A causal model of predictors of research productivity and science-related career goals among counseling psychology graduate students

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A causal model of predictors of research productivity and science-related career goals among counseling psychology graduate students

by

Jeffrey Howard Kahn

A dissertation submitted to the graduate faculty in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY

Department: Psychology
Major: Psychology (Counseling Psychology)
Major Professor: Norman A. Scott

Iowa State University
Ames, Iowa
1997
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For the Major Department

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For the Graduate College
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The present study investigated predictors of research productivity and science-related career goals in a sample of graduate students in counseling psychology. It was hypothesized that Holland personality and perceptions of the research training environment (RTE) influence interest in research and research self-efficacy. These latter two variables, in turn, were hypothesized to influence research productivity and career goals. It was further hypothesized that the students’ gender and year in the doctoral program would contribute to this causal model as additional predictor variables. A sample of 287 graduate students (representing a response rate of 55%) from 15 randomly selected APA-accredited counseling psychology doctoral programs was surveyed by mail to test these hypotheses.

The structural equation modeling procedure revealed that career goals and research productivity could be predicted by the aforementioned factors. As hypothesized, Holland personality was directly related to research interest, such that students with Investigative interests were more interested in research. The causal model also suggested that a favorable RTE leads to interest in research, both directly and via research self-efficacy. As predicted, gender was directly related to research self-efficacy, such that men reported greater research self-efficacy than women. Year in doctoral program was positively, directly related to both research productivity and research self-efficacy. Career goals were strongly predicted by research interest, and research productivity was ultimately predicted by a combination of year in program, research interest, career goals, and research self-efficacy. This model provided a very good fit to the data.

The present findings have implications for theories and applications of research training. The present study may contribute to theories of research training by presenting a comprehensive examination of all of the major factors previously investigated in the literature as predictors of research productivity and science-related career goals within the context of a causal model. The present model may also aid graduate training programs by helping to
identify points in the students' development as researchers at which different aspects of research training are most important, potentially leading to program interventions designed to help students become scientists.
CHAPTER 1
INTRODUCTION

Counseling psychology adopted the scientist-practitioner model of training over 40 years ago (American Psychological Association, 1952). Nevertheless, few counseling psychologists go on to publish research after obtaining the doctoral degree (Gelso, 1979, 1993; Krebs, Smither, & Hurley, 1991; Mallinckrodt, Gelso, & Royalty, 1990; Royalty, Gelso, Mallinckrodt, & Garrett, 1986; Royalty & Magoon, 1985; Watkins, Lopez, Campbell, & Himmell, 1986). Furthermore, most counseling psychology graduates seek careers in practice rather than in science (American Psychological Association, 1996; Fitzgerald & Osipow, 1988; Fretz & Simon, 1992; Tinsley, Tinsley, Boone, & Shim-Li, 1993). These two trends seem to reflect lower scientific output from counseling psychology graduate students than would be implied by a scientist-practitioner model of training that equally emphasizes both research and practice.

If one accepts the belief that the field is greatly enhanced by the production of more and better research (Gelso, 1979, 1993), then the current status of counseling psychology research training needs to be examined. However, the amount of literature on the issue of research training in counseling psychology is relatively small, suggesting that this issue has not been adequately addressed. The present study was designed to remedy the lack of attention to this issue by investigating factors contributing to the low levels of (a) research productivity and (b) interest in science careers that have characterized the work of most counseling psychology graduate students.

This chapter's discussion of factors relevant to graduate student research training is divided into the following sections. First, the personality and environment factors that were hypothesized to be necessary precursors to research productivity and the development of science-related career goals are addressed. Second, two hypothesized mediating variables in the relationships between person and environment factors (the predictor variables) and
research productivity and science-related career goals (the criterion variables) are discussed. Third, the two criterion variables, research productivity and science-related career goals, are examined. Fourth, the usefulness of including two additional predictor variables in the model, student gender and the student’s year in their doctoral program, is discussed. Finally, the specific hypothesized interrelationships among the variables are delineated.

Necessary Precursors: Person and Environment Factors

**Holland personality.** Most investigations of research training in counseling psychology have tended to focus on two factors as potential influences on research productivity and interest in a research career. One of these sources is the prototypical personality of counseling psychologists. In his theory of vocational choice, Holland (1985a) suggested that individuals make vocational decisions based on their personalities and interests. Consistent with this theory, Holland (1986) suggested that most counseling psychologists do not produce research because the majority of students enrolled in counseling psychology graduate programs have practitioner interests, as indicated by the large number of students with Social interests in such programs (Betz & Taylor, 1982; Holland, 1986; Magoon & Holland, 1984). Indeed, evidence has been found supporting the relationship between Holland personality type and interest in research in graduate school (Mallinckrodt et al., 1990) and post-doctoral research productivity (Krebs et al., 1991; Tinsley et al., 1993). In each case investigative interests were more positively related to these criterion variables than were Social interests.

**Research training environment.** A second perspective on the lack of research productivity suggests that many graduate research training environments (RTEs) lack a systematic research training program. Gelso (1979, 1993) has developed a comprehensive theory of RTE influences on graduate student interest in research. His theory suggests that many RTEs lack the ingredients necessary to facilitate students' attitudes toward research and research productivity. Ingredients theorized to directly affect student interest in research include (a) faculty modeling of appropriate scientific behavior and attitudes, (b) positive
reinforcement of students' research efforts, (c) early and minimally threatening student involvement in research, (d) teaching that all research studies are flawed and limited, (e) teaching varied approaches to research, and (f) wedding science and practice in training. Furthermore, Gelso (1993) theorized that two additional factors, (g) facilitating students' looking inward for research ideas and (h) conducting science as a partly social experience, influence student interest in research as moderated by student individual difference variables. A ninth factor, (i) untying research design from statistics, was initially proposed (Gelso, 1979) yet later omitted from the theory (Gelso, 1993) because of a lack of empirical evidence. Although there have been few empirical studies of the importance of RTE ingredients, these studies have supported the theory. For example, Royalty et al. (1986) found that five of the RTE ingredients (faculty modeling, positive reinforcement, early involvement in research, teaching that all studies are flawed, and wedding science and practice) were positively related to student interest in research. Krebs et al. (1991) found that five ingredients of the RTE were significantly related to research productivity: (a) faculty modeling, (b) early research involvement, (c) research as a social experience, (d) teaching that all research is flawed, and (e) research related to practice. No studies could be found that have examined the relationship between perceptions of the RTE and science-related career goals.

Mediators: Research Self-Efficacy and Interest in Research

Research self-efficacy. Although it is important to determine that personality and environmental factors play a role in the development of research productivity and science-related career goals, it is also important to understand the processes through which these interests develop in order to maximize training efficacy. One factor that has been mentioned as a probable mediator in the development of research interests is research self-efficacy (Gelso, 1993; Phillips & Russell, 1994). Bandura (1977, 1982) described self-efficacy as one's judgment about being able to complete a task or realize a goal. According to Bandura, self-efficacy is predictive of one's performance of a task, and this construct is easily applied
to the literature on vocational choice (Betz & Hackett, 1981; Hackett & Lent, 1992).

According to the self-efficacy theory of career development, the greater one's self-efficacy in performing a vocational task the more likely one will enter that field and the better one's performance will be (Hackett & Lent, 1992).

The concept of self-efficacy can also be applied to scientist behavior, specifically to research. In accord with Bandura's (1977, 1982) theory, research self-efficacy refers to one's confidence in being able to successfully complete various aspects of the research process. According to Gelso (1993), research self-efficacy mediates the relationships between RTE and (a) student interest in research and (b) research productivity. The positive relationship between research self-efficacy and perceptions of the RTE has received empirical support in samples of counseling psychology graduate students (Gelso, Mallinckrodt, & Judge, 1996; Phillips & Russell, 1994). Furthermore, the influence of self-efficacy on job performance, specifically research productivity, has been empirically demonstrated in samples of university faculty (Landino & Owen, 1988; Vasil, 1992, 1993), in a sample of counseling psychologists (Royalty & Reising, 1986), and in a sample of counseling psychology graduate students (Phillips & Russell, 1994). However, the mediating role of research self-efficacy in the relationships between RTE and (a) research interests, (b) research productivity, and (c) science-related career goals has yet to be empirically examined. The present study sought to test this mediation hypothesis.

In addition to research self-efficacy influencing research productivity, Betz (1986) suggested that early involvement in research can influence research self-efficacy. This suggestion is consistent with Bandura's (1977, 1982) theory, which states that direct mastery experiences are a primary way to increase one's self-efficacy. Thus, it is likely that a reciprocal relationship exists between research productivity and self-efficacy.

**Interest in research.** One's interest in doing research is a second important mediator in the relationships between personality and RTE factors (predictors), and research productivity.
and career goals (criterion variables). In a sample of doctoral-level clinical psychologists, Barrom, Shadish, and Montgomery (1988) found that interest in research significantly explained variance in research productivity beyond that accounted for by the work environment. Royalty and Magoon (1985) found a positive relationship between interest in research and number of publications in a sample of counseling psychology faculty. Parker and Detterman (1986) demonstrated the same relationship in clinical psychology graduate students. Because personality and RTE predict graduate student interest in research (e.g., Mallinckrodt et al., 1990), it is reasonable to suggest that interest in research mediates the observed relationships between (a) personality and research productivity, and (b) RTE and research productivity (e.g., Krebs et al., 1991). Moreover, because a sense of self-efficacy increases one's motivation to perform a task (Bandura, 1989), a greater interest in research should result from increased research self-efficacy.

Outcomes: Research Productivity and Career Goals

Research productivity. A comprehensive literature review failed to reveal any empirical examinations of the research productivity of counseling psychology graduate students. However, reports from doctoral-level counseling psychologists suggest that this research output is quite low, with the modal number of publications reported to be zero (Watkins et al., 1986). Several factors have been theorized as contributing to the low levels of research productivity among counseling psychology graduate students. These factors, and the hypothesized relationships between them and research productivity, have been summarized in earlier sections.

Science-related career goals. The second outcome variable in the present study was interest in a science-related career. According to a survey by Fitzgerald and Osipow (1988), only one-fourth of counseling psychology graduate students desire an academic career. Most recently, the American Psychological Association (1996) determined that only 11% of graduates from APA-accredited counseling psychology doctoral programs gain initial
employment as a faculty member. Despite this ostensible preference toward non-science fields, there is a dearth of literature on causal influences of science-related career goals among counseling psychology graduate students. Consequently, the present study was somewhat unique in this venture. As described earlier, self-efficacy theory as applied to vocational behavior (e.g., Hackett & Lent, 1992) suggests that research self-efficacy can predict entry into a research career. Accordingly, greater research self-efficacy should be associated with science-related (versus practice-related) career goals. In addition, Holland’s (1985a) theory postulates that interest in a career will lead to one choosing that career, suggesting that one’s interest in research should predict entry into a research career. Finally, research productivity was expected to predict science-related career goals. Students who are involved in research and produce research should believe that a career in research is more of an option to them than students who are not involved in or do not produce research.

Additional Predictors: Student Gender and Year in Doctoral Program

Student gender. Betz and her colleagues (e.g., Betz & Fitzgerald, 1987) have discussed how a lack of female role models in an academic setting may result in decreased self-efficacy for women. In a study of university faculty, Landino and Owen (1988) found that women reported significantly less research self-efficacy than did men. In accord with the Betz and Fitzgerald hypothesis, Landino and Owen predicted that the smaller percentage of women (versus men) in the academic departments contributed to this lower research self-efficacy; their data supported that belief. Vasil (1992, 1993) also found significant gender differences in research self-efficacy among two samples of university faculty. Schoen and Winocur (1988) found a similar pattern of means in their sample of university faculty, yet the gender difference in their study did not reach statistical significance. Because gender has been theorized to relate to self-efficacy in general and research self-efficacy in particular, it was included in the hypothesized model. Specifically, it was hypothesized that gender would be directly related to research self-efficacy, such that women would report less research self-
efficacy than would men.

Year in doctoral program. It is reasonable to assume that the longer a student has been in a doctoral training program, the more opportunities that student would have to conduct research and the greater that student's cumulative research productivity would be. Indeed, Phillips and Russell (1994) found support for this intuitive hypothesis in a sample of counseling psychology graduate students; advanced graduate students had produced more research than had beginning students. Accordingly, it was hypothesized that year in doctoral program would be directly related to research productivity in the present study, such that more advanced students would be more productive than beginning students.

Hypothesized Relations Among Variables in the Model

Consistent with the nomenclature of structural equation modeling (see Bollen, 1989), (a) student personality, operationalized as Holland theme or interests, (b) perceptions of the student's research training environment, (c) student gender, and (d) year in doctoral program will be referred to as exogenous variables. As exogenous variables, these variables cannot be explained by other variables in the model. Holland personality and RTE were selected for study because of their theoretical bases (Gelso, 1993; Holland, 1985a) and their common use in the literature as predictors of research-relevant outcomes. Gender and year in program were selected in order to help to explain additional variance in the criterion variables. Two variables were treated as mediators in the proposed model because of their theorized mediating roles (see Gelso, 1993): research interest and research self-efficacy. An extensive literature search failed to reveal other theorized or empirically-backed variables that play mediating roles in the development of career aspirations; thus, these were the only mediating variables included in the model. The final variables in the model, research productivity and career aspirations, were hypothesized to be predicted by combinations of direct and indirect relationships among the preceding variables. In addition, science-related career goals was hypothesized to be predicted by research productivity. The latter four
variables, (a) research interest, (b) research self-efficacy, (c) research productivity, and (d) science-related career goals, will be referred to as endogenous variables, as these are dependent upon other variables in the model (Bollen, 1989).

A large, national sample of graduate students from several counseling psychology programs was surveyed by mail. Based on the literature reviewed, the hypothesized model (see Figure 1) predicted that student gender directly influences research self-efficacy, year in program directly influences research productivity, Holland personality type directly influences interest in research, and the research training environment directly influences research self-efficacy. Research self-efficacy, in turn, was hypothesized to influence interest in research. It was further predicted that both interest in research and research self-efficacy would have direct impacts on research productivity and career goals. The relationship between research self-efficacy and research productivity was hypothesized to be a reciprocal one, such that research productivity also increases one's sense of self-efficacy. Finally, research productivity was hypothesized to have a direct effect on science-related career goals. It should be noted that the present study was cross-sectional and correlational, not longitudinal and experimental; as such, no cause-and-effect relationships could be determined.

In addition to testing the causal model depicted in Figure 1, the present study sought to examine descriptive statistics (i.e., means and frequencies) of the constructs measured. Although the assessment of many of these constructs in graduate students has been previously reported, some constructs (e.g., research productivity) have not yet been thoroughly reported. As such, determining these statistics, as well as any differences in these values as a function of gender, year in program, or training site, represented a second purpose of the present study.

A final purpose of the present study was to evaluate the adequacy of the factor structures of the measures used. Specifically, it seemed useful to examine dimensions of research productivity in counseling psychology graduate students; an exploratory factor analysis was
Figure 1. Hypothesized relationships among the constructs.
conducted for this purpose. Moreover, the confirmation of the factor structures of the Holland-personality, RTE, and research self-efficacy measures was attempted via three separate confirmatory factor analyses.
CHAPTER 2
REVIEW OF THE LITERATURE

Personality Type

The prototypical personality of counseling psychology graduate students has been cited as a possible explanation for the low research productivity among this group (Holland, 1986; Magoon & Holland, 1984). According to this view, graduate programs tend to select students with greater interests in counseling practice than in counseling research (Holland, 1986). Holland (1986) described these interests in terms of Holland themes, which represent broad areas of interest (Holland, 1985a). In his theory of vocational choice, Holland (1985a) described six themes: Realistic (R), which describes interests in working with objects, such as mechanics, construction, and outdoor activities; Investigative (I), which describes interests in working with abstract ideas and data, such as activities related to science and math; Artistic (A), which describes interests in creative projects and self-expression; Social (S), which describes interests in working with other people, such as teaching; Enterprising (E), which describes interests in selling and leadership; and Conventional (C), which describes interests in highly organized, structured, and detailed activities. According to Holland (1986), most students in counseling psychology have primarily practitioner interests, as indicated by Holland's S-theme, versus science interests, as indicated by Holland's I-theme. In addition, Holland (1986) suggested that many faculty, as a result of being counseling psychology graduates, are also mostly S-types. These faculty S-types design graduate programs in their own image and therefore attract student S-types. In sum, "our low productivity is more likely a function of too few students, faculty, and professionals whose main goal is researching and whose secondary goals are consulting, teaching, practicing, and so on" (Holland, 1986, p. 123). According to Holland, the way to increase research productivity is to change the distribution of personality types found in counseling psychology graduate programs, reducing the number with service interests and increasing the number with research interests.
However, Holland acknowledged that the pool of student l-types from which to draw is quite small.

