American Psychological Association

Scholarship of Teaching and Learning in Psychology

ISSN: 2332-2101

2019, Vol. 5, No. 3, 223–235
http://dx.doi.org/10.1037/stl0000156

High-Quality Research Training Environments and Undergraduate Psychology Students

Kaitlyn S. Burke and Loreto R. Prieto
Iowa State University

We sought to examine the applicability of an empirically established model of high-quality research training environments for graduate psychology students (Gelso, Mallinckrodt, & Judge, 1996) to undergraduate psychology students. We examined the ratings of students on the quality of their research training environments and the relation these ratings had to their reported research self-efficacy as well as their willingness to engage in future research activities. Students who reported higher ratings of the quality of their research training environments also reported higher research self-efficacy, $r = .31$, $p < .01$. In line with Social Cognitive Career Theory (Lent, 2013; Lent, Brown, & Hackett, 1994, 2000), we also found that student research self-efficacy partially mediated the direct effect of high-quality research training environments on student willingness to engage in future research activities ($t = 2.63$; $p < .01$). We discuss the implications of our findings for training and future research.

Keywords: undergraduate education, research training, self-efficacy

The American Psychological Association has established guidelines for the undergraduate psychology major that promote the achievement of several learning goals for psychology baccalaureates, emphasizing a focus on scientific inquiry and critical thinking where faculty create an educational environment that encourages students toward becoming psychologically literate citizens (American Psychological Association [APA], 2016). Early and effective training in research methods and statistics has been identified as a core element in accomplishing this learning goal in the undergraduate psychology educational environment (Dunn et al., 2010; McGovern et al., 2010), and these courses are an almost universally required component of the undergraduate psychology major (Norcross et al., 2016).

The use of cocurricular research activities (e.g., conducting research in professors' laboraatories, carrying out research projects during independent study or capstone courses) has also long been recognized as a key aspect of undergraduate research training in psychology (cf. Dunn et al., 2010). This is especially true because many psychology instructors report, for various reasons, it is difficult to provide undergraduate psychology students with in-depth research experiences within a single, semester-long research methods course (cf. Ciarocco, Strohmetz, & Lewandowski, 2017; Holmes & Beins, 2015). Relatedly, many psychology faculty consider the opportunity for their undergraduate students to be experientially mentored through all aspects of the full research process as the best way in which students can learn how to apply what they have learned in courses and understand how to use critical thinking skills in psychological science (cf. Saville, 2015; Vespia, Wilson-Doenges, Martin, & Radosevich, 2012). Finally, students who engage in research activities with faculty and peers, within their training environments, report higher levels of personal and academic achievement, and en-

This article was published Online First August 15, 2019.

Kaitlyn S. Burke and Loreto R. Prieto, Department of Psychology, Iowa State University.

This study was completed in partial fulfillment of the requirements for a master's degree in psychology at Iowa State University.

Correspondence concerning this article should be addressed to Kaitlyn S. Burke, Department of Psychology, Iowa State University, W-112 Lagomarcino Hall, 901 Stange Road, Ames, IA 50011-1041. E-mail: ksburke@iastate.edu

gagement in research activities is considered to be a high-impact learning experience (Kuh, 2008).

Several investigators examining how psychology undergraduate research training can be optimized have utilized the Social Cognitive Theory (Bandura, 1986) as a framework to explain how skills and knowledge surrounding research can be best imparted to undergraduate students. To date, however, these researchers have largely examined specific classroom-situated techniques (e.g., Bartsch, Case, & Meerman, 2012; Harlow, Burkholder, & Morrow, 2006) or the effects of particular student or teacher variables (e.g., Walker & Brakke, 2017; Waples, 2016) in terms of enhancing student research self-efficacy. Although helpful, these classroom-situated findings are neither able to determine the relations of cocurricular research activities on undergraduate student research self-efficacy nor evaluate the context of the research training environment (RTE) within which content courses and cocurricular research activities are offered. These contextual factors (e.g., faculty attitudes toward research, quality of research mentoring, sociocollaborative aspects of research) are important to account for to assess the fullness of student learning surrounding research training during undergraduate education. We argue that the adoption and use of a model of high-quality RTEs, with broad contextual elements, into which past classroom-situated findings can be integrated, may offer investigators a heuristic way to guide future research into this key learning goal in the psychology curriculum.

Previous literature examining and discussing the involvement of psychology students in research activities has suggested that substantive, integrated, and developmentally appropriate participation in these activities, under supportive faculty mentorship, can increase students' sense of research self-efficacy and foster an excitement about their involvement in future research activities (cf. Barron & Apple, 2014; Ciarocco, Lewandowski, & Van Volkom, 2013; Saville, 2015; Van Vliet, Klingle, & Hiseler, 2013). Importantly, the provision of high-quality RTEs, that continually enhance research self-efficacy in psychology students, can also increase student willingness to engage in future research activities within their chosen professional or educational career (Deemer, Martens, & Podchaski, 2007; Kahn, 2001).

In our study, we sought to discover whether an established model of high -uality RTEs (Gelso et al., 1996), already shown to enhance research self-efficacy among graduate psychology students, could also enhance research self-efficacy in undergraduate psychology students.

