *Data Analysis* (3 items), Factor 4: *Research Plan* (6 items), Factor 5: *Research Ethics* (4 items), Factor 6: *Conceptual/Theoretical Framework* (2 items). In the second half of the data set, CFA supported the proposed factor structure of the C-RSES and factorial invariance across gender was demonstrated. Reliability analyses indicated high internal consistency of the scores obtained from the subscales, with Cronbach's alpha values ranging from .85 to .94 in the first data set and .86 to .93 in the second data set. These findings provided evidence for the validity and reliability of the C-RSES to measure research self-efficacy for both graduate students and academics in research across disciplines.

Finally, in this study, a comparison of the researchers with and without a Ph.D. degree revealed differences in most of the self-efficacy aspects (i.e., Literature Review and Research Problem, Discussion, Research Plan, Research Ethics, and Conceptual/Theoretical Framework) in favor of Ph.D. holders. In doctorate study,

researchers have the opportunity to develop their research skills by conducting research, and thus, completing a doctorate may contribute to their research self-efficacy. According to Bailey (1999), "Completing doctoral research develops skill and confidence in one's research ability" (p. 354). Indeed, mastering the experience is the strongest source of self-efficacy (Bandura, 1997). Previous studies also revealed that as researchers' levels of education increase, their research self-efficacy increases (e.g., Bailey, 1999; Hemmings & Kay, 2009; Lambie et al., 2014; Vera et al., 2011). For instance, Vera et al. (2011) investigated whether the research self-efficacy of university faculty differs in regard to their level of academic education. ANOVA showed that faculties with higher level of education were more efficacious than faculties with a lower level of education and faculties with a Ph.D. degree had the highest research self-efficacy. The findings of the present study were in line with the literature providing further validity evidence for the C-RSES.

Implications

The major goal of graduate education, especially doctoral education, is to prepare researchers as competent and productive (Niehaus et al., 2018) and there is a strong relationship between the quality of graduate education and the quality of research produced (Henson et al., 2010). Niehaus et al. (2018) identified that the curriculum of graduate programs is an important facilitator for their research self-efficacy. Randazzo et al. (2021), for instance, found that the research self-efficacy of graduate students increased as a result of attending research methods courses. Indeed, developing doctoral students' research self-efficacy is identified to be a significant component of doctoral students' training (Litson et al., 2021). This highlights the fact that research abilities are gained through graduate education and research self-efficacy is planted in graduate education. Thus, measuring graduate students' research self-efficacy is critical to identify their level of confidence in performing research-related tasks so that their strengths and weaknesses can be determined, and if necessary, graduate programs can be revitalized to better prepare researchers of the next generation as competent and confident. Instructors of research methods courses in graduate programs may use factors of C-RSES to identify areas for growth.

Furthermore, the previous studies indicated that academics' research self-efficacy is associated with their job satisfaction (Ismayilova & Klassen, 2019) and researchers' productivity (e.g., Hemmings & Kay, 2010, 2016; Swank & Lambie, 2016; Wester et al., 2019, 2020). For instance, in a study with assistant professors in counselor education, research self-efficacy was found to be a significant and positive predictor of scholarly productivity (Wester et al., 2019). This highlights the fact that identifying how confident the researchers feel to perform research-related tasks should not be limited to graduate students but also include active researchers in academia. Measuring academics' research self-efficacy is also important to better prepare researchers of the next generation. If academics' research self-efficacy is measured in a valid way, potential gaps in performing research-related tasks can be determined and professional development opportunities can be facilitated. In the study of identifying faculty's needs and preferences for professional development, Hahn and Lester (2012) found that faculties indicated a need for research methodology for professional development. To provide such professional development opportunities for academics in all disciplines, we need to identify how efficacious they feel performing research-related tasks. The findings of this study indicated that the C-RSES can be used to measure both graduate students' and academics' self-efficacy for research across disciplines.

Limitations and Recommendations

There are a few limitations in the study, which need to be taken into consideration for future research. Firstly, one of the factors of the C-RSES has a low number of items; there are two items in the Conceptual/Theoretical Framework. It is recommended that a factor should have at least three items not to be weak and unstable (Costello & Osborne, 2005). Although the two items have high factor loadings and internal consistency, the low number of items in this factor needs careful consideration. Secondly, even though the data collected nationwide from both graduate students and academics across disciplines, they still represent researchers from a certain nation. For this reason, we call researchers across the globe to examine the psychometric properties of the C-RSES to measure research self-efficacy and report to what degree the scale was valid to measure research self-efficacy regardless of researchers' experience and disciplines. Future research may investigate the convergent validity of the scale by examining correlations between scores obtained from the C-RSES and related constructs, such as research interest and job satisfaction. Moreover, longitudinal studies are needed to examine how researchers' self-efficacy for research changes over time as they progress in their doctoral studies and academic career.

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Appendix. C-RSES

Item 2	I can identify the problem that I plan to do scientific research on by reviewing the existing literature.
Item 3	I can determine the problem I plan to do scientific research by discussing it with other researchers.
Item 4	I can access electronic and physical resources to conduct a literature review on the research problem I have identified.
Item 5	I can do a comprehensive literature review on the research problem I have identified.
Item 6	I can identify the theories in the literature related to the research problem I have identified.
Item 7	I can report the synthesis of the existing studies conducted on the research problem I have determined.
Item 8	I can decide on the appropriate theory to form the basis of my study related to the research problem I have identified.
Item 9	I can explain the significance of my study and its place in the literature related to the research problem I have identified.
Item 10	I know the difference between theoretical and conceptual frameworks.
Item 11	I can identify an appropriate theoretical or conceptual framework for my study.
Item 12	I can transform the problem I plan to research into a research question that can be studied by using scientific methods.
Item 14	I can transform the problem I plan to research into a research question by narrowing it down to a specific area.
Item 15	I can determine the appropriate research method (quantitative/qualitative/mixed) to find an answer to the research question I have formed.
Item 16	I can identify an appropriate and sufficient number of participants/sample groups to answer the research question I have formed.
Item 17	I can identify appropriate data collection tools to answer the research question I have formed.
Item 18	I can manage data collection processes to find an answer to the research question I have formed.
Item 20	I can analyze the collected data with the determined data analysis method in order to find an answer to the research question I have formed.
Item 21	I can identify appropriate computer software that can assist the data analysis process to answer the research question I have formed.
Item 22	I can effectively use the determined computer software in the data analysis process to answer the research question I have created.
Item 23	I can interpret the findings obtained as a result of data analysis.
Item 24	I can convey how the results I have obtained will contribute to the relevant field.
Item 25	I can discuss the findings of my study by relating them to the existing literature.
Item 26	I can make suggestions for future research based on the study findings.
Item 27	I can identify and explain the limitations of my study.
Item 30	I know the ethics committee application process is required for my study.
Item 31	I know the quotation and citation rules when referencing different resources in my study.
Item 32	I know the author's rights in the studies conducted with more than one researcher.
Item 33	I know the ethical rules about the storage, use, and protection of data collected from individuals.