Holland themes of counseling psychology graduate students. There is clear evidence that graduate students in counseling psychology have distinct Holland codes. Betz and Taylor (1982) examined Holland codes in 114 graduate students in counseling. They found that the most common high-point theme was Artistic (50%), followed by Social (30%), and Investigative (11%); the remaining three themes, Realistic, Enterprising, and Conventional were high points for only 10% of the sample. The most common second themes in this graduate student sample were, from first to third, Investigative, Social, and Enterprising. It seems from this investigation that students with primarily Investigative interests are a minority, thus supporting part of Holland's (1986) argument. Betz and Taylor also found differences in interest in research-related coursework among students with different Holland themes, as Realistic, Investigative, and Artistic interests were most associated with interest in research-related coursework. Social interests were slightly negatively related to interest in research-related coursework. Moreover, the theme with the strongest relationship with an academic job preference was not Social but Realistic. Thus, based on Betz and Taylor's data, one should not expect the majority of students in counseling psychology to be interested in research or an academic career, due to their Holland themes.

Holland themes and research productivity. Royalty and Magoon (1985) examined the role of personality on research productivity in 296 (75% male, 25% female) full-time and part-time faculty members from doctoral-level psychology programs. In their mail survey, they assessed whether counseling psychologists with different Holland personality types prefer research environments congruent with their personality type. Participants completed the Vocational Preference Inventory (VPI) to assess Holland themes, and the Scholarly Productivity Survey (SPS). The SPS, developed specifically for their study, assesses several aspects of research attitudes and interests, such as occupational activity preferences,
feelings regarding the professional activities of a counseling psychologist, and comments on the ideal research environments. Royalty and Magoon conducted a discriminant function analysis to see whether participants with different Holland types responded to the SPS items differently. Results revealed that psychologists with different Holland themes do prefer different research environments. Specifically, Investigative-types may be more interested in theoretical research, Social-types in more applied research and team research, and Artistic-types in more creative and less traditional research methods.

A more recent examination of Holland’s (1986) idea that personality type is associated with research productivity consisted of a longitudinal study conducted by Tinsley, Tinsley, Boone, and Shim-Li (1993). Data from 63 women and 30 men were collected from an archival data base of students who had been away from their counseling psychology program for at least 3 years. Predictors such as the Self-Directed Search and the Strong Interest Inventory (both of which measure Holland themes), the Minnesota Importance Questionnaire (which measures vocational needs), the Omnibus Personality Inventory (which measures ego functioning), the Tennessee Self-Concept Scale, and the MMPI were used to predict the dependent variable of research productivity. The research-productivity measure was constructed by giving points for observer-rated interest in scientific activities during graduate school, a job in academia or a research organization, publication before graduation, publication after graduation, and number of publications after graduation. The research productivity scores therefore ranged from 0 to 8, with higher numbers representing more scientific interests.

Tinsley et al. (1993) entered each instrument into a stepwise regression along with sex, ethnicity, and degree earned. The demographic variables did not significantly predict research productivity (3-5% of variance). Further, only two subscales significantly predicted productivity: the Independence scale of the MIQ, suggesting that research-productive counseling psychologists had a greater need for independence than less research-productive
counseling psychologists, and the Social Extroversion subscale of the OPI, suggesting that research-productive counseling psychologists are not as socially extroverted as less research-productive counseling psychologists. An additional 8-10% of the variance beyond demographics was explained by these subscales. Interestingly, the Holland themes on both the Self-Directed Search and the Strong Interest Inventory were not significant predictors. Tinsley et al. suggested that the small sample size may have resulted in a lack of necessary power to observe any differences. They also suggested a link between the Independence subscale and Holland's Investigative theme, and between the Social Extroversion subscale and Holland's Social theme. As such, Tinsley et al. believed that this study provides some support for Holland's (1986) theory. However, these results should be interpreted with caution because the most direct measures of Holland theme proved to be nonsignificant.

**Research Training Environment**

Although Holland (1986) suggested a selection problem, aspects of graduate training are also recognized to play a large role in researcher development (Magoon & Holland, 1984). Specifically, Magoon and Holland suggested that poor faculty modeling and supervision play a large role in deterring students' development as scientists. Although Magoon and Holland also acknowledged that the selection of graduate students is a key issue, they recommended a training approach that considers students' individual differences. As such, graduate training should contain elements that would be attractive to S-, A-, and E-types as well as to I-types.

Gelso (1979, 1993) has formulated a comprehensive theory of the role of the research training environment in graduate student research training. Gelso (1993) acknowledged that most students enter graduate school with strong service commitments and a basic sense of self-efficacy regarding service. These students are also ambivalent about their interest in research and their capabilities to be researchers and scientists. However, Gelso (1979, 1993) placed the burden of responsibility for training researchers on the graduate training
program. Specifically, the graduate training environment needs to aim at resolving students' ambivalence toward research by enhancing students' attitudes and self-efficacy; this in turn results in productivity.

Gelso (1979) originally proposed ten ingredients of an effective research training environment (RTE). However, after an accumulation of empirical research on these ingredients, he revised his theory (Gelso, 1993; Gelso, Mallinckrodt, & Judge, 1996). As such, only his most current thinking is reviewed here. Gelso (1993) described RTEs as "all of those forces in graduate training programs (and, more broadly, the departments and universities within which the programs are situated) that reflect attitudes toward research and science. Generally these attitudes exist on continua and may range from highly positive to highly negative" (p. 470). Of the original ten ingredients of the RTE seen as enhancing students' attitudes toward research and their subsequent productivity (Gelso, 1979), six of those remain as main effects and two as interacting variables.

RTE ingredients affecting students' attitudes toward research. The six main effect ingredients are believed to directly influence students' attitudes toward research, regardless of student attributes. These are: (a) Faculty modeling of appropriate scientific behavior and attitudes. It is crucial that faculty be excited by their research and share this excitement with students. In serving as effective research models, it is important that faculty share not only their positive experiences but their negative ones as well. (b) Positive reinforcement of students' research efforts. The RTE needs to provide sufficient research opportunities, encourage research, and reinforce research efforts that approximate the kinds of attitudes and behaviors that are desired. It is probably the less concrete, more interpersonal reinforcement that has the greatest effect on students. (c) Early and minimally threatening involvement. It is important that students be involved in both didactic and experiential components of research as soon as possible. The role of an early statistics course without the research component may paradoxically be a negative one. Several studies have
provided strong support for this early-involvement ingredient. (d) **The flawed and limited nature of every research study.** The myth that students' have to do flawless research that has earth-shattering implications needs to be dispelled. Two additional messages are important. First of all, despite the inevitable limitations of single studies, knowledge is advanced by research, especially when that research is programmatic. Second, single studies can indeed have an impact in that they may add usefully to an unfolding body of knowledge. (e) **Teaching varied approaches to research.** It is important to familiarize students with a range of methods and to permit, even facilitate, students' use of varying methodologies. The rationale behind this ingredient is so students have the greatest freedom in fitting the method to their research questions, and also so student researchers may use the methodology that fits his or her personality and personal preferences. Methodologies that differ from the traditional view of science should be incorporated into training. (f) **The wedding of science and practice.** The belief that research and practice may be integrated and clarification of how that may be done needs to be conveyed to students. Specifically, it should be stressed that practice is a potent source of ideas for research and that research relates to and can enhance practice.

In addition to the six main effects, Gelso (1993) described two empirically-driven treatment-by-aptitude Interactions: (a) **Looking inward for research ideas.** An RTE that fosters students' looking inward for their research ideas has a positive impact on research attitudes during the second and third year of training. First-year students may need to look outside themselves before looking inward, simply because they have yet to develop the skills and confidence necessary to look inward for ideas. For students beyond the fifth year, looking inward for ideas may frustrate and discourage them, as these students are typically trying to complete their required research as quickly as possible. In sum, students need to be developmentally ready for looking inward; if not, it may have an adverse effect. (b) **Science as a partly social experience.** Two vehicles through which social-interpersonal elements of
research could be emphasized are the advisor-advisee relationship and team research experiences. Research has supported this ingredient. However, this ingredient had the greatest effect for S and A types.

In sum, the overall goal of Gelso's (1979, 1993) theory was to facilitate the creation of RTEs that would result in more and better applied research in professional psychology. This focused on the "treatment" factor rather than the "input" factor. Gelso (1993) stressed that the main problem with the input factor is the initial pool of students that fit Holland's Investigate theme is quite small, a reality with which Holland (1986) agrees. Plus, most programs try to seek scientist-practitioners, not just scientists. Thus, from the standpoint of the scientist-practitioner model, it is probably most effective to select students who appear to have the potential for both and then to provide the students with RTEs that maximize the likelihood of them becoming both.

Empirical studies of RTE influences on research interests and attitudes. A relatively early study on the RTE by Gelso, Raphael, Black, Rardin, and Skalkos (1983) examined training factors that graduate students and recent graduates reported being responsible for their research skills and interests. The researchers asked participants to rate the impact of 22 research-related activities on both their skill and interest in doing research. These items were grouped into six categories: (a) coursework, (b) required research (e.g., thesis), (c) nonrequired research, (d) attendance at presentations, (e) presentation of research, and (f) research-relevant interpersonal relationships (e.g., advisor-advisee relationship). The factors that participants reported being the most influential on their research skills and interests were: (a) active participation in research; (b) high personal investment in research (e.g., thesis); and (c) interpersonal aspects, such as being on a research team.

Gelso et al. (1983) also examined qualitative data from their sample. These data consisted of participant responses to open-ended questions assessing elements of graduate training that affected their attitudes toward the role of research in their careers. The authors
reported three themes across the responses: (a) social/interpersonal interactions; (b) training in applied, practical, and less traditional approaches to research; and (c) early, active involvement in research. These three elements, similar to the ones most commonly reported to influence research skills and interests, represent three of the ingredients hypothesized by Gelso (1979, 1993) to be important elements of the RTE. Thus, this study provides support for the relative role of these three RTE elements on research skills and interest.

Another empirical study of the RTE theory by Royalty, Gelso, Mallinckrodt, and Garrett (1986) used, as a starting point, Gelso's (1979) ten ingredients hypothesized to exist in the RTE that should positively influence students' attitudes toward research. Whereas previous support was found for a few of Gelso's ingredients on research interests (Gelso et al., 1983), this was the first investigation to comprehensively examine the relationship of these ingredients to research attitudes. Royalty et al.'s sample consisted of 358 graduate students (190 female, 167 male) from 10 APA-accredited counseling psychology doctoral programs. The Research Training Environment Scale (RTES) was administered to assess the research training environment. Royalty et al. assessed attitudes by asking participants to rate on a 5-point scale the extent to which they agree with the following items: (a) "I would prefer to have the option of completing my doctoral training without being required to complete research projects" (reverse scored), (b) "I have a strong interest in doing research," (c) "I place a high value on the place of research in my future career", and (d) "Participating in research activities after graduation is not a major priority to me" (reverse scored). A second measure of attitudes was a single item asking participants to respond to the question: "What do you consider to be the ideal percentage of work time you would like to spend on research activities in your career after graduation?" Participants were asked to respond to the five items twice: once in terms of their recollection of what they felt at the point of entrance into their program and once in terms of their current feelings.

Royalty et al. (1986) found that training programs differed widely in their RTEs. There
was also wide variability in terms of the status of particular programs on particular subscales. Analyses comparing the two most impactful programs with the eight others on the RTE subscales revealed that six of the nine scales could be predicted by program impact: (a) faculty modeling of appropriate scientific behavior, (b) reinforcement of student research, (c) early involvement in research, (d) facilitating students' looking inward for research ideas, (e) teaching that all experiments are flawed and limited, and (f) the wedding of science and clinical practice. Interestingly, facilitating students' looking inward for research ideas was lower for the high-impact programs than for the others.

Royalty et al. (1986) also looked at individual students' relationships between ratings of RTE and current attitudes toward research after partialling out initial attitudes. Overall significant correlations were found for the RTE and three of the subscales: (a) science as a partly social experience, (b) teaching that all experiments are flawed and limited, and (c) wedding of science and clinical practice. However, when broken down by class level, Royalty et al. found that the significant correlations only occurred for the second-year and third-year students. Beyond the fifth year the correlations actually became negative.

Gelso et al. (1996) correlated the revised version of the Research Training Environment Scale (RTES-R) with a measure of research attitudes and a measure of research interests as a way of providing validity for the RTES-R. In a study of 106 doctoral students, they found that each of the nine subscales of the RTES-R was positively correlated with the research attitudes measures. Two of the subscales, (a) Looking Inward and (b) All Experiments are Flawed also showed positive correlations with the Scientist subscale of the Scientist-Practitioner Inventory (SPI; Leong & Zachar, 1993), a scale that measures interest in science-related activities. Gelso et al. suggested that only two subscales showed this relationship because the SPI assesses activities that are not likely to be immediately affected by graduate training, such as reviewing journal articles and supervising student research.

**Empirical studies of RTE influences on research productivity.** In their mail survey
described in an earlier section of this review, Royalty and Magoon (1985) assessed environmental factors to see how they correlated with the scholarly productivity of counseling psychology faculty, as measured by number of publications. T-tests (top 27% of productivity, 9 or more publications, vs. bottom 27% of productivity, 1 or 0 publications) were performed on various measures. The high producer (a) was interested in research when in graduate school, (b) felt that graduate school prepared him/her for the difficulties experienced in getting published, and (c) perceived her/his graduate training program as expecting the student to produce research. Thus, in retrospective accounts, graduate training was seen as an important influence on research productivity.

Galassi, Brooks, Stoltz, and Trexler (1986) demonstrated support for the importance of some of the RTE elements by examining data from 38 counseling psychology training program directors. Specifically, Galassi et al. were interested in comparing high versus low research productive programs (as measured by student publications or presentations) in terms of elements of the RTE and student productivity. Differences between high and low research-productive programs were found. First of all, high research-productive programs involved their students in research early in their training, either the first or second year. By contrast, half of the low-productive programs did not involve their students in research until the third year. Second, program directors in the high-productive programs perceived their program as providing more informal support for research in terms of encouragement and tangible support than did low productive programs. Finally, high-productive programs seemed to emphasize and support less traditional methods of research than did low-productive programs.

Phillips and Russell (1994) also found support for the role of the RTE in student research productivity. They conducted a study of 125 counseling psychology graduate students and found that for graduate students in their fourth year or beyond, the correlation between the RTES and research productivity (measured by a weighted scoring system, considering
activities such as completing the thesis or dissertation and number of publications) was significant; for students in their first and second year the correlation was not significant, although it was also positive. The difference between the two correlations was not significant.

Research Self-Efficacy

Bandura (1977, 1982) defined perceived self-efficacy as judgments of how well one can engage in a course of action required to deal with a given situation. These judgments, which may be applied to global functioning or a specific behavior, are considered extremely helpful to the effective completion of that behavior or task. According to Bandura, self-efficacy cognitions can develop from one (or more) of four sources: (a) mastery experience, or direct experience performing a behavior; (b) vicarious experience, or watching another person successfully perform the behavior; (c) verbal persuasion, or being convinced by another that one can complete the behavior; or (d) emotional arousal, or an intense emotional experience. Bandura (1982) reported several experiments in which perceived self-efficacy was related to the successful completion of a behavior.

Empirical studies of the relationship between research self-efficacy and research productivity. Several studies have shown that self-efficacy is related to research productivity among university professors. For example, Vasil (1992) conducted a study of 284 university professors. She used a weighted measure of research productivity that gave points for number of publications, presentations made, grants obtained, and advisees graduated. A hierarchical regression analysis revealed that after controlling for experience, rank (i.e., full professor, associate professor, etc.), and college, self-efficacy still explained unique variance. Self-efficacy correlated positively with productivity.

In 1993 Vasil replicated her 1992 results in a study of 397 New Zealand university professors. She used the same measures as in her previous study. In a hierarchical regression analysis, self-efficacy explained a unique proportion of variance beyond
experience, rank (i.e., professor, lecturer), academic field, and institution. Again, self-efficacy positively correlated with research productivity.

Landino and Owen (1988) tested a path model of predictors of research self-efficacy among full-time faculty. They measured research self-efficacy by asking faculty to respond to 11 tasks identified as research tasks. Although other variables such as gender and percent of women faculty in the department were among the strongest predictors of research self-efficacy, scholarly productivity, measured by number of publications and presentations, was also positively related to research self-efficacy.

Royalty and Reising (1986) found a significant relationship between self-efficacy and research productivity in a sample of counseling psychologists. In their survey of 355 members of Division 17 (Counseling Psychology) of the American Psychological Association, current research skill factors (such as research design skills, practical research skills, and quantitative and computer skills) were correlated with number of publications per year. The specific skills in which their sample was most confident were (a) writing, (b) asking questions amenable for investigation, (c) background preparation, (d) selecting a population, and (e) operationally defining variables. The skills to which felt their training program best contributed were (a) background preparation, (b) asking questions amenable to investigation, (c) confidence about doing research, (d) statistical skills, (e) selecting a population, and (f) operationally defining variables.

Correlates of research self-efficacy among graduate students. Although the above studies demonstrate positive relationships between research self-efficacy and research productivity among faculty, they differ from the intent of the present study, as the present study aims to test this relationship among graduate students. Two recent studies have examined correlates of research self-efficacy among counseling psychology graduate students.