High-Quality Research Training Environments

Gelso et al. (1996) identified nine elements within RTEs that positively impacted the research self-efficacy of graduate level psychology students. These nine elements are: (a) faculty modeling of appropriate scientific behavior and attitudes (i.e., faculty being actively involved in their own research, demonstrating enjoyment of the research process, and involving students as capable collaborators); (b) positive reinforcement of scholarly activities (i.e., providing students with encouragement and rewards for involvement in research activities); (c) early and minimally threatening student involvement in research (i.e., having students participate, early on in developmentally appropriate research activities that do not exceed their capabilities); (d) the teaching of relevant statistics and the logic of research designs (i.e., teaching the logical connection of various research designs with statistical tools); (e) encouraging students to look inward for research questions and ideas (i.e., encouraging students to explore personally meaningful research topics); (f) an emphasis on science as a partly social experience (e.g., providing socially interactive and collaborative research opportunities); (g) emphasizing the inherent imperfection of research studies (i.e., conveying that all research inevitably possesses limitations and cannot answer questions completely); (h) teaching varied methodology of research (i.e., relaying the value and purpose of various research methodologies); and (i) demonstrating science-practice integration with a focus on completing research relevant to all types of professional settings (i.e., faculty model the value of conducting research that possesses real-world significance). These nine elements of the Gelso et al. model are in line with the research training processes and outcomes for undergraduate psychology students supported by the APA 2.0 Guidelines

(APA, 2016) as well as approaches espoused by scholars in the area of undergraduate psychology research training (e.g., Dunn, 2015; Hulsizer & Woolf, 2009; Saville, 2008).

The Gelso et al. model (Gelso et al., 1996) posits the greater the presence of the nine elements within the research environment in which psychology students receive their training experiences (e.g., the higher the quality of their RTE), the higher students' self-efficacy toward research will be, and therefore, the greater the likelihood these students will pursue research activities in the future. Researchers have established empirical support for these premises in samples of psychology graduate students (Bieschke, 2006; Kahn & Scott, 1997; Phillips & Russell, 1994; Royalty, Gelso, Mallinckrodt, & Garrett, 1986).

In addition, many previous empirical findings and conceptual assertions regarding the research training of psychology students fit well within the overarching contextual elements contained within the Gelso et al. model (Gelso et al., 1996), for example, faculty modeling appropriate scientific behavior and attitudes (e.g., Miller, 2015); using early and minimally threatening student involvement in research (e.g., Brinthaupt & Ananth, 2018; Ciarocco et al., 2013); positive reinforcement of scholarly activities (e.g., Van Vliet et al., 2013); an emphasis on science as a partly social experience (e.g., DiLalla, 2015; Love, Bahner, Jones, & Milsson, 2007); encouraging students to look inward for research questions and ideas (e.g., Kierniesky, 1984, 2005); teaching the connections between statistics and research design (e.g., Barron et al., 2014; Pliske, Caldwell, Calin-Jageman, & Taylor-Ritzler, 2015); demonstrating the real-life applications of research (e.g., Burkley & Burkley, 2009; VanderStoep & Shaughnessy, 1997); emphasizing the imperfections inherent in research (e.g., Chew, 2015; Holmes et al., 2015); and valuing varied research methodologies (e.g., Hoover, Strapp, Ito, Foster, & Roth, 2018; Mitchell, Friesen, Friesen, & Rose, 2007).

Research Self-Efficacy

As aforementioned, the Social Cognitive Theory (Bandura, 1986) is a well-established lens through which the development of research self-efficacy (RSE) has been examined in psychology students. RSE is the specific belief individuals have in their ability to successfully complete research-related tasks (Bieschke, Bishop, & Garcia, 1996; Forester, Kahn, & Hesson-McInnis, 2004). RSE is affected by four primary elements (i.e., personal mastery experiences, vicarious experiences, verbal persuasion, and positive emotional arousal; Bandura, 1986), and empirical evidence indicates that these four elements can have a significant effect on student levels of RSE (e.g., Bartsch et al., 2012; Bieschke et al., 1996; Forester et al., 2004).

Willingness to Engage in Future Research Activities

The Social Cognitive Career Theory (SCCT; Lent, 2013; Lent et al., 1994, 2000), an extension of the Social Cognitive Theory, describes a chain of relations among self-efficacy and work domain interests, goals, actions, and outcomes. This theoretical chain provides a pathway to explain how RTEs can enhance undergraduate psychology RSE and, through successful performance accomplishments, heighten student willingness to engage in research-related activities in future work or educational careers.

Specifically, Lent and associates posit that Bandura's (1986) determinants of self-efficacy can influence the formation of academic and career-related interests, goals, and actions among psychology students. Within the specific domain of developing interest and skills in research activities, tangible displays of competence by students are a key part of their acquired and continued increases in RSE. This, in turn, leads to increased interest, goal setting, and further behavioral actions taken toward gaining more knowledge and skill in research. These increasingly advanced learning and performance accomplishments, reinforced initially by mentors and later autonomously by students themselves, are processed in an ongoing feedback loop that both strengthens RSE and spurs more engagement in interest-goal-action outcome chains concerning research activities during both students' baccalaureate training and in the world of work or in graduate education.

Summary

Current APA undergraduate education guidelines mandate that students need to acquire

strong skills in the use of research and statistical tools to become psychologically literate citizens (APA, 2016) as well as to be competitive for graduate school or the postbaccalaureate job market (Appleby, 2000; Kuther, 2013). Extant empirical evidence indicates meaningful participation in research activities that help to establish high levels of RSE greatly assist undergraduate psychology students in developing confidence and competence in research skills (Bartsch et al., 2012; Harlow et al., 2006; Walker et al., 2017; Waples, 2016). High-quality RTEs, as posited by Gelso et al. (1996), have been associated with higher levels of RSE in graduate psychology students and their greater willingness to engage in future research activities (Bieschke, 2006; Kahn et al., 1997; Phillips et al., 1994; Royalty et al., 1986). Lastly, SCCT provides a theoretical pathway of ongoing interest-goal-action-outcome chains surrounding students' continued involvement in research activities as a function of their increasing RSE and performance accomplishments (Lent et al., 1994, 2000). However, to date, researchers have not yet collectively examined the contextual characteristics that can enhance the quality of research training environments, within which undergraduate psychology students engage in curricular and cocurricular research training activities. We propose the Gelso et al. (1996) model of high-quality RTEs is a viable tool for this purpose and one that can also provide a framework to integrate past findings within this area of investigation.