Phillips and Russell (1994) suggested that self-efficacy may mediate the relationship between RTE and productivity, an argument also articulated by Gelso (1993). A sample of
132 graduate students and interns from 12 APA-accredited doctoral programs participated in the study. Third-year students were excluded from the data analysis to study developmental differences in the variables, yielding 125 participants.

Participants completed the RTES, the Self-Efficacy in Research Measure (SERM; Phillips & Russell, 1994), and items assessing research productivity. Research productivity was measured by a weighted scoring system. One point was given for a thesis or dissertation in progress, participation on a research team (later omitted because of poor item-to-total correlation), presentation of a paper at a conference, and for each article submitted to a refereed journal; 2 points were assigned for completing the thesis or dissertation and for each publication. These points were summed to form a single research-productivity score.

Significant positive correlations were found between research self-efficacy and the RTE, and between research self-efficacy and research productivity. Unfortunately, the authors did not compute the partial correlation between RTES and research productivity, controlling for self-efficacy. As such, the mediating role of self-efficacy was not determined by their data.

Phillips and Russell (1994) also conducted an ANOVA comparing 1st and 2nd year students vs. 4th year or beyond students. This ANOVA revealed differences on self-efficacy, with advanced students reporting greater self-efficacy. When broken down by developmental group, correlations between self-efficacy and research productivity, and between self-efficacy and perceptions of the RTE, were positive for both groups.

Gelso et al. (1996) also examined the relationship between RTE and research self-efficacy. In their study of 106 counseling psychology doctoral students, they found that each of the nine subscales of the RTES-R was positively correlated with the SERM, thus corroborating Phillips and Russell's (1994) finding. Thus, it seems clear from these two studies that elements of the research environment are associated with research self-efficacy, and that research self-efficacy is associated with research productivity.
Research Interest

Graduate students' interest in research has been theorized to be a mediator of the relationship between RTE and research productivity (Gelso, 1993). As such, it is important to investigate what graduate students' attitudes toward research are. Several studies provide evidence that graduate students' interest in research does increase throughout graduate school (Gelso et al., 1983; Perl & Kahn, 1983; Royalty et al., 1986). Others suggest that the RTE has a strong influence on research attitudes and interests (Barrom, Shadish, & Montgomery, 1988; Royalty et al., 1986; Royalty & Reising, 1986).

Perl and Kahn (1983) surveyed graduate students across all areas of psychology to assess research interest and attitudes. They found that, on average, counseling psychology graduate students wanted to spend 16% of their time doing research, versus wanting to spend 65% of their time involved in practice. Across all areas of psychology, research interests were quite positive. Nearly half of the sample (47%) reported that their research interests had increased while in graduate school, compared to 16% who stated that their research had waned.

Gelso et al. (1983) compared counseling psychology graduate students' research attitudes with those of recent graduates. They found that both groups reported that their research interest increased since entry into graduate school. Specifically, (a) their interest in doing research, (b) their perception of the value of research, and (c) the percent of time they wanted to devote to research increased as a result of their graduate training.

Royalty et al. (1986) investigated the following questions in their mail survey of graduate students: (a) Do training programs in counseling psychology differ in terms of students' reports of their initial attitudes toward research? (b) Do students' attitudes toward research change as they progress through doctoral training in counseling psychology? (c) Do these changes in attitudes differ across training programs? Royalty et al.'s measure of attitudes consisted of five items (described previously).
Royalty et al. (1986) found that the ten programs surveyed did not differ significantly in terms of students' retrospective reports of their initial attitudes about research. However, there was a modest increase in attitudes across all programs for both attitudes and ideal percent of work time. Second, there were program differences in impact, as the increase in attitudes was most pronounced for two of the programs and did not occur at all in two programs. This was also the case for ideal percent of work time. In addition, an ANOVA revealed that the programs did differ in terms of students' current attitudes.

In their survey of counseling psychologists, Royalty and Reising (1986) assessed aspects of students' graduate training that most positively influenced their research interest. The researchers found that the most common contributing factors to research interests among counseling psychology doctorates were (a) doctoral dissertation, (b) individual research effort, (c) presenting research at a professional meeting or conference, (d) role models, (e) master's thesis, and (f) the advisor-advisee relationship. Thus, the influence of the RTE on research attitudes exists among both graduate students and doctoral level psychologists.

In summary, Royalty and colleagues (Royalty et al., 1986; Royalty & Reising, 1986) demonstrated that training programs are associated with research attitudes. In contrast, Barrom et al. (1988) investigated research attitudes as a predictor of research or scholarly involvement. In their sample of doctoral level clinical psychologists, Barrom et al. found that, aside from the number of paid work hours that could be devoted to research and the percentage of colleagues doing research, the number of publications and the scholarly activity of these psychologists were best predicted by positive personal research attitudes. The specific attitudes assessed included the importance of evaluating treatment, relying on the research literature to guide practice, enjoying research, and interest in doing more research.

Finally, Parker and Detterman (1988) surveyed 176 clinical psychology graduate students to examine research interests versus clinical interests. The majority (71%) of the sample
reported that they hoped to spend most of their professional time doing clinical work. Parker and Detterman also assessed correlates of research interest and enjoyment. Both number of publications and number of submissions were positively correlated with (a) self-rated enjoyment of research, (b) self-rated performance of research (i.e., research self-efficacy), (c) current time spent doing research, and (d) ultimate desired time doing research. Other correlates of scholarly productivity and research interest were (a) advisor scholarly reputation and (b) research productivity of program. In sum, both research productivity and aspects of the training environment correlated with research interest.

**Research Productivity**

Most of the thinking on the research productivity of counseling psychology graduates suggests that productivity is somewhat low. However, no descriptive information on the research productivity of counseling psychology graduate students could be found in the literature. This is perhaps primarily because of the difficulty in measuring the concept. In their sample of doctoral-level clinical psychologists, Barrom et al. (1988) used a broad definition of “research productivity” to examine the question of how productive these psychologists were. They found that 27% had never published, the median number of publications was 2.56, and the mean number of publications was 14.09. However, when using alternative measures of scholarly productivity (e.g., other types of publications or presentations, current work on data analysis, gathering data, engaging in research activities that may be associated with clinical evaluation), well over half of the individuals reported being involved in scholarly productivity. In a sample of doctoral-level counseling psychologists, Watkins, Lopez, Campbell, and Himmell (1986) reported similar numbers of publications. Their sample mean, median, and mode were 13.1, 4, and 0, respectively. Rodgers and Maranto (1989) sampled 485 psychologists in academia and asked for retrospective reports of the number of articles published before obtaining the doctorate. They reported a mean of 0.80, although this number is difficult to interpret because it was weighted
by the impact of the journal.

At least two causal models of research productivity among psychology faculty have appeared in the literature. Helmreich, Spence, Beane, Lucker, and Matthews (1980) explored the role of personality (e.g., achievement motivation, instrumentality) and institutional factors on number of publications and number of citations in 196 psychologists. Their path model revealed a strong direct path between participant sex and number of publications, such that women had fewer publications than men. Motivation showed positive paths to the reputation of the graduate training department, the reputation of the current department, and the number of citations. Reputation of the current department also had a positive effect on the number of publications.

Rodgers and Maranto (1989) tested six theoretical models of research productivity among 485 psychology faculty members. These models were based on theories from sociology, economics, and psychology. In their survey, factors such as ability, quality of the graduate program, number of publications in graduate school, quality of the first job, and sex of the researcher all significantly predicted publishing productivity. Although several of the theoretical models fit the data well, Rodgers and Maranto described the best-fit model as one in which sex of the researcher, ability, pre-doctoral publications, and quality of the first job had direct effects on the number of publications. Quality of the graduate program was seen as having an indirect effect on publications, mediated by quality of the first job. Ability was also described as having an influence on quality of the graduate program, pre-doctoral publications, and citations. Finally, number of publications and pre-doctoral publications, were also described as directly influencing citations.

Investigations of the research productivity of faculty has examined the amount of productivity and predictors of that productivity. Unfortunately, no direct empirical examination of the research productivity of current counseling psychology graduate students could be found in the literature.
Graduate Students' Career Goals

A final area concerns the careers counseling psychology graduate students are planning to pursue. Fitzgerald and Osipow (1986) conducted a study of 351 Division 17 counseling psychologists to find out where counseling psychologists work and what their job activities are. They developed an instrument that consisted of 64 work behaviors. These work behaviors were classified into seven dimensions: (a) counseling, (b) research, (c) supervision, (d) teaching/training, (e) administration, (f) consultation, and (g) writing/editing. Each item was rated on three separate 7-point scales. The three scales assessed (a) the importance of the activity, (b) how central that activity was to the central identity of counseling psychologists, and (c) relative amount of time spent on that activity. Participants were only asked to respond to those activities that they performed on their present job. In addition to the work behavior scale, Fitzgerald and Osipow also assessed their primary employment settings of participants.

The results of the survey revealed that nearly half of the sample (48%) was employed in an academic setting. However, when broken down into age groups (40 and younger versus 41 and older), the data revealed that only 35% of younger counseling psychologists, compared with 53% of older counseling psychologists, worked in academia, suggesting a trend away from academic positions. With regard to work behaviors, the authors concluded that counseling psychologists are primarily involved in counseling and secondarily involved in teaching and training. Far fewer counseling psychologists were involved in research. The analysis by age revealed a more striking trend, as younger participants conducted significantly less research than did older participants.

Because of what appeared to be a trend away from academic job settings for younger counseling psychology graduates, Fitzgerald and Osipow (1988) examined the vocational aspirations of 210 counseling psychology graduate students. Utilizing the same methodology and instruments as in their earlier (1986) study, Fitzgerald and Osipow (1988) found that,
although 59% of students reported wanting some involvement with an academic setting, only 24% reported that it was their first choice for a career setting, compared with 27% desiring a career in private practice. When settings such as a counseling center, VA hospital, and community mental health center were added, the number of students desiring a practice-oriented setting jumped to 56%. Moreover, over 97% of students reported wanting to perform some counseling-related activity, compared with just under 75% desiring to conduct research.

In their survey of trends in counseling psychology graduate programs between 1975 and 1987, Cameron, Galassi, Birk, and Waggener (1989) determined that initial employment in academic settings increased between 1985 and 1987. However, this increase followed a steady decrease between 1981 and 1985. Thus, it appears from Cameron et al.'s data that initial placement in academic jobs was becoming slightly more common at the time of the survey. It is unclear whether this trend has continued, however, as a comprehensive literature search failed to uncover more recent studies of graduate students' career choices.
CHAPTER 3
METHODOLOGY

Participants

Power analysis. A power analysis was conducted for the present study in order to determine an appropriate sample size for the proposed analyses. Effect sizes reported in the literature varied from small to large, although the lowest $R^2$ found in the literature was .08, a small to medium effect (Cohen, 1992). In order to have adequate power to detect differences, this conservative estimate was used; consequently, small to medium effect sizes were predicted in the present research. According to Cohen (1992), the number of observations necessary to detect a medium effect ($R^2 = .13$) at .80 power is 76 for a three-predictor regression model (the maximum number of predictors in the proposed structural equation model equations), whereas the number of observations necessary to detect a small effect ($R^2 = .02$) is 547. In order to provide adequate power without obtaining unnecessary participation from respondents, a target sample of approximately 300 participants was sought.

Initial pool of participants. In order to obtain 300 participants, an initial pool of 525 students from 15 randomly-selected APA-accredited counseling psychology doctoral programs was targeted. Every student in each of these programs was invited to participate. The sample was restricted to counseling psychology training programs (versus counselor education, etc.) because the theories upon which the hypotheses are based are relevant to that group. In addition, the sampling of APA-accredited programs ensured that at least some minimal standards of graduate and professional education consistent with APA-accreditation criteria were met, thus allowing inferences to be made about the training programs' standards. The pool consisted of such a large number of students because return rates of studies involving graduate students vary, with some higher than 85% (e.g., Royalty, Gelso, Mallinckrodt, & Garrett, 1986), yet others closer to 60% (e.g., Fitzgerald & Osipow, 1988;
Phillips & Russell, 1994). Because of the difficulty in predicting the final return rate, enough participants needed to be solicited to account for whatever the final return rate would be. A second reason for choosing a large number of participants is because students' year in graduate school was included in the analyses. Because an effort was made to recruit approximately equal numbers of students across different stages of training (i.e., first-year students through post-internship students), it was necessary to procure as many participants as possible so each stage of graduate training was well represented in the sample.

**Characteristics of final sample.** Of the initial pool of 525 questionnaires sent to potential participants, 287 returned usable questionnaires. This resulted in a response rate of 55%. Response rates varied somewhat across training sites (see Table 1).

Of this sample, 198 (69.5%) respondents were female and 87 were male (30.5%). Two participants did not indicate their gender. Of the 277 respondents that indicated their ethnicity, 218 (78.7%) reported being Caucasian-American, 22 (7.9%) reported being Latin-American, 21 (7.6%) reported being African-American, 8 (2.8%) reported being of Asian descent, 2 (0.7%) reported being Native American, and 6 (2.2%) reported being another ethnicity. The number of women and the number of members of ethnic minority groups included in this final sample were comparable to national estimates of women and minority-group members in APA-accredited counseling psychology doctoral programs (American Psychological Association, 1996). The average age of participants in the present study was 31.7 years (SD = 6.9).

As indicated in Table 2, students in the final sample represented a broad variety of stages in the doctoral program. One hundred twenty-nine participants (45.6%) had finished their master's thesis, 48 (17.0%) had not completed their thesis at the time of the survey, and 106 (37.5%) indicated that a thesis was not required. Students completed an average of 1.6 courses in research methods (SD = 1.00) and 2.7 courses in statistics (SD = 1.41).
<table>
<thead>
<tr>
<th>Training Site</th>
<th>Questionnaires Distributed</th>
<th>Questionnaires Returned</th>
<th>Percent of Total Sample</th>
<th>Response Rate</th>
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Note. N = 285 in this table because of missing data.
Table 2

Year in Doctoral Program of Participants

<table>
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<th>Year in Doctoral Program</th>
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<th>%</th>
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<td>19.0</td>
</tr>
<tr>
<td>Fourth</td>
<td>33</td>
<td>13.7</td>
</tr>
<tr>
<td>Fifth</td>
<td>24</td>
<td>8.5</td>
</tr>
<tr>
<td>Sixth or beyond</td>
<td>11</td>
<td>3.9</td>
</tr>
<tr>
<td>Internship</td>
<td>25</td>
<td>8.8</td>
</tr>
<tr>
<td>Post-Internship</td>
<td>26</td>
<td>9.2</td>
</tr>
</tbody>
</table>

Measures

Holland personality. The Investigative and Social subscales of the Vocational Preference Inventory Form B (VPI-B; Holland, 1985b) were used to assess students' personalities in terms of Holland themes (see Appendix A). These two subscales were selected because of their theorized role in research training (Holland, 1986). Form B of the VPI is a 42-item research version of the original 160-item VPI (Holland, 1977). The VPI-B contains 7 items assessing each of the six Holland themes: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. VPI-B items consist of titles of occupations to which the participants respond by indicating occupations that "interest or appeal" to them. Responses to each occupation are scored as "like" or "dislike." Thus, each subscale has a possible score of 0 to 7, with higher numbers representing greater interests in that area.

Holland (1985b) reported mean scores of the Investigative subscale to be 3.52 for college men and 2.89 for college women. Means of the Social subscale have been reported as 2.76
for college men and 4.09 for college women. Neither test-retest reliability nor internal
consistency estimates for the VPI-B were reported by Holland (1985b), although he did report
that internal consistency measures (K-R 20) for the subscales on the entire inventory range
from .85 to .91. In the present study, K-R 20 for the Investigative subscale was .61 (N = 263)
and K-R 20 was .58 (N = 268) for the Social subscale.

The VPI-B has been shown to discriminate between professionals with an academic
orientation versus a practice orientation. Weil, Schleiter, and Tarlov (1981) found that the
VPI-B discriminated between residents of internal medicine who preferred clinical practice to
academic medicine. The Investigative and Social subscales of the VPI-B can also
discriminate between those students interested in research and producing research, and
those students who are not. Mallinckrodt, Gelso, and Royalty (1990) found a positive
correlation between the Investigative subscale and research interests in graduate students,
and a negative correlation between research interests and the Social subscale. Krebs,
Smither, and Hurley (1991) found that Investigative interests, as measured by the VPI-B,
were positively related to research productivity, whereas Social interests were negatively
related to research productivity.

Research training environment. The revised version of the Research Training
Environment Scale (RTES-R; Gelso, Mallinckrodt, & Judge, 1996) is a 54-item measure
designed to assess nine of the ingredients of the graduate training environment that Gelso
(1979, 1993) claimed to be important to the development of positive attitudes toward
research and scholarly productivity (see Appendix B). The subscales assessed by the RTES-
R are (a) faculty modeling of appropriate scientific behavior, (b) positive reinforcement of
scholarly activities, (c) early, low threat involvement in research activities, (d) teaching
relevant statistics and the logic of design, (e) teaching students to look inward for research
ideas, (f) seeing science as a partly social experience, (g) teaching that all experiments are
inevitably flawed, (h) focus on varied investigative styles, and (i) science is wed to clinical
service. Each subscale consists of six items rated from disagree (1) to agree (5); thus, scores for each subscale can range from 5, indicating that the ingredient is not perceived to be present in the research training environment, to 30, indicating that the ingredient is strongly perceived as present in the environment.

Psychometric data for the RTES-R has been evaluated in a counseling psychology graduate student sample (Gelso et al., 1996). Internal consistency estimates for the subscales from the present study are displayed and contrasted with those obtained by Gelso et al. in Table 3. Gelso et al. reported that test-retest reliability for each of the nine subscales was above .70, and seven of the nine subscales had test-retest reliability above .80 (n = 57). Validity for the RTES-R was demonstrated by Gelso et al., who found that the nine subscales of the RTES-R correlated well with (a) change in research attitudes throughout graduate school and (b) research self-efficacy. The RTES-R correlated only slightly with self-esteem. Curiously, the RTES-R subscales failed to correlate with interest in science-related activities.

Research self-efficacy. A brief version of the Self-Efficacy in Research Measure (SERM; Phillips & Russell, 1994) was used to assess research self-efficacy. The SERM is designed to assess research self-efficacy, specifically, one's research skills and perceptions of the impact of one's graduate program on developing those skills (see Appendix C for brief form). This brief version of the original 33-item self-report measure was created specifically for the present study by selecting the three items with the highest item-to-subscale-total correlations (based on the Phillips and Russell data) for each of the SERM's four factors: Research Design Skills, Practical Research Skills, Quantitative and Computer Skills, and Writing Skills. In responding to the SERM, participants are asked to indicate their confidence either in successfully performing each task or in their belief that they possess the skill for each item. Level of confidence is measured on a scale from 0 to 9, with 0 indicating no confidence and 9 indicating total confidence for that task. The SERM items were summed to create four measures (i.e., factors) of research self-efficacy ranging from 0 to 27 (in this brief version),
Table 3

Internal Consistency Estimates for RTES-R in the Gelso, Mallinckrodt, and Judge (1996) Study and in the Present Study

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Gelso et al. (1996)</th>
<th>Present Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\alpha)</td>
<td>N</td>
</tr>
<tr>
<td>Faculty Modeling</td>
<td>.81</td>
<td>173</td>
</tr>
<tr>
<td>Positive Reinforcement</td>
<td>.73</td>
<td>173</td>
</tr>
<tr>
<td>Early Involvement</td>
<td>.73</td>
<td>173</td>
</tr>
<tr>
<td>Relevant Statistics</td>
<td>.80</td>
<td>173</td>
</tr>
<tr>
<td>Looking Inward</td>
<td>.82</td>
<td>173</td>
</tr>
<tr>
<td>Science as a Social Experience</td>
<td>.76</td>
<td>173</td>
</tr>
<tr>
<td>All Experiments Flawed</td>
<td>.57</td>
<td>173</td>
</tr>
<tr>
<td>Varied Investigative Styles</td>
<td>.85</td>
<td>173</td>
</tr>
<tr>
<td>Wedding of Science and Practice</td>
<td>.82</td>
<td>173</td>
</tr>
<tr>
<td>Total Scale</td>
<td>.90</td>
<td>173</td>
</tr>
</tbody>
</table>

Note. Ns vary across subscales in the present study due to missing values.
with higher scores reflecting greater self-efficacy. The four factor scores were used as indicator variables of research self-efficacy in the latent variable analysis.

Based on a sample of counseling psychology graduate students, Phillips and Russell (1994) reported that the SERM has good internal consistency for the total scale ($\alpha = .96$) and for the four subscales: Research Design Skills, $\alpha = .90$; Practical Research Skills, $\alpha = .83$; Quantitative and Computer Skills, $\alpha = .93$; and Writing Skills, $\alpha = .94$. The brief version used in the present study had generally acceptable internal consistency estimates: Total Scale, $\alpha = .90$ ($N = 283$); Research Design Skills, $\alpha = .78$ ($N = 284$); Practical Research Skills, $\alpha = .57$ ($N = 284$); Quantitative and Computer Skills, $\alpha = .86$ ($N = 283$); and Writing Skills, $\alpha = .80$ ($N = 284$). Test-retest reliability data were not provided by Phillips and Russell.

Phillips and Russell (1994) reported that the SERM was positively related to research productivity ($r = .45$) and the research training environment ($r = .39$). This latter relationship has been supported by Gelso et al. (1996).

**Interest in research.** Interest in research was measured via the procedure utilized by Royalty et al. (1986) and Mallinckrodt et al. (1990). Participants were asked to rate on a 5-point scale (ranging from 1 = disagree to 5 = agree) the extent to which they agree with the following items: (a) "I would prefer to have the option of completing my doctoral training without being required to complete research projects" (reverse scored), (b) "I have a strong interest in doing research," (c) "I place a high value on the place of research in my future career", and (d) "Participating in research activities after graduation is not a major priority to me" (reverse scored). These four items were summed to form one measure of interest in research. Possible scores ranged from 4 to 20, with higher scores reflecting a greater interest in research. Cronbach's alpha for these four items was .88 ($N = 285$) in the present study.

A second measure of research interest consisted of a single item used in the Royalty et al. (1986) study: "What do you consider to be the ideal percentage of work time you would
like to spend on research activities in your career after graduation?" Scores on this item ranged from 0 to 100, with higher numbers reflecting a greater interest in research.

**Research productivity.** Research productivity was assessed in a way similar to that done by Barrom, Shadish, and Montgomery (1988). Barrom et al. recommended the use of a broad definition of research productivity, versus the use of only publications, when measuring this variable. Consistent with this recommendation, participants were asked 12 questions about their recent and current involvement in a broad range of research activities (see Appendix D).

Because of the severe skew among the items, each research-productivity item was dichotomized as 0 or 1, where a score of 1 indicated that the student had some involvement in the particular research activity, no matter how little or how much, and a score of 0 indicated that the student had no experience in that activity. These dichotomized items were used in hypothesis tests in order to make the distributions more normal. However, the original continuous scaling of the items were retained for descriptive analyses.

An exploratory factor analysis using principal-axis factoring was conducted on the 12 dichotomized items (see Chapter 4). This factor analysis suggested that three dimensions of research productivity existed. These factors were named Current Research Involvement, Past Research Productivity, and Research in Clinical Practice. Internal consistency (K-R 20) for the entire dichotomized scale was .67 (N = 269). K-R 20 estimates for the three subscales composed of dichotomized items were as follows: Current Research Involvement (4 items) was .60 (N = 283), Past Research Productivity (5 items) was .70 (N = 282), and Research in Clinical Practice (3 items) was .48 (N = 271). These internal consistency estimates based on dichotomized items reflected a marked improvement over those obtained by using continuous measures (α = .60 for total scale, α = .56 for Current Research Involvement, α = .54 for Past Research Productivity, and α = .50 for Research in Clinical Practice.)
Career goals. Students' career goals were assessed by asking them to rank order their preferences for working in one of ten environments (see Appendix E). Specifically, the method used by Fitzgerald and Osipow (1988) was utilized in the present study. This methodology asked students to rank order their top three choices of job setting.

In order to perform the structural equation modeling analyses, the measure of career goals had to be quantified such that one's intention to pursue a research career could be reflected in one number. In order to quantify this measure, a weighted sum was created based on the students' top three choices of job setting. A weighted sum was used because the student's first choice of a career should be given more weight than their second or third choice, and because their second choice should be given more weight than their third. Accordingly, students received a score of 1 for any of the three choices in which they selected a research setting (operationalized as an academic setting or one in a research facility) and a score of 0 for those in which they selected a practice setting (operationalized as a position in a counseling center, a Veterans Affairs hospital, a community mental health center, or private practice) or a combined/other setting (operationalized as all other choices). Moreover, a weight of 3 was given to the score (i.e., 1 or 0) obtained from their first choice and a weight of 2 to the score from their second choice. Thus, students' total scores on this new measure could range from 0 to 6, with higher scores indicating a greater interest in pursuing a research career.

Demographic information. The demographic information assessed included year in graduate school to examine developmental differences in the constructs of interest (see Appendix F). Additional demographic information included age, sex, ethnicity, number of statistics or research methods courses, approximate number of practicum hours, and whether or not the thesis has been completed.

Pilot Study

In order to verify that the questionnaires could be completed in a reasonable amount of
time and that the instructions were clear, the questionnaires were given to a sample of 17 graduate students in counseling psychology from the institution at which the research was conducted. Questions assessing how clear the instructions were, how much time the questionnaire took to complete, and other observations were returned anonymously. Qualitative feedback regarding the ease of completion and the clarity of the instructions was also assessed from this small pool of participants and incorporated into the final materials. Of the 17 students solicited, 7 (41%) returned questionnaires.

Procedure

The research described in this section and the remainder of the dissertation was approved by the Iowa State University Human Subjects Review Committee. The present study was a mail survey and followed many of the methodological guidelines outlined by Weathers, Furlong, & Solórzano (1993) and those described in previous studies of this type (e.g., Royalty et al., 1986). A random sample of 15 of the 63 counseling psychology doctoral programs accredited by the American Psychological Association as of August, 1995 (American Psychological Association, 1994) was selected for participation (the present institution was not included.) Training directors from these programs were contacted by telephone and provided a description of the study. Training directors were asked for their permission to sample all of their students and provide class rosters for the purposes of obtaining participants. All 15 training directors agreed to participate in the study. Three of the training directors provided a list of students' addresses, whereas the remaining twelve agreed to distribute materials directly to the students' campus mailboxes.

Participants were mailed a packet that contained a cover letter, a questionnaire, a stamped return envelope, and a stamped return postcard. This initial mailing took place early in the Fall semester when students were likely to be under less pressure from course work (Royalty et al., 1986). The cover letter stressed the importance of the study and assured participants that their names would not be associated with the data (see Appendix G). As in
the Royalty et al. survey, the cover letter also expressed respect for students' time and the researcher's appreciation for their participation. Participants were asked to return the questionnaire in the envelope and to return the postcard separately. The questionnaire itself was printed on colored paper to enhance the appearance, and steps were taken to increase personalization (e.g., by using first-class postage on the return envelope as opposed to business reply envelopes; Weathers et al., 1993). The purpose of the postcard was to inform the researcher who has returned a questionnaire, as the questionnaires only contained code numbers indicating the school; specific identities of participants were not known. In addition, participants were informed that if they completed the questionnaires and returned the postcard they would be eligible for one of two $50 prizes to be raffled off, as the use of incentives has been found to increase response rate (Weathers et al., 1993).

Follow-up postcards were sent out three weeks after the initial mailing to all participants. This follow-up postcard reminded participants about the questionnaire and asked that they please return the questionnaire if they would like to participate. Unfortunately, because many questionnaires were distributed to campus mailboxes by training directors, it was not known who returned completed questionnaires. Thus, a second mailing of materials was not possible.
CHAPTER 4

RESULTS

Chapter 4 is separated into three sections. The first section describes overall means and frequencies, including descriptions of differences in means and frequencies across gender, stages of the doctoral program, and doctoral training sites (i.e., the 15 programs sampled). A description of exploratory and confirmatory factor analyses appears in the second section. The third and final section of this chapter describes the latent variable modeling procedure. Both an explanation of the measurement model and the structural model results are presented in this third section.

Means, Frequencies, and Group Differences

In this section, descriptive statistics are reported on all variables. Differences between women and men; across beginning, intermediate, and advanced students; and across training sites were also assessed. In order to examine mean differences as a result of stage of doctoral program, the eight categories of the year-in-program variable were collapsed into three groups: first-year and second-year students were collapsed into a category called Beginning Students; third-year and fourth-year students were collapsed into a category called Intermediate Students; and students in their fifth year or beyond, or those on internship were collapsed into a category called Advanced Students.

The present section begins with descriptions of means and mean differences for the research training environment (RTE) and Holland personality. Descriptive statistics and group differences on research self-efficacy and research interest follow. This subsection concludes with means and frequencies of research productivity and career goals.

A sequential process was used for testing group differences. First, a multivariate analysis of variance (MANOVA) was conducted, using the Wilks' criterion and an alpha level of .05. Provided this MANOVA was significant, a series of univariate analyses of variance (ANOVAs) or t-tests with Bonferroni-adjusted alpha levels was conducted. Pending any significant
univariate effects, Scheffé tests, with the reduced alpha level used in the univariate ANOVA, were employed to examine the nature of the group differences. Although Scheffé tests with Bonferroni-adjusted alpha levels may seem unnecessarily conservative, the sheer number of tests conducted, coupled with the lack of hypotheses, warranted this degree of conservativism to protect against Type I error. Bonferroni-adjusted chi-square tests were used to test for group differences when data were categorical.

**Vocational preferences.** Students in the present sample had an average score on the Social subscale of the VPI-B of 4.02 (SD = 1.77, N = 283) and an average score on the Investigative subscale of the VPI-B of 2.53 (SD = 1.88, N = 280). In their sample of graduate students, Mallinckrodt, Gelso, and Royalty (1990) reported a mean of 3.74 for the Social subscale of the VPI-B (SD = 1.89, N = 358) and a mean of 2.95 (SD = 2.17, N = 358) for the Investigative subscale; students in the present sample reported significantly lower Investigative interests than did students in the Mallinckrodt et al. sample, t(636) = 2.57, p < .025, yet the two samples did not differ in Social interests, t(639) = 1.92, p > .025. The difference between the two VPI subscales was highly significant in the present sample, F(1, 279) = 90.27, p < .001, η² = .24. Although, theoretically, Investigative and Social interests are slightly correlated (Holland, 1985a, 1985b), the Investigative-subscale and Social-subscale scores of the VPI-B were not correlated in the present sample, r(280) = .00.

A MANOVA comparing women and men on both VPI-B subscales was conducted. This MANOVA was significant, Wilks' lambda = .97, F(2, 276) = 3.71, p = .026, η² = .03. Two t-tests with Bonferroni-adjusted alpha levels of .025 were then conducted to examine gender differences on the VPI-B subscales. Women and men differed on one of the two VPI-B subscale scores. Women's average Investigative score was 2.35 (SD = 1.91, n = 195), whereas men's average score was 2.94 (SD = 1.74, n = 84). This difference was significant, t(277) = 2.46, p = .015. For the Social subscale, women averaged 4.08 (SD = 1.82, n = 196), whereas men averaged 3.87 (SD = 3.87, n = 86), a nonsignificant difference, t(280) = .91, p =
A MANOVA examining the relationship between stage of doctoral program (i.e., beginning, intermediate, or advanced) and VPI-B scores was conducted. This multivariate test was nonsignificant, Wilks' lambda = .99, \( F(4, 548) = 0.44, p = .78, \eta^2 = .00 \). A second MANOVA tested whether the 15 doctoral training sites sampled differed in the VPI-B scores of their students. This MANOVA was also nonsignificant, Wilks' lambda = .92, \( F(28, 524) = 0.79, p = .78, \eta^2 = .04 \).

As a precursor to the causal modeling procedure, four groups of students were created based on VPI-B scores: a High-Investigative/High-Social group, a High-Investigative/Low-Social group, a Low-Investigative/High-Social group, and a Low-Investigative/Low-Social group. These groups were created by taking a median split on the Investigative subscale to yield high and low Investigative groups (a score of 2 or less versus a score of more than 2) and by taking a median split on the Social subscale to yield high and low S groups (a score of less than 4 versus a score of 4 or above.) Means of the four groups are illustrated in Table 4.

Table 4
Means of Investigative and Social Subscales for VPI-B Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Investigative M</th>
<th>Investigative SD</th>
<th>Social M</th>
<th>Social SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>High I, High S</td>
<td>4.03</td>
<td>1.31</td>
<td>5.17</td>
<td>1.15</td>
<td>74</td>
</tr>
<tr>
<td>High I, Low S</td>
<td>4.21</td>
<td>1.22</td>
<td>2.38</td>
<td>0.76</td>
<td>63</td>
</tr>
<tr>
<td>Low I, High S</td>
<td>1.05</td>
<td>0.82</td>
<td>5.29</td>
<td>1.03</td>
<td>87</td>
</tr>
<tr>
<td>Low I, Low S</td>
<td>0.97</td>
<td>0.81</td>
<td>2.23</td>
<td>0.87</td>
<td>56</td>
</tr>
</tbody>
</table>

Note. I = Investigative interests; S = Social interests.
Research training environment. The means of each of the nine RTE ingredients are presented in Table 5. The means of the nine ingredients significantly differed within participants, $F(8, 2280) = 33.32$, $p < .001$, $\eta^2 = .11$. The ingredients that students found to be most present in their RTE were (a) faculty modeling appropriate scientific behavior, (b) learning that all experiments are inevitably flawed in some way, (c) learning that science can be a social experience, and (d) learning that science and clinical practice can be integrated. Least present in this sample’s RTEs were (a) learning varied investigative styles, (b) receiving positive reinforcement for doing research, and (c) learning relevant statistics and the logic of research design. As indicated by Table 5, the means from the present sample were generally similar to those found in the Gelso, Mallinckrodt, and Judge (1996) study.