The Current Study

Our goals for this study were threefold. First, we sought to generally relate the elements of the Gelso et al. (1996) model to the research training experiences of undergraduate psychology students by asking students to evaluate the quality of their RTEs during their engagement in various research-related activities. Given previous findings with graduate psychology student samples, we hypothesized that the quality ratings of RTEs reported by undergraduate psychology students would be significantly related to their reported levels of RSE. Second, as previously found with graduate psychology student samples, we sought to discover whether undergraduate psychology students' willingness to engage in future research activities was significantly related to their quality ratings of RTEs and reported level of RSE. Finally, because SCCT posits that increasing levels of RSE drives ongoing interest-goal-action-outcome chains among psychology students surrounding research-based activities (cf. Lent et al., 1994, 2000), we hypothesized that students' reported RSE would mediate the direct relation between their quality ratings of RTEs and their willingness to engage in future research activities.

Method

Procedure

Our study was approved by our institutional review board, and all human subjects' rights were observed. We obtained a list of e-mail addresses for all currently enrolled undergraduate psychology majors or minors at a major Midwestern university during the 2017–2018 academic year. We sent initial and follow-up e-mail invitations to participate during the fall 2017 and spring 2018 semesters. To enhance participation, we offered the opportunity to enter a drawing to win one of three $25 gift cards to an online retailer. A URL link to an anonymous survey was embedded in the invitation e-mail sent to participants, which provided access to research materials. We used Qualtrics, a firewalled online survey platform, for data collection. Participants were required to provide informed consent before completing research materials. Participants completed a demographic survey, the Research Training Environment Scale-Short Form (RTES-SF; Kahn & Miller, 2000), the Research Self-Efficacy Scale (RSES; Bieschke et al., 1996); and the Willingness to Engage in Future Research Activities scale (WEFRA; Burke & Prieto, 2017).

Data cleaning. A total of 224 participants accessed research materials, but because of high numbers of empty data records, data-cleaning procedures were necessary. Participants who endorsed either no items or endorsed only initial demographic items and did not complete any of the study measures were removed from the data set. Twelve participants fully completed some research measures but not others; we retained these cases to conserve data and maximize power. These data-cleaning procedures resulted in a usable sample size of 165 participants. Seven of these participants failed to endorse only one or

two items across the various study measures; five failed to respond to a single item on the RSES; one failed to respond to two items on the RSES; and one failed to respond to one item on the WEFRA. To address these individual points of missing data in usable cases, the participant's average item score on a measure was imputed for any missing data point in cases in which participants had responded to at least 80% of the items on a given measure.

Participants

Demographic and academic data. Participants ranged in age from 18 to 38 years ($M = 20.0$, $SD = 2.33$), and 89% of the sample identified as female. Seventy-six percent identified as European American; 6% as Latinx American; 5% as bi/multiracial; 4% as Asian American; 4% as African American; 3% as international; and 1% as American Indian or Alaskan Native. These percentages, although proportionately aligning with those reflected in recent data from the National Center for Educational Statistics regarding U.S. psychology undergraduate degree holders by sex (78%) and cultural affiliation (European American, 57%; Latinx American, 17%; African American, 12%; Asian American, 13%; and American Indian or Alaskan Native, 1%; National Center for Educational Statistics, 2018a, 2018b, 2018c), our sample had higher numbers of European-American students and fewer men as compared with these national level data.

Ten percent of the sample identified as freshmen, 29% as sophomores, 26% as juniors, and 35% as seniors. Eighty-six percent of the sample identified as psychology majors, with the remaining identifying as psychology minors. Seventy-seven percent of the sample had attended only their current 4-year institution, with the remainder identifying as transfer students. Total number of psychology classes completed by participants at the time of sampling ranged from 0 to 33 ($M = 6.92$, $SD = 4.86$). Participants' grade point average for all psychology courses completed at the time of survey ranged from 2.0 to 4.0 ($M = 3.46$, $SD = 0.44$).

Measures

Revised Research Training Environment Scale–Short Form (RTES-SF). The RTES-SF (Kahn et al., 2000) was derived from the 54-item Research Training Environment Scale–Revised; RTES-R; Gelso et al. (1996). The RTES-SF is a self-report measure consisting of 18 items that assessed participants' perceived level of quality of their RTEs, with two items tapping each of the nine elements in the Gelso et al. (1996) model. Because the RTES-SF was originally designed to assess graduate psychology research training environments (i.e., some items reflected thesis and dissertation processes), we adapted these items to reflect activities found within undergraduate RTEs.

We asked participants to consider the following research activities in which they may have participated during their undergraduate psychology education to guide their overall assessment of the quality of the RTE they experienced: (a) designing and/or conducting research projects in a psychology class or in a psychology professor's laboratory; (b) preparing papers or critical reviews of psychology literature in a psychology class or in a psychology professor's laboratory; (c) conducting program evaluations or needs assessments in a psychology class or in a psychology professor's laboratory; (d) authoring and/or making presentations at local, regional, or national psychology conferences; (e) participating as a member of a psychology research team engaged in any of the above activities; and (f) advising others on psychology research projects.

Participants rated their level of agreement with various statements describing their RTE, using a five-point Likert-type scale, with 1 (*disagree*) and 5 (*agree*) as polar anchors. Half of the items were reverse scored. Higher scores on the RTES-SF indicate students' perception that they have been exposed to a higher-quality RTE. The RTES-SF yields a full-scale score providing a global measure of RTE quality, within a possible range of 18–90. We divided the total score by 18 to obtain a full-scale average score ranging from 1 to 5 to align with Likert anchors. Regarding the validity of the RTES-SF, confirmatory factor analyses conducted by Kahn et al. (2000) indicated that a single factor, with a median item loading weight of .63 and a comparative fit index coefficient of .96, best fit their data. Kahn et al. (2000) found a correlation of $r = .96$ between the full-length RTES-R and RTES-SF and found the total scale score of the RTES-SF to be highly reliable ($\alpha = .90$). For the current sample, the RTES-SF had

a mean of 3.78 (above the scale midpoint toward the *agree* anchor; *SD* = .56), and an alpha coefficient of .83.

Research Self-Efficacy Scale (RSES). The RSES (Bieschke et al., 1996) is a self-report measure consisting of 49 items in which participants rated their degree of confidence in successfully accomplishing various research tasks, using a Likert scale ranging from 0 (*no confidence*) to 10 (*complete confidence*). The RSES has a possible score range of 0–490. We divided the total score by 49 to obtain a full-scale average score ranging from 1 to 10 to align with Likert anchors. Higher scores on the RSES indicate a greater sense of research self-efficacy. Regarding the validity of the RSES, the measure has been shown to predict interest in future research involvement and been significantly correlated with previous research experience, amount of research training, research outcome expectations, and interest in research activities (Bishop & Bieschke, 1998; Deemer et al., 2007). Bieschke et al. (1996) found a full-scale score reliability of $\alpha = .96$. For the current sample, the RSES had a mean of 6.41 (above the scale midpoint toward the *confident* anchor; *SD* = 1.49) and an alpha coefficient of .97.

Willingness to Engage in Future Research Activities (WEFRA). The WEFRA, created by Burke and Prieto (2017), is a measure of students' willingness to engage in future research activities in world-of-work or educational settings. The WEFRA is a 10-item, self-report measure using a five-point Likert scale, with 1 (*disagree*) and 5 (*agree*) as polar anchors. The WEFRA has a possible score range of 10–50. We divided the total scores on the WEFRA by 10 to align with its 1–5 Likert anchors. Higher scores on the WEFRA indicate a greater willingness to engage in future research activities.

Item development for the WEFRA was guided by the recommended conceptual, design, communication, and statistical skills associated with research competence in undergraduate training found in the APA 2.0 Guidelines (APA, 2016) as well as those skills suggested by various scholars in the area of undergraduate research training in psychology (e.g., Dunn, 2015; Hulsizer et al., 2009; Saville, 2008). The WEFRA items describe various activities found within typical psychology research activities; these items, as well as their associated descriptive data for the sample, are presented in Table 1.

We conducted an exploratory factor analysis on WEFRA items to provide a valid empirical factor structure for use in our current analyses, using principal axis factoring with a Varimax rotation. We used the Kaiser rule (eigenvalues greater than 1.0), retention of items with loading weights at .40 or greater, and an examination of the scree test, to determine the best-fitting solution (cf. Tabachnick & Fidell, 2016). An exploratory factor analysis, using a rotation scheme allowing for multiple related factors to emerge, is a very robust test because this analysis allows for no a priori constraints on data as far as specified factors or item placement (cf. Thompson, 2004). The 10 WERFA items converged after four iterations into a single factor solution, with an eigenvalue of 5.94, that accounted for 55% of the variance in the data. The scree plot demonstrated an asymptote after the first factor. Item loading weights ranged from .59 to .87. For the current sample, the WEFRA had a mean

Table 1
Descriptive Data for WEFRA Items

Descriptive data for WEFRA items	Mean/*SD*
Develop research ideas to address an existing problem	4.0/1.0
Critically evaluate the quality of existing research in an area	4.0/1.0
Design a research study	3.6/1.2
Carry out a research study	3.7/1.3
Perform basic statistical analyses	3.6/1.3
Perform more precise statistical tests	3.2/1.4
Summarize your research results	4.1/1.0
Identify and understand limitations of your research	4.2/1.1
Write a report of your research results	3.9/1.2
Use research results to make informed decisions concerning an existing problem	4.3/.86

of 3.90 (above the scale midpoint and toward the *agree* anchor; *SD* = .87) and an alpha coefficient of .92.

Results

For all analyses, we used the Statistical Package for the Social Sciences (SPSS; Version 24.0); specific to the mediation analysis, we used the Hayes PROCESS module for SPSS (Version 2.15). The PROCESS module employs bootstrapping techniques in order to determine existing confidence intervals for direct and indirect effects, through high frequency repeated sampling of the data. Bootstrapping is a powerful method for testing the effects and relations of an intervening variable on the relation of independent and dependent variables (Mac Kinnon, Lockwood, & Williams, 2004; Shrout & Bolger, 2002; Williams & MacKinnon, 2008). We employed 1000 repeated bootstrap samplings of the data to obtain final confidence intervals on the indirect effect; the presence of a statistically significant mediation effect is evidenced by a confidence interval for the indirect effect that does *not* include zero.

Power Analysis

We used a table of empirically obtained, required minimum sample sizes (based on Monte Carlo analyses of simulated data) provided by Fritz and MacKinnon (2007); these minimum sample sizes reflect a power coefficient of .80 during a test of a simple mediation. Fritz et al. (2007) indicated a minimum sample size of 115 participants was needed in our analysis to achieve a power coefficient of .80. Our sample exceeded this minimum requirement.

Preliminary Examination of the Data

We first examined general demographic and academic data to assess whether these variables were significantly related to the key study variables of quality ratings of RTEs, participant RSE, and participant willingness to engage in future research activities. Participant sex, cultural affiliation, and status as psychology majors or minors did not have significant relations with the three primary study variables. However, the total number of psychology courses completed at the time of survey and participants' year in school were significantly related to endorsed levels of student RSE ($r = .19$; $p < .02$, and $r = .22$; $p < .01$, respectively); and participants' year in school and participant GPA in all psychology courses completed were significantly related to participant willingness to engage in future research activities ($r = .22$; $p < .01$, and $r = .18$; $p < .04$, respectively). Status as a transfer student was also significantly related to an overall lower-quality rating of RTEs ($r = .19$; $p < .02$); we followed up on this significant correlation, and found the quality level of RTE endorsement to be slightly but significantly different between transfer and nontransfer students ($F[1, 165] = 5.98$; $p < .02$; partial eta squared = .35; observed power = .68; $M = 3.6$ [$SD = .52$] vs. 3.8 [$SD = .55$], respectively). This detected mean difference is relatively small and may be due to the power inherent in the sample size.