Gender differences in students’ perceptions of their RTE were investigated via a MANOVA. This MANOVA compared women and men on the nine RTES-R subscales. The multivariate test was significant, Wilks’ lambda = .91, $F(9, 274) = 3.15$, $p = .001$, $\eta^2 = .09$. Nine t-tests were then conducted to examine on which subscales these gender differences occurred. A Bonferroni adjustment reduced the alpha level to .0056. The results of these tests are illustrated in Table 6. As indicated by Table 6, when compared with women, men reported that they perceive that (a) faculty provide positive reinforcement for research, (b) students are taught to look inward for research ideas, (c) students are taught that science can be a social experience, and (d) varied investigative styles are taught.

Differences in RTE perceptions as a function of stage of doctoral program were assessed via a MANOVA. This MANOVA was significant, Wilks’ lambda = .83, $F(18, 544) = 2.90$, $p < .001$, $\eta^2 = .09$. The multivariate test was followed by 9 one-way ANOVAs. A Bonferroni adjustment reduced the alpha level of these univariate tests to .0056. As displayed in Table 7, stage of doctoral program was related to all of the RTE ingredients with the exception of teaching students that all experiments are flawed. The means of each group are presented in Table 8.
Table 5
Comparison of RTES-R Subscale Scores Between Present Study and Gelso, Mallinckrodt, and Judge (1996) Study

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Present Study</th>
<th>Gelso et al. (1996)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Faculty Modeling</td>
<td>23.80</td>
<td>5.20</td>
</tr>
<tr>
<td>Positive Reinforcement</td>
<td>20.62</td>
<td>5.00</td>
</tr>
<tr>
<td>Early Involvement</td>
<td>21.26</td>
<td>5.47</td>
</tr>
<tr>
<td>Relevant Statistics</td>
<td>20.99</td>
<td>5.40</td>
</tr>
<tr>
<td>Science as Social Experience</td>
<td>22.37</td>
<td>5.03</td>
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<tr>
<td>All Experiments Flawed</td>
<td>23.15</td>
<td>3.90</td>
</tr>
<tr>
<td>Varied Investigative Styles</td>
<td>20.06</td>
<td>5.38</td>
</tr>
<tr>
<td>Wedding Science</td>
<td>22.08</td>
<td>5.33</td>
</tr>
</tbody>
</table>

Note. All differences between studies are nonsignificant at the Bonferroni-adjusted .0056 significance level.
Table 6

Gender Differences of RTES-R Subscales

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Women M</th>
<th>SD</th>
<th>n</th>
<th>Men M</th>
<th>SD</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Modeling</td>
<td>23.46</td>
<td>5.30</td>
<td>198</td>
<td>24.78</td>
<td>4.67</td>
<td>87</td>
<td>2.00</td>
<td>283</td>
<td>.046</td>
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<td>Positive Reinforcement</td>
<td>20.05</td>
<td>4.99</td>
<td>198</td>
<td>22.06</td>
<td>4.69</td>
<td>87</td>
<td>3.19</td>
<td>283</td>
<td>.002*</td>
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<tr>
<td>Early Involvement</td>
<td>20.84</td>
<td>5.67</td>
<td>198</td>
<td>22.38</td>
<td>4.82</td>
<td>86</td>
<td>2.33</td>
<td>189</td>
<td>.021</td>
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<tr>
<td>Relevant Statistics</td>
<td>20.59</td>
<td>5.51</td>
<td>198</td>
<td>21.90</td>
<td>5.02</td>
<td>86</td>
<td>1.88</td>
<td>282</td>
<td>.061</td>
</tr>
<tr>
<td>Looking Inward</td>
<td>20.74</td>
<td>5.28</td>
<td>198</td>
<td>23.20</td>
<td>4.45</td>
<td>86</td>
<td>4.03</td>
<td>190</td>
<td>.000*</td>
</tr>
<tr>
<td>Social Experience</td>
<td>21.70</td>
<td>5.08</td>
<td>198</td>
<td>24.00</td>
<td>4.52</td>
<td>87</td>
<td>3.80</td>
<td>183</td>
<td>.000*</td>
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<tr>
<td>All Experiments Flawed</td>
<td>23.00</td>
<td>4.05</td>
<td>198</td>
<td>23.62</td>
<td>3.50</td>
<td>87</td>
<td>1.23</td>
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<td>5.42</td>
<td>198</td>
<td>21.87</td>
<td>4.84</td>
<td>86</td>
<td>3.74</td>
<td>282</td>
<td>.000*</td>
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<tr>
<td>Wedding Science</td>
<td>21.75</td>
<td>5.53</td>
<td>198</td>
<td>22.85</td>
<td>4.83</td>
<td>86</td>
<td>1.60</td>
<td>282</td>
<td>.110</td>
</tr>
</tbody>
</table>

Note. * indicates significant at the .0056 significance level.
Table 7

Differences in RTE Perceptions as a Function of Stage of Doctoral Program: Test Statistics

<table>
<thead>
<tr>
<th>Subscale</th>
<th>F</th>
<th>df</th>
<th>p</th>
<th>n²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Modeling</td>
<td>8.01</td>
<td>2, 281</td>
<td>.0004*</td>
<td>.05</td>
</tr>
<tr>
<td>Positive Reinforcement</td>
<td>9.97</td>
<td>2, 281</td>
<td>.0001*</td>
<td>.07</td>
</tr>
<tr>
<td>Early Involvement</td>
<td>14.49</td>
<td>2, 280</td>
<td>.0001*</td>
<td>.09</td>
</tr>
<tr>
<td>Relevant Statistics</td>
<td>10.45</td>
<td>2, 280</td>
<td>.0001*</td>
<td>.07</td>
</tr>
<tr>
<td>Looking Inward</td>
<td>5.98</td>
<td>2, 280</td>
<td>.0029*</td>
<td>.04</td>
</tr>
<tr>
<td>Social as a Social Experience</td>
<td>9.88</td>
<td>2, 281</td>
<td>.0001*</td>
<td>.06</td>
</tr>
<tr>
<td>All Experiments Flawed</td>
<td>2.94</td>
<td>2, 281</td>
<td>.0543</td>
<td>.02</td>
</tr>
<tr>
<td>Varied Investigative Styles</td>
<td>13.25</td>
<td>2, 280</td>
<td>.0001*</td>
<td>.09</td>
</tr>
<tr>
<td>Wedding Science and Practice</td>
<td>12.69</td>
<td>2, 280</td>
<td>.0001*</td>
<td>.08</td>
</tr>
</tbody>
</table>

Note. * indicates significant at the .0056 significance level.
Table 8

Differences in RTE Perceptions as a Function of Stage of Doctoral Program: Descriptive Statistics

<table>
<thead>
<tr>
<th>Stage of Doctoral Program</th>
<th>Beginning</th>
<th>Intermediate</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Faculty Modeling</td>
<td>25.44</td>
<td>4.43</td>
<td>22.85</td>
</tr>
<tr>
<td>Positive Reinforcement</td>
<td>22.33</td>
<td>4.35</td>
<td>19.49</td>
</tr>
<tr>
<td>Early Involvement</td>
<td>23.51</td>
<td>5.04</td>
<td>20.18</td>
</tr>
<tr>
<td>Relevant Statistics</td>
<td>22.76</td>
<td>4.58</td>
<td>20.43</td>
</tr>
<tr>
<td>Looking Inward</td>
<td>22.85</td>
<td>4.24</td>
<td>20.76</td>
</tr>
<tr>
<td>Social as a Social Experience</td>
<td>24.10</td>
<td>4.27</td>
<td>21.31</td>
</tr>
<tr>
<td>All Experiments Flawed</td>
<td>23.92</td>
<td>3.56</td>
<td>22.71</td>
</tr>
<tr>
<td>Varied Investigative Styles</td>
<td>22.16</td>
<td>4.44</td>
<td>19.13</td>
</tr>
<tr>
<td>Wedding Science and Practice</td>
<td>23.95</td>
<td>4.54</td>
<td>21.70</td>
</tr>
</tbody>
</table>

Note. n = 104 for Beginning (n = 105 for Faculty Modeling, Positive Reinforcement, Science as a Social Experience, and All Experiments Flawed); n = 93 for Intermediate; n = 86 for Advanced.
Results of the post-hoc Scheffé tests revealed several significant differences between groups. Beginning students reported more than did intermediate students that faculty model appropriate scientific behavior. Beginning students reported more than did advanced students that (a) relevant statistics are taught and (b) the wedding of science and practice is stressed. Finally, beginning students reported more than did either intermediate or advanced students that (a) positive reinforcement is given for research, (b) early involvement in research is stressed, (c) science is taught as a social experience, and (d) varied investigative styles are taught. All of these differences were significant at the .006 level.

Differences in perceptions of the RTE as a function of which of the 15 doctoral training sites the student was in were investigated via a MANOVA. This MANOVA was significant, Wilks' lambda = .20, F(126, 2008) = 3.77, p < .001, η^2 = .17. This significant MANOVA was followed by 9 one-way ANOVAs with alpha levels adjusted to .0056. As would be expected, doctoral training sites varied widely in their students' perceptions of the RTE. Table 9 illustrates the strength of these differences across RTE dimensions. Because the confidentiality of the training programs prohibits meaningful interpretation of the nature of these differences, post hoc analyses were not conducted.

Research self-efficacy. Based on an examination of the SERM subscale scores, students had the most confidence in practical research skills (M = 22.06, SD = 3.53, N = 284), followed by their writing skills (M = 20.66, SD = 4.18, N = 284) and their research design skills (M = 19.61, SD = 4.30, N = 284). Students had the least self-efficacy with respect to computer and quantitative skills (M = 17.02, SD = 5.67, N = 284). These within-participants differences were highly significant, F(3, 849) = 145.82, p < .001, η^2 = .34.

A MANOVA tested for gender differences across the four dimensions of research self-efficacy. This test was significant, Wilks' lambda = .91, F(4, 278) = 7.09, p < .001, η^2 = .09. Four t-tests with alpha levels of .0125 revealed gender differences in research self-efficacy on three of the four dimensions. As illustrated in Table 10, men reported higher self-efficacy
Table 9
Differences in RTE Perceptions as a Function of Doctoral Training Site

<table>
<thead>
<tr>
<th>Subscale</th>
<th>F</th>
<th>df</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Modeling</td>
<td>5.98</td>
<td>14, 270</td>
<td>.0001a</td>
<td>.23</td>
</tr>
<tr>
<td>Positive Reinforcement</td>
<td>1.79</td>
<td>14, 270</td>
<td>.0407</td>
<td>.09</td>
</tr>
<tr>
<td>Early Involvement</td>
<td>5.89</td>
<td>14, 269</td>
<td>.0001a</td>
<td>.23</td>
</tr>
<tr>
<td>Relevant Statistics</td>
<td>3.80</td>
<td>14, 269</td>
<td>.0001a</td>
<td>.17</td>
</tr>
<tr>
<td>Looking Inward</td>
<td>2.45</td>
<td>14, 269</td>
<td>.0029a</td>
<td>.11</td>
</tr>
<tr>
<td>Social as a Social Experience</td>
<td>5.14</td>
<td>14, 270</td>
<td>.0001a</td>
<td>.21</td>
</tr>
<tr>
<td>All Experiments Flawed</td>
<td>3.55</td>
<td>14, 270</td>
<td>.0001a</td>
<td>.15</td>
</tr>
<tr>
<td>Varied Investigative Styles</td>
<td>1.98</td>
<td>14, 269</td>
<td>.0195</td>
<td>.09</td>
</tr>
<tr>
<td>Wedding Science and Practice</td>
<td>2.14</td>
<td>14, 269</td>
<td>.0104</td>
<td>.10</td>
</tr>
</tbody>
</table>

Note. * indicates significant at the .0056 significance level.
Table 10

Gender Differences Among SERM Subscales

<table>
<thead>
<tr>
<th>SERM Subscale</th>
<th>Women</th>
<th></th>
<th>Men</th>
<th></th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Design Skills</td>
<td>19.01</td>
<td>4.37</td>
<td>20.95</td>
<td>3.84</td>
<td>3.57</td>
<td>.000a</td>
</tr>
<tr>
<td>Practical Research Skills</td>
<td>21.94</td>
<td>3.53</td>
<td>22.29</td>
<td>3.54</td>
<td>0.76</td>
<td>.448</td>
</tr>
<tr>
<td>Quant. &amp; Computer Skills</td>
<td>16.11</td>
<td>5.73</td>
<td>19.00</td>
<td>4.97</td>
<td>4.06</td>
<td>.000a</td>
</tr>
<tr>
<td>Writing Skills</td>
<td>20.15</td>
<td>4.32</td>
<td>21.81</td>
<td>3.65</td>
<td>3.12</td>
<td>.002a</td>
</tr>
</tbody>
</table>

Note. n = 197 for women; n = 86 for men; df = 281 for all tests; a indicates significant at the .0125 significance level.

than women in the areas of research design skills, quantitative and computer skills, and writing skills.

A MANOVA revealed that stage of doctoral program was also related to research self-efficacy, Wilks' lambda = .91, F(8, 552) = 3.27, p = .001, η² = .05. Univariate ANOVAs revealed relationships between stage of program and three dimensions of research self-efficacy: research design skills, practical research skills, and writing skills (see Table 11). Differences in the four dimensions of self-efficacy across stage of program are presented in Table 12.

Post-hoc Scheffé tests at the .013 alpha level found significant differences between students in different stages of their doctoral program. Advanced students reported greater research self-efficacy than did either beginning or intermediate students in the areas of practical research skills and writing skills. Advanced students also reported greater research self-efficacy with respect to research design skills than did beginning students.
Table 11

Differences in Research Self-Efficacy as a Function of Stage of Doctoral Program: Test Statistics

<table>
<thead>
<tr>
<th>SERM Subscale</th>
<th>F</th>
<th>df</th>
<th>p</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Design Skills</td>
<td>6.28</td>
<td>2,279</td>
<td>.0022*</td>
<td>.04</td>
</tr>
<tr>
<td>Practical Research Skills</td>
<td>9.23</td>
<td>2,279</td>
<td>.0001*</td>
<td>.06</td>
</tr>
<tr>
<td>Quantitative and Computer Skills</td>
<td>2.30</td>
<td>2,279</td>
<td>.1027</td>
<td>.02</td>
</tr>
<tr>
<td>Writing Skills</td>
<td>8.59</td>
<td>2,279</td>
<td>.0002*</td>
<td>.06</td>
</tr>
</tbody>
</table>

Note: * indicates significant at the .0125 significance level.

Table 12

Differences in Research Self-Efficacy as a Function of Stage of Doctoral Program: Descriptive Statistics

<table>
<thead>
<tr>
<th>SERM Subscale</th>
<th>Beginning</th>
<th>Intermediate</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Research Design Skills</td>
<td>18.80</td>
<td>4.82</td>
<td>19.26</td>
</tr>
<tr>
<td>Practical Research Skills</td>
<td>21.24</td>
<td>4.09</td>
<td>21.75</td>
</tr>
<tr>
<td>Quantitative and Computer Skills</td>
<td>16.06</td>
<td>5.81</td>
<td>17.34</td>
</tr>
<tr>
<td>Writing Skills</td>
<td>19.85</td>
<td>4.65</td>
<td>20.15</td>
</tr>
</tbody>
</table>

Note: n = 105 for Beginning; n = 91 for Intermediate; n = 86 for Advanced.
A MANOVA testing differences in research self-efficacy across training sites was conducted. This analysis was nonsignificant, Wilks' lambda = .76, \(F(56, 1029) = 1.31, p = .07, \eta^2 = .07\).

**Research interest.** Overall, respondents indicated a moderately high amount of interest in research. The sample averaged 13.64 (SD = 4.67) on a scale that ranged from 1 (little interest) to 20 (great interest). The average percent of time students hoped to devote to research in their future career was 27.69 (SD = 17.50).

Gender differences in (a) overall interest in research and (b) percent of time expected to devote to research in one's career after graduation were examined via a MANOVA. This MANOVA was significant, Wilks' lambda = .98, \(F(2, 281) = 3.19, p = .043, \eta^2 = .02\). Two t-tests with Bonferroni-adjusted alpha levels of .025 were then conducted to see on which measure women and men differed. Female and male students differed in terms of overall research interest, \(t(282) = 2.27, p = .024\), with women (\(M = 13.20, SD = 4.74, n = 197\)) reporting less interest in research than men (\(M = 14.55, SD = 4.35, n = 87\)). However, female and male students did not differ in terms of the percent of their time they hoped to devote to research in their career after graduation, \(t(282) = .68, p = .50\). Female students reported wanting to spend 27.18% (SD = 17.61, n = 197) and males reported wanting to spend 28.72% (SD = 17.35, n = 87) of their time in research activities.