With respect to the relations among the key study variables, as shown in previous research using graduate psychology student samples, quality ratings of RTEs were significantly correlated with endorsed levels of RSE, $r = .31$, $p < .01$, indicating that the greater presence of elements associated with higher-quality RTEs (as outlined by the Gelso et al., 1996) model was associated with higher levels of student RSE. Quality ratings of RTEs were also positively correlated in a manner that approached statistical significance, $r = .15$, $p = .07$, with student willingness to engage in future research activities. Lastly, student levels of RSE were significantly related to student willingness to engage in future research activities, $r = .26$, $p = .002$. These findings suggest that the nine elements of high-quality RTEs, in the Gelso et al. (1996) model as a whole, may offer a heuristic way to explain gains psychology undergraduate students' research self-efficacy and willingness to engage in future research activities.

As a result of these zero-order correlational findings, we were interested in learning which of the specific elements present in the Gelso et al. (1996) model most strongly accounted for variance in endorsed levels of student RSE and willingness to engage in future research activities. We conducted two separate linear regression analyses (with the nine RTE elements regressed against RSE scores and then WEFRA scores), using a forward selection procedure,

with PIN at .05 and POUT at .10. The elements of positive reinforcement of scholarly activities and science-practice integration ($R^2 = .17$, $F[2, 148] = 14.68$; $p < .001$) and faculty modeling of appropriate scientific behavior and attitudes ($R^2 = .04$, $F[1, 128] = 4.67$; $p < .03$), were the elements that significantly accounted for variance in endorsed levels of RSE and willingness to engage in future research activities, respectively.

Mediation Analysis

Given that the SCCT (Lent et al., 1994, 2000) would predict that student RSE is an ongoing facilitator of student willingness to engage in future research activities, both during and after exposure to high-quality RTEs, we examined this assumption by testing the role of RSE as a mediator of the direct relation between participants' reported quality of their RTEs and their endorsed willingness to engage in future research activities.

Given the aforementioned significant correlations of certain academic variables with our key variables of interest, we included the number of psychology classes completed and participant GPA in all psychology courses completed as potential moderators of the proposed indirect effect of student RSE. Although participant year in school was also significantly related to both RSE and WEFRA scores, the number of psychology classes completed is arguably a more relevant variable related to the promotion of RSE in psychology undergraduates and their general perception of psychology RTEs than is their year in college, so we chose to use the former variable as a moderator.

In the mediation analysis, we entered RTES scores as the independent variable, WEFRA scores as the outcome variable, and RSE scores as the mediator. We used PROCESS mediation model #9, which positions the two potential moderators as operating on the relation between RTE scores and RSE scores, to examine the moderating role of these variables on RSE in its potential indirect effect on the direct relation between RTE and WEFRA scores.

The findings of our mediation analysis are presented in Table 2. Regarding potential moderated mediation effects, neither the number of completed psychology courses nor participant GPA in all psychology courses completed moderated the relation between RTE and RSE; the confidence interval range for each interaction term contained zero. However, participant number of completed courses did show a direct effect on RSE, in step with the earlier noted significant zero-order correlation between these variables. Regarding RSE as a mediator of the direct relation between RTE and WEFRA, the lower and upper levels of the confidence interval of the indirect effect were .0455 and .3243, respectively, and did not include zero, indicating that RSE partially mediated the direct relation between RTE and WEFRA scores. This finding supports the theoretical notion in SCCT that, although high-quality RTEs may be significantly related to building higher levels of RSE in undergraduate psychology students, students' ongoing increased efficacy building (through ongoing SCCT interest-goal-action-outcome chains) is likely of more importance in fostering their greater willingness to engage in future research activities.

Table 2
Moderated Mediation of the Relation Between RTE-SF and WEFRA

Predictor	b	*SE*	*t*	*p*	R^2	*F*
Step 1 (RSE as DV)				.001	.20	4.62
RTES	.57	.28	2.01	.05		
CRS	.11	.04	3.12	.002		
GPA	.06	.32	.19	.85		
RTES × CRS	.06	.09	.72	.48		
RTES × GPA	−.26	.59	−.45	.66		
Step 2 (WEFRA as DV)				.01	.09	4.60
RSE	.18	.07	2.63	.01		
RTES	.15	.20	.73	.47		

Note. RSE = Research Self-Efficacy Scale; RTES = Revised Research Training Environment Scale–Short Form; WEFRA = Willingness to Engage in Future Research Activities; CRS = number of completed psychology courses; GPA = GPA earned in completed psychology courses.

Discussion

The purposes of our study were to explore the applicability of the Gelso et al. (1996) model of high-quality RTEs to the reported levels of RSE of undergraduate psychology students and their willingness to engage in future research activities. We also sought to determine whether students' RSE played a mediating role in their willingness to engage in future research activities. Our results indicated that the three key

study variables of RTEs, RSE, and WEFRA related to one another in expected theoretical ways, similar to previous research findings in graduate psychology student samples. We also found levels of endorsed student RSE partially mediated the direct relation between their RTE and WEFRA scores. Below we discuss the implications of, as well as limitations to, our study.

Implications for Future Research

Our findings suggest exposing undergraduate psychology students to high-quality RTEs may help to prepare them as psychologically literate citizens in their world-of-work careers and enhance their confidence surrounding research activities they will encounter during graduate level training in psychology. However, our study was only an initial and molar level examination of the applicability of Gelso et al.'s (1996) model of high-quality RTEs to the undergraduate psychology student population. Therefore, our findings need to be replicated and better specified to pinpoint details as to exactly how student RSE and willingness to engage in future research activities are related to the characteristics found in high-quality RTEs. For example, we did not collect data on or specifically link particular research training activities (or the number of these opportunities) students may have taken part in, to their reported sense of RSE or willingness to engage in future research activities. Therefore, some participants may have rated the quality of their RTE based on doing term papers and canned research projects in psychology courses, whereas others may have had laboratory experiences that allowed them to work, from start to finish, on a self-chosen research project. Therefore, our current study was unable to identify the specific research experiences most tied to enhancing student RSE. In the future, investigators will want to account for these different types and numbers of training experiences (and students' actual performance accomplishments with them) to determine what direct empirical links these activities may have to enhanced student RSE and willingness to engage in future research activities.

Participants' anticipated career goals may also have impacted relations among quality ratings of RTEs, student RSE, and their willingness to conduct research in the future. For example, most undergraduate students do not move on to graduate training in psychology, and the extent to which they believe any acquired research and statistical skills in undergraduate psychology may be useful to, or utilized in, their career of choice could vary widely. Previous research has also shown that psychology undergraduate students tend to underestimate the research and statistical skills desired by future employers or graduate admissions committees (Appleby, Keenan, & Mauer, 1999; Green, McCord, & Westbrooks, 2005). In the future, investigators may want to account for students' anticipated career goals, as well as the salience students perceive their acquired research skills to have to their anticipated career goals, in terms of the relations these variables may possess with endorsements of RTEs, RSE, and willingness to engage in future research activities.

Lastly, Deemer and associates (Deemer, Martens, & Buboltz, 2010; Deemer, Martens, Haase, & Jome, 2009; Deemer, 2010; Deemer et al., 2007) found that within graduate psychology student samples, personal motivations for engaging in research, achievement goals connected to research activities, expectations of outcomes associated with conducting research, and student utilization of a mastery approach to learning and skill acquisition in the domain of research, were significantly related to RTEs and continuing student interest in research activities. Therefore, these variables may also be of importance to examine with undergraduate psychology students.

Implications for Undergraduate Research Training

The Gelso et al. (1996) model could be used by undergraduate psychology educators to evaluate of the overall quality of prevailing RTEs in their departments, courses and labs and use its elements to assist undergraduate students in meeting the (APA, 2016) guidelines regarding research-related outcomes and becoming psychologically literate citizens. Our study indicated that the RTE elements of positive reinforcement of scholarly activities, demonstrating the real world applicability of research, and faculty modeling of appropriate scientific behavior and attitudes were significantly related to our participants' reported levels of RSE and their willingness to engage in future research

activities. However, as earlier noted, several past empirical findings and discussions in this area of research have noted the importance of pedagogical practices that can be argued to fit within the nine elements in the Gelso et al. (1996) model. Therefore, RTEs in which all nine noted model elements are emphasized in content courses, independent study, capstone experiences, and lab opportunities, may optimize the ability of faculty to enhance student RSE and foster their continuing student interest in research activities. Of special note, scholars emphasize the importance of experiential learning for psychology undergraduate students, such as serving as participants in research (VanWormer, Jordan, & Blalock, 2014), gaining experience as an undergraduate research assistant (Vespia et al., 2012), and engaging in research teams (Holmes et al., 2015). This emphasis suggests not only the importance of cocurricular research opportunities but also the importance of relating these activities to student RSE and their continuing interest in research-related activities.

Limitations

We sampled a group of undergraduate psychology students who were exposed to faculty and RTEs within a single department, which may have restricted the range and variability of RTEs and the types of research opportunities to which students were exposed. In future investigations, researchers should sample students from more than one psychology department to offset any bias that may be present in our single-location data.

Because of the cross-sectional design and measures we used, we neither assessed participants' actual competency with various research skills, nor did we assess their actual degree of continued engagement in future research activities. Longitudinal designs that account for these variables are needed to better explore the relations among high-quality RTEs, student RSE, and student willingness to future engage in research activities, especially because these occur in the world of work or during graduate education.

Our WEFRA measure, although demonstrating a sound factor structure and good psychometrics in our study, needs to be cross-validated using a larger and more diverse sample of psychology undergraduate students. Our sample, largely comprised of European-American females, did not allow for robust comparative tests across certain demographic variables. Therefore, our results should tentatively be generalized only to European-American, female undergraduate psychology students at Midwestern institutions.

Conclusions

The Gelso et al. (1996) model of high-quality RTEs shows strong promise as contextual framework for the research training of psychology undergraduates, and provides an empirically supported, testable model to drive further research in this area. Especially in light of established APA 2.0 guidelines (APA, 2016), and the underexamined nature of the relation of cocurricular research opportunities to educational outcome goals for psychology undergraduates, this model may prove valuable to psychology educators, researchers, and students alike.

References

American Psychological Association. (2016). Guidelines for the undergraduate psychology major: Version 2.0. *American Psychologist, 71,* 102–111. http://dx.doi.org/10.1037/a0037562

Appleby, D. (2000). Job skills valued by employers who interview psychology majors. *Eye on Psi Chi, 4(3),* 17. http://dx.doi.org/10.24839/1092-0803.Eye4.3.17

Appleby, D., Keenan, J., & Mauer, B. (1999). Applicant characteristics valued by graduate programs in psychology. *Eye on Psi Chi, 3(3),* 39.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Barron, K., & Apple, K. (2014). Debating curricular strategies for teaching statistics and research methods: What does the current evidence suggest? *Teaching of Psychology, 41,* 187–194. http://dx.doi.org/10.1177/0098628314537967

Bartsch, R., Case, K., & Meerman, H. (2012). Increasing academic self-efficacy in statistics with a live vicarious experience presentation. *Teaching of Psychology, 39,* 133–136. http://dx.doi.org/10.1177/0098628312437699

Bieschke, K. (2006). Research self-efficacy beliefs and research outcome expectations: Implications for developing scientifically minded psychologists. *Journal of Career Assessment, 14,* 77–91. http://dx.doi.org/10.1177/1069072705281366

Bieschke, K., Bishop, R., & Garcia, V. L. (1996). The utility of the research self-efficacy scale. *Journal of Career Assessment, 4,* 59–75. http://dx.doi.org/10.1177/106907279600400104

Bishop, R., & Bieschke, K. (1998). Applying social cognitive theory to interest in research among counseling psychology doctoral students: A path analysis. *Journal of Counseling Psychology, 45,* 182–188. http://dx.doi.org/10.1037/0022-0167.45.2.182

Brinthaupt, T., & Ananth, P. (2018). Teaching students to speak fluent "research." *Scholarship of Teaching and Learning in Psychology, 4,* 258–270. http://dx.doi.org/10.1037/stl0000128

Burke, K., & Prieto, L. (2017). *The 'Willingness to Engage in Future Research Activities' scale*. Unpublished instrument.