A MANOVA tested whether stage of doctoral program was related to the two measures of research interest: overall interest in research and percent of time expected to devote to research in the career after graduation. The overall MANOVA was significant, Wilks' lambda = .94, \(F(4, 558) = 4.54, p = .001, \eta^2 = .03\). This MANOVA was followed by 2 one-way ANOVAs with adjusted alpha levels of .025. The first ANOVA revealed that research interest in general was related to stage of doctoral program, \(F(2, 280) = 6.16, p = .002, \eta^2 = .04\). The second ANOVA revealed that the percent of time students hoped to devote to research in one’s career also varied as a function of the students’ stage of their doctoral program, \(F(2,\)
The post-hoc Scheffé tests suggested the same pattern for each measure of interest: Beginning students reported significantly greater interest in research and reported wanting to spend a greater percent of their time in research activities in their careers than did Advanced students (ps < .013). Table 13 illustrates the means on these two variables for each stage of graduate training.

Table 13
Research Interest and Percent of Time Planning to Devote to Research in Career by Stage of Doctoral Program

<table>
<thead>
<tr>
<th>Stage of Doctoral Program</th>
<th>Beginning</th>
<th>Intermediate</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest Measure</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Self-Reported Research Interest</td>
<td>14.84</td>
<td>4.16</td>
<td>13.16</td>
</tr>
<tr>
<td>Percent of Time Devoting to Research</td>
<td>31.98</td>
<td>16.28</td>
<td>27.57</td>
</tr>
</tbody>
</table>

Note. n = 105 for Beginning; n = 92 for Intermediate; n = 86 for Advanced.

Investigation of differences in the two research-interest measures as a function of graduate training site was conducted via a MANOVA. This effect was significant, Wilks' lambda = .79, F(28, 534) = 2.37, p < .001, η² = .11. Two univariate ANOVAs with alpha levels of .025 were conducted. The ANOVA on research interest level revealed a pronounced effect, F(14, 268) = 2.47, p = .003, η² = .11, suggesting that students from different training sites have very different levels of research interest. Again, because of the confidentiality of the training programs, meaningful post hoc comparisons were not possible. A separate ANOVA revealed that training sites did not differ in the percent of time their
students hoped to devote to research after graduation $F(14, 268) = 1.69, \ p = .06, \ \eta^2 = .08$.

**Research productivity.** Recall that research productivity consisted of ten continuous and two categorical items (see Appendix D). As illustrated in Table 14, a depiction of the means of the ten continuous variables, research productivity was relatively low for this sample. The mode was 0 on each of the continuous measures displayed in Table 14. With respect to the two categorical items, 109 of the 283 students (39%) reported currently gathering data not related to their thesis or dissertation, and 80 of the 283 students (28%) reported currently conducting statistical analyses not related to their thesis or dissertation.

Because of the severe skew of the research productivity items, all hypothesis-testing analyses were conducted on the dichotomized items (see "Measures" section of Chapter 3 for a description of dichotomization procedure). Gender differences in research productivity were examined via 12 separate chi-square analyses with Bonferroni-adjusted alpha levels of

<table>
<thead>
<tr>
<th>Activity</th>
<th>M</th>
<th>SD</th>
<th>Maximum</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Published Manuscripts</td>
<td>0.68</td>
<td>1.17</td>
<td>7</td>
<td>285</td>
</tr>
<tr>
<td>Unpublished Manuscripts</td>
<td>1.15</td>
<td>1.59</td>
<td>10</td>
<td>284</td>
</tr>
<tr>
<td>Manuscripts Submitted</td>
<td>0.82</td>
<td>1.41</td>
<td>10</td>
<td>284</td>
</tr>
<tr>
<td>Manuscripts Preparing to Submit</td>
<td>0.78</td>
<td>1.07</td>
<td>11</td>
<td>284</td>
</tr>
<tr>
<td>Presentations Given</td>
<td>2.03</td>
<td>3.93</td>
<td>50</td>
<td>284</td>
</tr>
<tr>
<td>Presentations Preparing to Submit</td>
<td>0.50</td>
<td>0.86</td>
<td>6</td>
<td>284</td>
</tr>
<tr>
<td>Conferences Attended</td>
<td>3.11</td>
<td>4.40</td>
<td>30</td>
<td>283</td>
</tr>
<tr>
<td>Case Studies of Clients</td>
<td>3.34</td>
<td>7.69</td>
<td>80</td>
<td>280</td>
</tr>
<tr>
<td>Program Evaluations</td>
<td>1.12</td>
<td>3.59</td>
<td>50</td>
<td>282</td>
</tr>
<tr>
<td>Informal Comparative Counseling Outcomes</td>
<td>0.60</td>
<td>1.94</td>
<td>25</td>
<td>276</td>
</tr>
</tbody>
</table>
.0042. None of the analyses were significant, \( p_s > .01 \).

Twelve chi-square analyses (alpha levels of .0042) were conducted to assess differences in research productivity as a function of stage of doctoral program. The results revealed that six of the twelve chi-square analyses were significant. Specifically, stage of program (collapsed into three categories) was significantly related to being an author of an unpublished empirical manuscript, \( \chi^2(2, N = 282) = 12.64, p = .002 \), having had submitted a manuscript for publication, \( \chi^2(2, N = 282) = 14.48, p = .001 \), having made a presentation at a research convention, \( \chi^2(2, N = 282) = 19.15, p < .0001 \), having attended a research convention, \( \chi^2(2, N = 281) = 18.90, p < .0001 \), having conducted a case study of a client, group, or consultation, \( \chi^2(2, N = 278) = 16.42, p = .0003 \), and currently collecting data, \( \chi^2(2, N = 281) = 15.10, p = .0005 \). Table 15 illustrates the frequencies with which students across the three stages of graduate training reported involvement in these six activities. As indicated by Table 15, research productivity increased as a function of stage of graduate training with the exception of "currently collecting data"; this activity was most commonly reported by beginning students and least by advanced students.

**Career goals.** As illustrated in Table 16, respondents reported being interested in a variety of occupations within the domain of counseling psychology. Private practice was the most common first choice for graduate students, followed by both an academic job in a small college and a position in a counseling center. Research positions (academic jobs and research facility) were not as sought after as were applied positions (counseling center, VA hospital, community mental health center, and private practice). Whereas 29% indicated that a research position was their first choice, 54% of the sample indicated that an applied position was their first choice. The mean of the weighted variable reflecting the student's intentions to pursue a science-related career (ranging from 0 to 6, with higher numbers indicating more science-related career goals) was 1.72 (SD = 1.77, \( N = 278 \)).
<table>
<thead>
<tr>
<th>Stage of Doctoral Program</th>
<th>Beginning</th>
<th></th>
<th>Intermediate</th>
<th></th>
<th>Advanced</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Authored an unpublished manuscript</td>
<td>40</td>
<td>38.1</td>
<td>54</td>
<td>58.7</td>
<td>52</td>
<td>61.2</td>
</tr>
<tr>
<td>Submitted a manuscript for publication</td>
<td>31</td>
<td>29.5</td>
<td>35</td>
<td>38.0</td>
<td>48</td>
<td>56.5</td>
</tr>
<tr>
<td>Made a presentation at a convention</td>
<td>46</td>
<td>43.8</td>
<td>54</td>
<td>58.7</td>
<td>64</td>
<td>75.3</td>
</tr>
<tr>
<td>Attended a research convention</td>
<td>61</td>
<td>58.1</td>
<td>66</td>
<td>71.7</td>
<td>73</td>
<td>86.9</td>
</tr>
<tr>
<td>Conducted a case study</td>
<td>44</td>
<td>42.7</td>
<td>49</td>
<td>53.3</td>
<td>60</td>
<td>72.3</td>
</tr>
<tr>
<td>Currently collecting data</td>
<td>52</td>
<td>49.5</td>
<td>38</td>
<td>41.8</td>
<td>19</td>
<td>22.4</td>
</tr>
</tbody>
</table>

Note. n = 105 for Beginning (n = 103 for "conducted a case study"); n = 92 for Intermediate (n = 91 for "currently collecting data"); n = 85 for Advanced (n = 84 for "attended a research convention" and n = 83 for "conducted a case study").
Table 16

Career Goals of Counseling Psychology Graduate Students

<table>
<thead>
<tr>
<th>Setting</th>
<th>First Choice</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Academic (large university)</td>
<td>29</td>
<td>10.4</td>
<td>35</td>
<td>12.5</td>
<td>29</td>
<td>10.4</td>
<td></td>
</tr>
<tr>
<td>Academic (small college)</td>
<td>44</td>
<td>15.7</td>
<td>39</td>
<td>13.9</td>
<td>42</td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td>Counseling center</td>
<td>44</td>
<td>15.7</td>
<td>49</td>
<td>17.5</td>
<td>50</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td>Veterans Affairs Hospital</td>
<td>6</td>
<td>2.1</td>
<td>17</td>
<td>6.1</td>
<td>15</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Research facility</td>
<td>8</td>
<td>2.9</td>
<td>5</td>
<td>1.8</td>
<td>12</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Government agency</td>
<td>3</td>
<td>1.1</td>
<td>8</td>
<td>2.9</td>
<td>13</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>3</td>
<td>1.1</td>
<td>9</td>
<td>3.2</td>
<td>6</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Community Mental Health Center</td>
<td>32</td>
<td>11.4</td>
<td>34</td>
<td>12.1</td>
<td>38</td>
<td>13.7</td>
<td></td>
</tr>
<tr>
<td>Private Practice</td>
<td>70</td>
<td>25.0</td>
<td>47</td>
<td>16.8</td>
<td>41</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>Full-time Consultation</td>
<td>10</td>
<td>3.6</td>
<td>26</td>
<td>9.3</td>
<td>20</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>31</td>
<td>11.1</td>
<td>11</td>
<td>3.9</td>
<td>12</td>
<td>4.3</td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 280 except for third choice (n = 278).
In order to conduct chi-square analyses assessing the relationships between career goals and other variables, some of the categories within employment choice needed to be collapsed in order to meet the requirement of 5 observations per cell. As discussed in the Measures section of Chapter 3, employment choice was collapsed from 11 to 3 categories: academic settings (large university and small college) and a research facility were collapsed into a category named Research Setting; counseling center, Veterans Affairs hospital, community mental health center, and private practice were collapsed into a category called Practice Setting; and all other categories were collapsed into a category called Combined/Other Setting.

Three 3 x 2 chi-square analyses were conducted to assess differences in career goals between men and women. A Bonferroni adjustment reduced the alpha level to .0167. Men and women did not differ in their first choices for employment setting, $\chi^2(2, N = 278) = 0.69, p = .71$. However, they did differ in their second choice, $\chi^2(2, N = 277) = 9.27, p = .0097$. These choices are presented in Table 17. The greatest contribution to the significant chi-square value was the larger-than-expected number of men who sought a research position.

Table 17

<table>
<thead>
<tr>
<th>Setting</th>
<th>Women</th>
<th>Men</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Research</td>
<td>45</td>
<td>23.3</td>
<td>34</td>
</tr>
<tr>
<td>Practice</td>
<td>111</td>
<td>57.5</td>
<td>34</td>
</tr>
<tr>
<td>Combined/Other</td>
<td>37</td>
<td>19.2</td>
<td>17</td>
</tr>
</tbody>
</table>

Note. n = 193 for women, n = 85 for men, N = 278 total.
as their second choice. No gender differences were observed for third choice of employment setting, \( \chi^2(2, N = 276) = 0.29, p = .87 \).

The relationships between stage of doctoral program and employment choices were examined via three chi-square analyses with Bonferroni-adjusted alpha levels of .0167. As before, stage of doctoral program consisted of three categories (beginning, intermediate, and advanced students). Students' first choice of a career was related to their stage of doctoral training, \( \chi^2(4, N = 277) = 13.70, p = .0083 \). Table 18 illustrates these differences. The

Table 18
First Choice of Employment Setting by Stage of Doctoral Program

<table>
<thead>
<tr>
<th>Setting</th>
<th>Beginning Students</th>
<th>Intermediate Students</th>
<th>Advanced Students</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>39 38.2</td>
<td>25 27.5</td>
<td>14 16.7</td>
<td>78 28.2</td>
</tr>
<tr>
<td>Practice</td>
<td>53 52.0</td>
<td>49 53.8</td>
<td>50 59.5</td>
<td>152 54.9</td>
</tr>
<tr>
<td>Combined/Other</td>
<td>10  9.8</td>
<td>17 18.7</td>
<td>20 23.8</td>
<td>47 17.0</td>
</tr>
</tbody>
</table>

Note, \( n = 102 \) for beginning students, \( n = 91 \) for intermediate students, \( n = 84 \) for advanced students, \( N = 277 \) total.

greatest contribution to the significant chi-square value was the fewer-than-expected number of advanced students who reported seeking a research career as their first choice for employment. The relationship between stage of graduate training and second choice, \( \chi^2(4, N = 277) = 4.23, p = .38 \), and third choice of a career, \( \chi^2(4, N = 275) = 2.39, p = .66 \), were nonsignificant.
Factor Analyses

A series of exploratory and confirmatory factor analyses were conducted in order to uncover and confirm the factor structures of the measures used in the structural equation modeling. Specifically, factor analyses were conducted on the Holland-personality measure (i.e., the VPI-B), the RTE measure (i.e., the RTES-R), the research self-efficacy measure (i.e., the SERM), and the research-productivity items.

An exploratory factor analysis (EFA) was conducted on the 12 research productivity items to uncover previously unexplored dimensions of research productivity in counseling psychology graduate students. This EFA was also necessary to develop indicator variables for the structural equation model. The results of this EFA are presented first in this section.

Confirmatory factor analyses (CFAs) were conducted on the Social and Investigative subscales of the VPI-B, the RTES-R, and the SERM as a prelude to structural equation modeling. A second-order confirmatory factor analysis was performed on the RTES-R in order to reduce the number of indicator variables of the RTES-R construct, thereby potentially improving the fit of the measurement model in the latent variable modeling. In addition, conducting a second-order factor analysis on the RTES-R was useful because it allowed an examination of how the nine theorized RTES-R factors fit together. The CFAs for the VPI-B, the RTES-R, and the SERM are presented after the research-productivity EFA.

Research productivity exploratory factor analysis. An exploratory factor analysis was conducted on the research productivity scale in order to identify dimensions of research productivity in which counseling psychology graduates students are involved. Because of the severe skew among the items (refer back to Table 14), each research-productivity item was dichotomized as 0 or 1, where a 1 indicated that the student had some involvement in the particular research activity, no matter how little or how much. A principal axis factoring (PAF) approach yielded a scree test suggesting that three factors should be extracted. The eigenvalues of the twelve initial factors are presented in Table 19.
Table 19

Initial Statistics From Exploratory Factor Analysis of Research Productivity Items

<table>
<thead>
<tr>
<th>Factor</th>
<th>Eigenvalue</th>
<th>Percent of Variance</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.72804</td>
<td>22.7</td>
<td>22.7</td>
</tr>
<tr>
<td>2</td>
<td>1.65642</td>
<td>13.8</td>
<td>36.5</td>
</tr>
<tr>
<td>3</td>
<td>1.44279</td>
<td>12.0</td>
<td>48.6</td>
</tr>
<tr>
<td>4</td>
<td>1.01093</td>
<td>8.4</td>
<td>57.0</td>
</tr>
<tr>
<td>5</td>
<td>0.95866</td>
<td>8.0</td>
<td>65.0</td>
</tr>
<tr>
<td>6</td>
<td>0.83763</td>
<td>7.0</td>
<td>72.0</td>
</tr>
<tr>
<td>7</td>
<td>0.75478</td>
<td>6.3</td>
<td>78.2</td>
</tr>
<tr>
<td>8</td>
<td>0.66301</td>
<td>5.5</td>
<td>83.8</td>
</tr>
<tr>
<td>9</td>
<td>0.62651</td>
<td>5.2</td>
<td>89.0</td>
</tr>
<tr>
<td>10</td>
<td>0.55418</td>
<td>4.6</td>
<td>93.6</td>
</tr>
<tr>
<td>11</td>
<td>0.41473</td>
<td>3.5</td>
<td>97.1</td>
</tr>
<tr>
<td>12</td>
<td>0.35233</td>
<td>2.9</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Because dimensions of research productivity were expected to be correlated, an oblique rotation was applied to a three-factor solution. Although the three factors accounted for only 32.2% of the variance among the items, solutions with more than three factors were not interpretable. Thus, the three-factor model was retained. The rotated factor matrix is presented in Table 20 (note that the pattern matrix illustrating factor loadings controlling for the other factors is presented). The three factors were labeled Past Research Productivity, Current Research Involvement, and Research in Clinical Practice. These three factors were slightly correlated: Past Research Productivity and Current Research Involvement, \( r = .26 \); Past Research Productivity and Research in Clinical Practice, \( r = .14 \); and Current Research Involvement and Research in Clinical Practice, \( r = .20 \).