Burkley, E., & Burkley, M. (2009). Mythbusters: A tool for teaching research methods in psychology. *Teaching of Psychology, 36,* 179–184. http://dx.doi.org/10.1080/00986280902739586

Chew, S. (2015). Directing undergraduate research in independent studies, honors, and thesis projects. In D. Dunn (Ed.), *The Oxford handbook of undergraduate psychology education* (pp. 241–253). New York, NY: Oxford University Press.

Ciarocco, N., Lewandowski, G., Jr., & Van Volkom, M. (2013). The Impact of a multifaceted approach to teaching research methods on students' attitudes. *Teaching of Psychology, 40,* 20–25. http://dx.doi.org/10.1177/0098628312465859

Ciarocco, N., Strohmetz, D., & Lewandowski, G. (2017). What's the point? Faculty perceptions of research methods courses. *Scholarship of Teaching and Learning in Psychology, 3,* 116–131. http://dx.doi.org/10.1037/stl0000085

Deemer, E. (2010). Achievement goals as predictors of research self-efficacy. *Individual Differences Research, 8,* 229–238.

Deemer, E., Martens, M., & Buboltz, W. (2010). Toward a tripartite model of research motivation: Development and initial validation of the research motivation scale. *Journal of Career Assessment, 18,* 292–309. http://dx.doi.org/10.1177/1069072710364794

Deemer, E., Martens, M., Haase, R., & Jome, L. (2009). Do mastery approach goals and research outcome expectations mediate the relationship between the research training environment and research interest? Test of a social cognitive model. *Training and Education in Professional Psychology, 3,* 250–260. http://dx.doi.org/10.1037/a0017384

Deemer, E., Martens, M., & Podchaski, E. (2007). Counseling psychology students' interest in research: Examining the contribution of achievement goals. *Training and Education in Professional Psychology, 1,* 193–203. http://dx.doi.org/10.1037/1931-3918.1.3.193

DiLalla, L. (2015). Mentoring undergraduates in research. In D. Dunn (Ed.), *The Oxford handbook of undergraduate psychology education* (pp. 255–264). New York, NY: Oxford University Press.

Dunn, D. (Ed.). (2015). *The Oxford handbook of undergraduate psychology education*. New York, NY: Oxford University Press. http://dx.doi.org/10.1093/oxfordhb/9780199933815.001.0001

Dunn, D., Brewer, C., Cautin, R., Gurung, R., Keith, K., McGregor, L., . . . Voigt, M. (2010). The undergraduate psychology curriculum: Call for a core. In D. Halpern (Ed.), *Undergraduate education in psychology: A blueprint for the future of the discipline* (pp. 47–62). Washington, DC: American Psychological Association. http://dx.doi.org/10.1037/12063-003

Forester, M., Kahn, J., & Hesson-McInnis, M. (2004). Factor structures of three measures of research self-efficacy. *Journal of Career Assessment, 12,* 3–16. http://dx.doi.org/10.1177/1069072703257719

Fritz, M. S., & Mackinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18,* 233–239. http://dx.doi.org/10.1111/j.1467-9280.2007.01882.x

Gelso, C., Mallinckrodt, B., & Judge, A. (1996). Research training environment, attitudes toward research, and research self-efficacy: The revised research training environment scale. *Counseling Psychologist, 24,* 304–322. http://dx.doi.org/10.1177/0011000096242010

Green, R., McCord, M., & Westbrooks, T. (2005). Student awareness of educational requirements for desired careers and the utility of a careers in psychology course. *College Student Journal, 39,* 218–222.

Harlow, L., Burkholder, G., & Morrow, J. (2006). Engaging students in learning: An application with quantitative psychology. *Teaching of Psychology, 33,* 231–235. http://dx.doi.org/10.1207/s15328023top3304_3

Holmes, J., & Beins, B. (2015). Teaching laboratory courses in psychology. In D. Dunn (Ed.), *The Oxford handbook of undergraduate psychology education* (pp. 143–154). New York, NY: Oxford University Press.

Hoover, S., Strapp, C., Ito, A., Foster, K., & Roth, K. (2018). Teaching qualitative research interviewer skills: A developmental framework for social justice psychological research teams. *Qualitative Psychology, 5,* 300–318. http://dx.doi.org/10.1037/qup0000101

Hulsizer, M., & Woolf, L. (2009). *A guide to teaching statistics: Innovations and best practices*. Malden, MA: Blackwell Publishing.

Kahn, J. (2001). Predicting the scholarly activity of counseling psychology students: A refinement and extension. *Journal of Counseling Psychology, 48,* 344–354. http://dx.doi.org/10.1037/0022-0167.48.3.344

Kahn, J., & Miller, S. (2000). Measuring global perceptions of the research training environment using a short form of the RTES-R. *Measurement & Evaluation in Counseling & Development, 33,* 103–119.

Kahn, J., & Scott, N. (1997). Predictors of research productivity and science-related career goals among counseling psychology doctoral students. *Counseling Psychologist, 25,* 38–67. http://dx.doi.org/10.1177/0011000097251005

Kierniesky, N. (1984). Undergraduate research in small psychology departments. *Teaching of Psychology, 11,* 15–18. http://dx.doi.org/10.1207/s15328023top1101_3

Kierniesky, N. (2005). Undergraduate research in small psychology departments: Two decades later. *Teaching of Psychology, 32,* 84–90. http://dx.doi.org/10.1207/s15328023top3202_1

Kuh, G. (2008). *High-impact educational practices: Who has access to them and why they matter*. Washington, DC: Association of American Colleges and Universities.

Kuther, T. (2013). *What employers seek in job applicants: You've got the skills they want*. Retrieved from http://www.apa.org/ed/precollege/psn/2013/09/job-applicants.aspx

Lent, R. (2013). Social cognitive career theory. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work* (pp. 115–146). Hoboken, NJ: Wiley.

Lent, R., Brown, S., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45,* 79–122. http://dx.doi.org/10.1006/jvbe.1994.1027

Lent, R., Brown, S., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology, 47,* 36–49. http://dx.doi.org/10.1037/0022-0167.47.1.36

Love, K., Bahner, A., Jones, L., & Milsson, J. (2007). An investigation of early research experience and research self-efficacy. *Professional Psychology, Research and Practice, 38,* 314–320. http://dx.doi.org/10.1037/0735-7028.38.3.314

Mackinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39,* 99–128. http://dx.doi.org/10.1207/s15327906mbr3901_4

McGovern, T., Corey, L., Cranney, J., Dixon, W., Holmes, J., Kuebli, J., . . . Walker, S. (2010). Psychologically literate citizens. In D. F. Halpern (Ed.), *Undergraduate education in psychology: A blueprint for the future of the discipline* (pp. 9–28). Washington, DC: American Psychological Association. http://dx.doi.org/10.1037/12063-001

Miller, R. (2015). Collaboration: Student-Faculty research. In D. Dunn (Ed.), *The Oxford handbook of undergraduate psychology education* (pp. 225–240). New York, NY: Oxford University Press.

Mitchell, T., Friesen, M., Friesen, D., & Rose, R. (2007). Learning against the grain: Reflections on the challenges and revelations of studying qualitative research methods in an undergraduate psychology course. *Qualitative Research in Psychology, 4,* 227–240. http://dx.doi.org/10.1080/14780880701473441

National Center for Educational Statistics. (2018a). Bachelor's degrees conferred by postsecondary institutions, by race/ethnicity and field of study: 2014–15 and 2015–16. *Digest of Education Statistics 2017,* Table 322.30.

National Center for Educational Statistics. (2018b). Bachelor's degrees conferred to males by postsecondary institutions, by race/ethnicity and field of study: 2014–15 and 2015–16. *Digest of Education Statistics 2017,* Table 322.40.

National Center for Educational Statistics. (2018c). Bachelor's degrees conferred to females by postsecondary institutions, by race/ethnicity and field of study: 2014–15 and 2015–16. *Digest of Education Statistics 2017,* Table 322.50.

Norcross, J. C., Hailstorks, R., Aiken, L. S., Pfund, R. A., Stamm, K. E., & Christidis, P. (2016). Undergraduate study in psychology: Curriculum and assessment. *American Psychologist, 71,* 89–101. http://dx.doi.org/10.1037/a0040095

Phillips, J., & Russell, R. (1994). Research self-efficacy, the research training environment, and research productivity among graduate students in counseling psychology. *Counseling Psychologist, 22,* 628–641. http://dx.doi.org/10.1177/0011000094224008

Pliske, R., Caldwell, T., Calin-Jageman, R., & Taylor-Ritzler, T. (2015). Demonstrating the effectiveness of an integrated and intensive research methods and statistics course sequence. *Teaching of Psychology, 42,* 153–156. http://dx.doi.org/10.1177/0098628315573139

Royalty, G., Gelso, C., Mallinckrodt, B., & Garrett, K. (1986). The environment and the student in counseling psychology: Does the environment influence graduate students' attitudes toward research? *Counseling Psychologist, 14,* 9–30. http://dx.doi.org/10.1177/0011000086141002

Saville, B. (2008). *A guide to teaching research methods in psychology*. Malden, MA: Blackwell Publishing.

Saville, B. (2015). Teaching research methods. In D. Dunn (Ed.), *The Oxford handbook of undergraduate psychology education* (pp. 323–341). New York, NY: Oxford University Press.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7,* 422–445. http://dx.doi.org/10.1037/1082-989X.7.4.422

Tabachnick, B., & Fidell, L. S. (2016). *Using Multivariate Statistics* (4th ed.). New York, NY: Pearson.

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC: American Psychological Association. http://dx.doi.org/10.1037/10694-000

VanderStoep, S., & Shaughnessy, J. (1997). Taking a course in research methods improves reasoning about real-life events. *Teaching of Psychology, 24,* 122–124. http://dx.doi.org/10.1207/s15328023top2402_8

Van Vliet, K., Klingle, K., & Hiseler, L. (2013). The mentorship of undergraduate students in counselling psychology research. *Counselling Psychology Quarterly, 26,* 406–426. http://dx.doi.org/10.1080/09515070.2013.844095

VanWormer, L., Jordan, E., & Blalock, L. (2014). Assessing the perceived value of research participation. *Teaching of Psychology, 41,* 233–236. http://dx.doi.org/10.1177/0098628314537974

Vespia, K., Wilson-Doenges, G., Martin, R., & Radosevich, D. (2012). Experiential leaning. In B. Schwartz & R. A. R. Gurung (Eds.), *Evidence-based teaching for higher education* (pp. 77–97). Washington, DC: American Psychological Association. http://dx.doi.org/10.1037/13745-005

Walker, E., & Brakke, K. (2017). Undergraduate psychology students' efficacy and attitudes across introductory and advanced statistics courses. *Scholarship of Teaching and Learning in Psychology, 3,* 132–140. http://dx.doi.org/10.1037/stl0000088

Waples, J. (2016). Building emotional rapport with students in statistics courses. *Scholarship of Teaching and Learning in Psychology, 2,* 285–293. http://dx.doi.org/10.1037/stl0000071

Williams, J., & Mackinnon, D. P. (2008). Resampling and distribution of the product methods for testing indirect effect in complex models. *Structural Equation Modeling, 15,* 23–51. http://dx.doi.org/10.1080/10705510701758166

Received July 3, 2018
Revision received June 24, 2019
Accepted June 28, 2019 ■