VPI-B confirmatory factor analysis. The CFA on the VPI-B was conducted via the LISREL 8 program (Jöreskog & Sörbom, 1993). This program is useful for testing the fit of factor structures because it provides a means of assessing the "goodness" of model fit. The goodness of fit of latent variable models (i.e., CFA and structural equation models) to data may be assessed in a number of ways. The \( \chi^2 \) statistic is typically reported as a goodness-of-fit indicator, with a nonsignificant \( \chi^2 \) value suggesting a good fit to the data. The difference (\( \Delta \)) between the \( \chi^2 \) values of two nested models may also be interpreted as a \( \chi^2 \), thus enabling one to compare the fit between the two models (Anderson & Gerbing, 1988; Bentler & Bonett, 1980; Bollen, 1989). In this case, a significant difference between the two \( \chi^2 \) values suggests that one model fits the data better than the other. Despite being a good measure of relative fit, the \( \chi^2 \) statistic is not a good measure of overall model fit because of the influence that sample size (i.e., the higher the sample size the higher the value of the \( \chi^2 \) statistic) and distribution of the variables have on it. Thus, indices such as the Goodness-of-Fit Index (GFI) and the Comparative Fit Index (CFI) have been proposed and commonly used as alternatives to the \( \chi^2 \) statistic when assessing overall model fit (see Bentler, 1990; Bollen,
Table 20

**Factor Loadings (Pattern Matrix) of Research Productivity Items (Oblique Rotation)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Past Research Productivity</th>
<th>Current Research Involvement</th>
<th>Research in Clinical Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authored a published manuscript</td>
<td>.67</td>
<td>-.05</td>
<td>-.14</td>
</tr>
<tr>
<td>Authored an unpublished manuscript</td>
<td>.38</td>
<td>.13</td>
<td>.12</td>
</tr>
<tr>
<td>Submitted an article for publication</td>
<td>.82</td>
<td>-.05</td>
<td>-.13</td>
</tr>
<tr>
<td>Presented at a convention</td>
<td>.52</td>
<td>.09</td>
<td>.09</td>
</tr>
<tr>
<td>Attended a research convention</td>
<td>.47</td>
<td>.02</td>
<td>.20</td>
</tr>
<tr>
<td>Currently preparing an article for publication</td>
<td>.14</td>
<td>.46</td>
<td>-.06</td>
</tr>
<tr>
<td>Currently preparing a presentation</td>
<td>-.08</td>
<td>.63</td>
<td>.03</td>
</tr>
<tr>
<td>Currently gathering data</td>
<td>-.02</td>
<td>.45</td>
<td>.03</td>
</tr>
<tr>
<td>Currently conducting statistical analyses</td>
<td>.01</td>
<td>.57</td>
<td>-.05</td>
</tr>
<tr>
<td>Conducted a case study of client or group</td>
<td>.09</td>
<td>-.13</td>
<td>.61</td>
</tr>
<tr>
<td>Participated in a program evaluation</td>
<td>.11</td>
<td>.08</td>
<td>.44</td>
</tr>
<tr>
<td>Participated in informal outcome study</td>
<td>-.11</td>
<td>.03</td>
<td>.40</td>
</tr>
</tbody>
</table>

**Note.** Items are dichotomized to reflect no involvement versus some involvement; loadings presented in bold reflect the highest loading for each item.
The GFI reflects the proportion of variance in the data that can be explained by the theoretical model (Bollen, 1989). In other words, the GFI is analogous to a model $R^2$. The CFI, on the other hand, reflects the difference in fit between two nested models, and it is relatively unaffected by sample size (Bentler, 1990). The range of possible values of the GFI and CFI is from 0 to 1, with a higher number representing a better fit to the data. Using these indicators, a good fit to the data in latent variable analyses would be suggested by a GFI and CFI of .90 or above. The $\chi^2$ statistic, the GFI, and the CFI were reported as goodness-of-fit indicators in the CFA of the VPI-B and in subsequent CFAs.

Two factor structures were tested for the VPI-B in order to compare the relative fit. Model 1 tested a model with one factor called \textit{Vocational Preferences} on which all 14 items loaded. This model essentially suggests that Social and Investigative items on the VPI-B could not be discriminated. Model 2 tested a model with two correlated factors termed \textit{Investigative} and \textit{Social}. The 7 Investigative items were specified to load on the Investigative factor, whereas the 7 Social items were specified to load on the Social factor. All other factor loadings were constrained to equal 0. This is the factor structure one would expect; the factor analysis should be able to discriminate between Social and Investigative items. Although an empirical examination of the raw-score VPI-B subscales failed to reveal a correlation, correlated factors were tested because of the theoretical association between the two constructs (Holland, 1985a, 1985b). It was expected that Model 2 would fit significantly better than Model 1.

Model 1 provided a poor fit to the data, $\chi^2(77, N = 261) = 1285.30$, GFI = .62, CFI = .26. Model 2, which specified two factors, also provided a poor fit to the data, $\chi^2(76, N = 261) = 1006.30$, GFI = .70, CFI = .43. However, the two-factor model represented a significant improvement over Model 1, $\Delta\chi^2(1, N = 261) = 279.00$, $p < .001$. Table 21 illustrates the factor loadings from Model 2. These two latent factors were slightly negatively correlated, $r = -.20$. 

1989; Hu, Bentler, & Kano, 1992; Mulaik et al., 1989).
Table 21

Factor Loadings for VPI-B Subscales from Confirmatory Factor Analysis

<table>
<thead>
<tr>
<th>Item</th>
<th>Investigative</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemist</td>
<td>.63</td>
<td>--</td>
</tr>
<tr>
<td>Astronomer</td>
<td>.75</td>
<td>--</td>
</tr>
<tr>
<td>Editor of Scientific Journal</td>
<td>.22</td>
<td>--</td>
</tr>
<tr>
<td>Meteorologist</td>
<td>.81</td>
<td>--</td>
</tr>
<tr>
<td>Independent Research Scientist</td>
<td>.27</td>
<td>--</td>
</tr>
<tr>
<td>Scientific Research Worker</td>
<td>.21</td>
<td>--</td>
</tr>
<tr>
<td>Zoologist</td>
<td>.58</td>
<td>--</td>
</tr>
<tr>
<td>Youth Camp Director</td>
<td>--</td>
<td>.69</td>
</tr>
<tr>
<td>Vocational Counselor</td>
<td>--</td>
<td>.25</td>
</tr>
<tr>
<td>Social Science Teacher</td>
<td>--</td>
<td>.47</td>
</tr>
<tr>
<td>School Principal</td>
<td>--</td>
<td>.73</td>
</tr>
<tr>
<td>High School Teacher</td>
<td>--</td>
<td>.86</td>
</tr>
<tr>
<td>Director of Welfare Agency</td>
<td>--</td>
<td>.41</td>
</tr>
<tr>
<td>Clinical Psychologist</td>
<td>--</td>
<td>.10</td>
</tr>
</tbody>
</table>

Note. N = 261.
**RTES-R confirmatory factor analysis.** A second-order factor analysis was conducted on the RTES-R. Before conducting the CFA on the RTES-R, either a theoretical or an empirical basis for determining a second-order factor structure needed to be established. Because no theoretical basis was available, an EFA was performed on data from Gelso et al.'s (1996) study of 173 graduate students in counseling, clinical, or school psychology from four universities. Demographic characteristics of Gelso et al.'s sample were similar to those of the present sample. Gelso et al.'s data were used to conduct an EFA at the subscale level by using subscale totals as the input data. This approach essentially amounts to an exploratory second-order factor analysis, using the first-order factors as manifest variables (i.e., measurement error is incorporated into the first-order factors).

A principal-axis exploratory factor analysis was conducted on the nine subscale scores from the RTES-R using Gelso et al.'s (1996) data. Subscale scores were computed based on the mean of the six items comprising each subscale. The scree test suggested that two factors should be extracted. Final estimates indicated that the two factors explained 57.9% of the variance. Due to the high correlation between the two factors, an oblique rotation was conducted. Rotated factor loadings are presented in Table 22. As can be seen from the table, the nine subscales fit neatly into the two factors, labeled Interpersonal and Instructional factors. The two factors were highly correlated ($r = .70$).

Based on the analysis of Gelso et al.'s (1996) data, a second-order CFA was conducted on the present data. This CFA was designed to replicate the factor structure depicted in Table 22. Leading researchers in the area of latent variable modeling such as Bentler and Chou (1987) have suggested that a minimum of 5 observations per estimated parameter is necessary in latent variable modeling, and 10 observations per parameter is optimal. Although confirming the loadings of all 54 items would have been ideal, such an analysis would have required a sample of at least 600 observations. Thus, in order to reduce problems associated with the small sample size, pairs of items within each subscale were
Table 22

Second-Order Factor Loadings for RTES-R Subscales from Exploratory Factor Analysis
(Oblique Rotation) of Gelso, Mallinckrodt, and Judge (1996) Data

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Interpersonal</th>
<th>Instructional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Involvement (El)</td>
<td>.64</td>
<td>.18</td>
</tr>
<tr>
<td>Faculty Modeling (FM)</td>
<td>.85</td>
<td>-.05</td>
</tr>
<tr>
<td>Positive Reinforcement (PR)</td>
<td>.75</td>
<td>.13</td>
</tr>
<tr>
<td>Science as Social Experience (SS)</td>
<td>.86</td>
<td>-.03</td>
</tr>
<tr>
<td>All Experiments Flawed (EF)</td>
<td>.22</td>
<td>.48</td>
</tr>
<tr>
<td>Looking Inward (LI)</td>
<td>.25</td>
<td>.53</td>
</tr>
<tr>
<td>Teaching Relevant Statistics (RS)</td>
<td>-.12</td>
<td>.67</td>
</tr>
<tr>
<td>Varied Investigative Styles (VI)</td>
<td>.07</td>
<td>.76</td>
</tr>
<tr>
<td>Wedding Science and Practice (WS)</td>
<td>.11</td>
<td>.67</td>
</tr>
</tbody>
</table>

Note. N = 173; subscale scores are manifest variables computed by averaging the six items that comprise each subscale; loadings presented in bold reflect the highest loading for each item.
aggregated. This aggregation was based on nine separate factor analyses on each subscale that forced all six subscale items to load on one factor. The items with the highest and lowest loadings were combined, as were the items with the next highest and lowest loadings, and so on. This technique was designed to result in homogeneity with respect to item-to-factor correlation across the three aggregated indicators of each subscale/factor.

Following this aggregation, four CFA models were examined. Model 1 specified the nine factors as independent (orthogonal) factors. Given the high correlations among the factors (Gelso et al., 1996), it was expected that this model would have had the poorest fit. Model 2 allowed the nine factors to correlate with one another. This model should have had the best fit to the data. Two additional, second-order models were then tested. Model 3 hypothesized one second-order factor called Research Training Environment on which all nine first-order factors loaded, whereas Model 4 tested the hypothesized model with two second-order factors termed Instructional and Interpersonal. Model 4 is consistent with the model suggested by the earlier EFA. It was hypothesized that Model 4 would fit slightly better than Model 3, and only slightly less well than Model 2.

As hypothesized, Model 1 did not represent a good fit to the data, $\chi^2(324, N = 270) = 2191.80$, GFI = .49, CFI = .55. Model 2, which allowed factors to correlate, fit the data much better, $\chi^2(288, N = 270) = 664.86$, GFI = .85, CFI = .91. This second model represented a significant improvement over Model 1, $\Delta \chi^2(36, N = 270) = 1527.94$, $p < .001$. It seemed clear that allowing correlations among the factors resulted in the improvement in fit. However, based on the GFI, the fit of the overall model was not optimal.

Model 3 tested a second-order factor structure with one second-order factor, whereas Model 4 tested a model with two second-order factors. Both models converged with improper solutions. Specifically, Model 3 revealed a "Heywood case" (a negative variance estimate), and Model 4 revealed a Heywood case and a correlation greater than 1.0. Such improper solutions often suggest model misspecification or extreme outliers in the sample,
although it is also likely that extremely high correlations among the latent variables may be responsible for these solutions (Bentler & Chou, 1987; Bollen, 1989). This latter explanation seems most plausible given the high correlations observed among the first-order latent factors. Thus, although the two-factor model may help to explain the correlations among the first-order factors, that hypothesis could not be tested using this method.

Because of the difficulty in interpreting the second-order factor loadings in the previous models, an alternative approach to estimating the second-order factor structure was undertaken. This approach was a CFA conducted at the subscale level. Although this analysis (erroneously) assumed perfect measurement of the nine subscales, it was useful in that it was able to provide a better portrait of the factor structure of the nine subscales as measured by the 54 RTES-R items. In addition, this analysis more closely paralleled the EFA described earlier, thus facilitating comparison across the two analyses.

Table 23 illustrates the factor loadings of the nine subscales onto the two second-order factors. This model fit the data very well, \( \chi^2(26, N = 270) = 91.24, GFI = .93, CFI = .95 \). The two latent second-order factors were highly correlated in this model, \( r = .86 \). A similar model forcing all nine manifest factors onto one second-order factor was also run, \( \chi^2(27, N = 270) = 146.24, GFI = .88, CFI = .91 \). Despite the high correlation between the two factors, the model with two second-order factors fit much better than did the one-factor model, \( \Delta \chi^2(1, N = 270) = 54.00, p < .001 \).

SERM confirmatory factor analysis. Two factor structures were tested for the SERM. Model 1 tested a model with one factor called Research Self-Efficacy on which all 12 items loaded, whereas Model 2 tested the hypothesized model with four correlated factors termed Practical Research Skills, Research Design Skills, Quantitative and Computer Skills, and Writing Skills. Three items corresponding to their respective subscale were specified to load on each factor; all other loadings were fixed to 0. A model with correlated factors was favored over a model with orthogonal factors because of the theoretical associations.
Table 23

Second-Order Factor Loadings for Confirmatory Factor Analysis on RTES-R Manifest

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Factor</th>
<th>Interpersonal</th>
<th>Instructional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Involvement (EI)</td>
<td>Factor</td>
<td>.80</td>
<td>--</td>
</tr>
<tr>
<td>Faculty Modeling (FM)</td>
<td>Factor</td>
<td>.80</td>
<td>--</td>
</tr>
<tr>
<td>Positive Reinforcement (PR)</td>
<td>Factor</td>
<td>.86</td>
<td>--</td>
</tr>
<tr>
<td>Science as Social Experience (SS)</td>
<td>Factor</td>
<td>.87</td>
<td>--</td>
</tr>
<tr>
<td>All Experiments Flawed (EF)</td>
<td></td>
<td>--</td>
<td>.66</td>
</tr>
<tr>
<td>Looking Inward (LI)</td>
<td></td>
<td>--</td>
<td>.74</td>
</tr>
<tr>
<td>Teaching Relevant Statistics (RS)</td>
<td></td>
<td>--</td>
<td>.54</td>
</tr>
<tr>
<td>Varied Investigative Styles (VI)</td>
<td></td>
<td>--</td>
<td>.80</td>
</tr>
<tr>
<td>Wedding Science and Practice (WS)</td>
<td></td>
<td>--</td>
<td>.73</td>
</tr>
</tbody>
</table>

Note. N = 270.

among dimensions of research self-efficacy (Phillips & Russell, 1994). Because the SERM is designed to measure four factors of research self-efficacy, it was expected that Model 2 would fit significantly better than Model 1.

Model 1 provided a poor fit to the data, $\chi^2(54, N = 283) = 431.56$, GFI = .77, CFI = .77. Model 2, which specified four correlated factors of research self-efficacy, provided a very good fit to the data, $\chi^2(48, N = 283) = 180.02$, GFI = .90, CFI = .92. This four-factor model was a substantial improvement over Model 1, $\Delta \chi^2(6, N = 283) = 251.54, p < .001$. Table 24 illustrates the factor loadings from Model 2. Table 25 illustrates the correlations among the latent factors from Model 2.
<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
<th>RDS</th>
<th>PRS</th>
<th>QCS</th>
<th>WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designing an experiment using traditional methods</td>
<td></td>
<td>.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formulating hypotheses</td>
<td></td>
<td>.67</td>
<td></td>
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<tr>
<td>Operationalizing variables of interest</td>
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<tr>
<td>Keeping records during a research project</td>
<td></td>
<td>.36</td>
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<tr>
<td>Utilizing resources for needed help</td>
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<tr>
<td>Defending a thesis or dissertation</td>
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<td></td>
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<tr>
<td>Understanding computer printouts</td>
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<td></td>
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<tr>
<td>Using multivariate statistics</td>
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<td>.84</td>
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<tr>
<td>Using statistical packages</td>
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<tr>
<td>Writing the introduction and literature review for a dissertation</td>
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<tr>
<td>Writing the introduction and discussion sections for publication</td>
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<td>.78</td>
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</tr>
<tr>
<td>Writing the methods and results sections of a thesis</td>
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<td>.68</td>
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</tr>
</tbody>
</table>

*Note. N = 261; some items in this table have been shortened from their original wording.*
Table 25

Correlations Among SERM Latent Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>RDS</th>
<th>PRS</th>
<th>QCS</th>
<th>WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Design Skills (RDS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practical Research Skills (PRS)</td>
<td>.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative and Computer Skills (QCS)</td>
<td>.77</td>
<td>.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing Skills (WS)</td>
<td>.78</td>
<td>.88</td>
<td>.48</td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 261; all correlations significant (p < .01).

Model Estimation

Structural equation modeling with latent variables was used to test the goodness-of-fit of the hypothesized model via the LISREL 8 program's (Jöreskog & Sörbom, 1993) maximum-likelihood procedure. The use of latent variables (i.e., factors) as opposed to manifest (i.e., observed) variables in testing a causal model allows for the removal of random measurement error from the model, error that often attenuates path coefficients in ordinary least squares regression. The LISREL program simultaneously estimates the measurement and structural components of a model based on the variances and covariances of the observed variables, yielding a goodness-of-fit test of the model to the data. In the present study, the hypothesized model consisted of 8 constructs: Holland personality, perceptions of the RTE, gender, year in the doctoral program, research interest, research self-efficacy, research productivity, and career goals.

In the initial model tested, these 8 constructs were operationalized via 17 measured variables. Holland personality was composed of three dummy-coded variables reflecting the
four groups described earlier: a High-Investigative/High-Social group, a High-Investigative/Low-Social group, a Low-Investigative/High-Social group, and a Low-Investigative/Low-Social group. In order to reflect membership in these groups, a variable called High-Investigative/High-Social (HI/HS) was created, whereby a score of 1 on this variable reflected inclusion in this group; a score of 0 reflected inclusion in one of the three other groups. Likewise, a dichotomous variable called High-Investigative/Low-Social (HI/LS) was created with the same scoring scheme. Finally, a third dichotomous variable called Low-Investigative/High-Social (LI/HS) was created. Because of the nature of these dummy-coded variables, a participant with a score of 0 on all three of these new variables was a member of the Low-Investigative/Low-Social group.

Perceptions of the RTE were measured by the two second-order constructs determined by the factor analyses described earlier. These two factors, Instructional aspects (RTE-Str) and Interpersonal (RTE-Per) aspects of the RTE, were used as the two indicator variables of the latent construct RTE. The nine RTE subscale totals were specified to load on the Instructional and Interpersonal factors as indicated in Table 23. Both gender and number of years in the doctoral program were treated as single indicators of their respective constructs. Gender was coded such that female = 1 and male = 0; year in program was coded such that all fifth-year, sixth-year, internship, or post-internship students were collapsed into one category (resulting in a total of 5 categories of year in program) in order to keep this measure continuous. Research interest was measured by two indicators: the sum of the four self-reported research-interest items (Int-SR) and the percent of time the student plans to spend in research in one's career (Int-P). Research self-efficacy was measured by the four subscale scores of the SERM: research design skills (RDS), practical research skills (PRS), quantitative and computer skills (QCS), and writing skills (WS). Research productivity was measured by the three factors determined by the earlier factor analysis: past research productivity (PRP), current research involvement (CRI), and research in clinical practice
(RCP). These factor scores were created by summing the dichotomous items within each factor. Finally, career goals were measured by the weighted sum of the three career choices (see p. 39). Figure 2 illustrates the hypothesized relationships among the constructs. It should be noted that, although only 8 latent constructs were modeled, the Holland-personality construct required three separate latent variables in order to be tested. As such, the model technically tested the fit of 17 indicators to 10 latent constructs. In addition, note that abbreviations for the indicator variables presented here were used throughout this section of Chapter 4.

Measurement model. The first step in testing the fit of a model is to assess the fit of the indicator variables to their latent factors (Bollen, 1989). This is, in essence, a confirmatory factor analysis on all of the measures. The fit of the 17 measured variables to the 10 latent constructs was tested. All factor loadings of the single indicators of latent constructs (the three Holland variables, gender, year in program, and career goals) were fixed to 1 and their error terms were fixed to 0 (i.e., suggesting perfect measurement). Moreover, all correlations among the latent constructs were freed, thereby allowing all relationships among the constructs to be estimated as part of the measurement model. As such, the measurement model should only deviate from the true nature of the data to the extent that constructs are imprecisely measured.

The LISREL 8 program suggested that the fit of the model was very good, $\chi^2(80, N = 267) = 186.98$, GFI = .93, CFI = .93. However, an examination of the factor loadings revealed that the research-in-clinical-practice dimension of the research-productivity construct was not highly correlated with the latent construct. Specifically, the factor loading was only .27, as compared with .46 and .50 for current research involvement and past research productivity, respectively. Thus, a new measurement model was tested. This new model specified only two measured indicators of research productivity (PRP and CRI) in order to purify the measurement of the research-productivity latent construct.
Figure 2. Hypothesized relations among manifest variables and latent constructs.
A variance-covariance matrix with 16 measured variables was used as input data for the new measurement model. The model again fit well, $\chi^2(65, N = 267) = 166.21$, GFI = .93, CFI = .93. The correlations among the latent constructs in the measurement model are presented in Table 26. Research interest, research self-efficacy, career goals, and gender were correlated with many of the constructs. In contrast, research productivity was only related to three of the latent constructs: research interest, research self-efficacy, and career goals.

Factor loadings of the indicators on their respective latent constructs are presented in Table 27. The 16 indicator variance-covariance matrix was retained for use in the structural model. This matrix is presented in Table 28.
Table 27

Factor Loadings, Standard Errors, and Random Errors of Indicator Variables in Measurement Model

<table>
<thead>
<tr>
<th>Construct and Indicator</th>
<th>Standardized Factor Loading</th>
<th>Raw Factor Loading</th>
<th>Standard Error</th>
<th>Random Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int-SR</td>
<td>.89</td>
<td>1.00</td>
<td>--</td>
<td>.21</td>
</tr>
<tr>
<td>Int-P</td>
<td>.79</td>
<td>3.17</td>
<td>.24</td>
<td>.37</td>
</tr>
<tr>
<td>Research Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDS</td>
<td>.85</td>
<td>1.00</td>
<td>--</td>
<td>.27</td>
</tr>
<tr>
<td>PRS</td>
<td>.75</td>
<td>0.71</td>
<td>.05</td>
<td>.44</td>
</tr>
<tr>
<td>QCS</td>
<td>.71</td>
<td>1.09</td>
<td>.09</td>
<td>.50</td>
</tr>
<tr>
<td>WS</td>
<td>.80</td>
<td>0.90</td>
<td>.06</td>
<td>.35</td>
</tr>
<tr>
<td>Research Interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRP</td>
<td>.45</td>
<td>1.00</td>
<td>--</td>
<td>.80</td>
</tr>
<tr>
<td>CRI</td>
<td>.50</td>
<td>0.87</td>
<td>.18</td>
<td>.75</td>
</tr>
<tr>
<td>Perceptions of RTE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTE-Str</td>
<td>.96</td>
<td>1.00</td>
<td>--</td>
<td>.09</td>
</tr>
<tr>
<td>RTE-Per</td>
<td>.77</td>
<td>0.76</td>
<td>.08</td>
<td>.40</td>
</tr>
</tbody>
</table>

Note. Factor loadings of all single indicators of latent constructs were fixed to 1.00; dashes indicate the standard error was not estimated.
Table 28

Variance-Covariance Matrix of Observed Variables

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Int-SR</td>
<td>22.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Int-P</td>
<td>56.04</td>
<td>283.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. RDS</td>
<td>6.28</td>
<td>11.94</td>
<td>19.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>4. PRS</td>
<td>2.40</td>
<td>3.11</td>
<td>9.16</td>
<td>12.75</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5. QCS</td>
<td>8.07</td>
<td>20.30</td>
<td>16.45</td>
<td>10.71</td>
<td>32.87</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. WS</td>
<td>4.54</td>
<td>9.07</td>
<td>12.43</td>
<td>10.31</td>
<td>11.46</td>
<td>17.39</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7. PRP</td>
<td>0.99</td>
<td>3.17</td>
<td>1.49</td>
<td>1.21</td>
<td>1.45</td>
<td>1.61</td>
<td>2.72</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. CRI</td>
<td>2.01</td>
<td>8.63</td>
<td>0.78</td>
<td>0.69</td>
<td>1.42</td>
<td>0.35</td>
<td>0.48</td>
<td>1.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Career</td>
<td>4.20</td>
<td>15.07</td>
<td>0.74</td>
<td>0.13</td>
<td>1.33</td>
<td>0.53</td>
<td>0.40</td>
<td>0.79</td>
<td>3.12</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10. HI/HS</td>
<td>0.29</td>
<td>0.76</td>
<td>0.24</td>
<td>0.02</td>
<td>0.31</td>
<td>0.07</td>
<td>0.02</td>
<td>0.03</td>
<td>0.12</td>
<td>0.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. HI/LS</td>
<td>0.57</td>
<td>1.54</td>
<td>0.21</td>
<td>0.03</td>
<td>0.31</td>
<td>0.16</td>
<td>-0.01</td>
<td>0.02</td>
<td>0.10</td>
<td>-0.06</td>
<td>0.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. LI/HS</td>
<td>-0.35</td>
<td>-1.25</td>
<td>-0.27</td>
<td>-0.09</td>
<td>-0.29</td>
<td>-0.22</td>
<td>-0.03</td>
<td>0.00</td>
<td>-0.07</td>
<td>-0.08</td>
<td>-0.07</td>
<td>0.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. RTE-Str</td>
<td>35.23</td>
<td>82.98</td>
<td>21.40</td>
<td>6.92</td>
<td>26.50</td>
<td>13.51</td>
<td>-1.19</td>
<td>3.64</td>
<td>7.43</td>
<td>0.38</td>
<td>0.60</td>
<td>0.04</td>
<td>370.92</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14. RTE-Per</td>
<td>22.72</td>
<td>40.61</td>
<td>13.38</td>
<td>7.43</td>
<td>19.42</td>
<td>7.69</td>
<td>-0.46</td>
<td>3.82</td>
<td>5.23</td>
<td>0.41</td>
<td>0.01</td>
<td>0.62</td>
<td>257.40</td>
<td>326.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Gender</td>
<td>-0.28</td>
<td>-0.29</td>
<td>-0.46</td>
<td>-0.11</td>
<td>-0.69</td>
<td>-0.38</td>
<td>-0.07</td>
<td>-0.05</td>
<td>-0.11</td>
<td>-0.01</td>
<td>-0.03</td>
<td>0.03</td>
<td>-1.72</td>
<td>-1.52</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>16. Year</td>
<td>-1.27</td>
<td>-5.18</td>
<td>1.37</td>
<td>1.40</td>
<td>1.21</td>
<td>1.53</td>
<td>0.78</td>
<td>-0.17</td>
<td>-0.52</td>
<td>0.01</td>
<td>-0.02</td>
<td>-0.03</td>
<td>-8.53</td>
<td>-7.32</td>
<td>-0.02</td>
<td>2.27</td>
</tr>
</tbody>
</table>

Note. N = 267.
Structural model. The hypothesized model presented in Figure 1 (p. 9) was tested by the LISREL 8 maximum-likelihood procedure using the covariance matrix presented in Table 28 as input. This model provided a good overall fit to the data, \( \chi^2(82, N = 267) = 230.61 \), GFI = .90, CFI = .90. Moreover, the hypothesized model fit significantly better than the null model of independent factors, \( \Delta \chi^2(38) = 1374.46, p < .001 \), suggesting that the causal relationships specified in the structural model accounted for a significant amount of covariation among the constructs. However, the fit of the structural model reflected a significant departure from the fit of the measurement model, \( \Delta \chi^2(17) = 64.40, p < .001 \), suggesting that the structural model does not completely explain the relations among the constructs. Estimates of the path coefficients are presented in Figure 3. Correlations among the exogenous variables (i.e., those not explained by other variables in the model) are presented in Table 29. All of the factor loadings were highly significant (see Table 30).

The results from the LISREL program suggested that seven of the hypothesized causal paths were significant. First, although perceptions of the RTE and research productivity significantly predicted research self-efficacy, gender did not (R² for research self-efficacy was

<table>
<thead>
<tr>
<th>Table 29</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>HI/HS</th>
<th>HI/LS</th>
<th>LI/HS</th>
<th>RTE</th>
<th>Gender</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>VPI-B–HI/HS</td>
<td>- .32*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VPI-B–HI/LS</td>
<td>- .40*</td>
<td>- .36*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VPI-B–LI/HS</td>
<td>.06</td>
<td>.05</td>
<td>.03</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>RTE</td>
<td>Gender</td>
<td>Year</td>
<td>- .05</td>
<td>- .16*</td>
<td>.12*</td>
</tr>
<tr>
<td>Year in Program</td>
<td>.02</td>
<td>- .03</td>
<td>.04</td>
<td>- .33*</td>
<td>.03</td>
</tr>
<tr>
<td>Note. * indicates significant at .05 level.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Figure 3. Parameter estimates for hypothesized structural model.
### Table 30

**Factor Loadings, Standard Errors, and Random Errors of Indicator Variables in Hypothesized Structural Model**

<table>
<thead>
<tr>
<th>Construct and Indicator</th>
<th>Standardized Factor Loading</th>
<th>Raw Factor Loading</th>
<th>Standard Error</th>
<th>Random Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Interest</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Int-SR</td>
<td>.86</td>
<td>0.30</td>
<td>.02</td>
<td>.25</td>
</tr>
<tr>
<td>Int-P</td>
<td>.81</td>
<td>1.00</td>
<td>--</td>
<td>.35</td>
</tr>
<tr>
<td>Research Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDS</td>
<td>.85</td>
<td>1.00</td>
<td>--</td>
<td>.27</td>
</tr>
<tr>
<td>PRS</td>
<td>.75</td>
<td>0.72</td>
<td>.05</td>
<td>.44</td>
</tr>
<tr>
<td>QCS</td>
<td>.71</td>
<td>1.09</td>
<td>.09</td>
<td>.50</td>
</tr>
<tr>
<td>WS</td>
<td>.80</td>
<td>0.90</td>
<td>.06</td>
<td>.35</td>
</tr>
<tr>
<td>Research Interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRP</td>
<td>.52</td>
<td>1.00</td>
<td>--</td>
<td>.73</td>
</tr>
<tr>
<td>CRI</td>
<td>.38</td>
<td>0.56</td>
<td>.13</td>
<td>.86</td>
</tr>
<tr>
<td>Perceptions of RTE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTE-Str</td>
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<td>17.26</td>
<td>1.29</td>
<td>.20</td>
</tr>
<tr>
<td>RTE-Per</td>
<td>.83</td>
<td>14.93</td>
<td>1.20</td>
<td>.32</td>
</tr>
</tbody>
</table>

*Note.* Factor loadings of all single indicators of latent constructs were fixed to 1.00; dashes indicate the standard error was not estimated.
Research interest was significantly predicted by Holland personality ($R^2 = .05$). An examination of the paths suggested that those students with high Investigative personality themes, regardless of the level of Social theme, were more interested in research than were those in the low-Investigative groups. Research self-efficacy did not significantly predict research interest. Research productivity was significantly predicted by research interest and year in program, yet not by research self-efficacy ($R^2$ for research productivity was .61). Finally, career goals were only predicted by research interest ($R^2 = .38$); neither research self-efficacy nor research productivity significantly predicted this endogenous variable.

The LISREL program allows for the examination of indirect, or mediational, relationships among variables. Several such relationships were hypothesized in the model (see Table 31). The relationship between Holland personality and research productivity (as mediated by research interest) was significant. Second, the relationship between Holland personality and career goals (as mediated by research interest and research productivity) was also significant. Third, the indirect relationship between Holland personality and research self-efficacy (as mediated by research interest and research productivity) was also significant. In each case, students in the high-Investigative groups had higher scores on the endogenous variable. Contrary to hypothesis, the relationship between RTE and research interest (as mediated by research self-efficacy) was not significant. In fact, RTE was not indirectly related to any of the four endogenous variables. None of the indirect relationships between participant gender and the endogenous variables were statistically significant. Finally, the relationship between year in doctoral program and research self-efficacy (as mediated by research productivity) was significant. Year in program did not indirectly affect any of the other endogenous variables. With respect to indirect effects among the endogenous variables, only the relationship between research interest and research self-efficacy (as mediated by research productivity) was significant.

Although the hypothesized model provided a good fit to the data, a trimmed model was
Table 31

**Indirect Relationships (Correlations) Among Constructs in Hypothesized Model**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Research Interest</th>
<th>Research Self-Efficacy</th>
<th>Research Productivity</th>
<th>Career Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Investigative/High-Social</td>
<td>-</td>
<td>.16&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.23&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.21&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>High-Investigative/Low-Social</td>
<td>-</td>
<td>.20&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.29&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.26&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Low-Investigative/High-Social</td>
<td>-</td>
<td>.05</td>
<td>.07</td>
<td>.06</td>
</tr>
<tr>
<td>RTE</td>
<td>-.03</td>
<td>-</td>
<td>-.04</td>
<td>-.03</td>
</tr>
<tr>
<td>Gender</td>
<td>.02</td>
<td>-</td>
<td>.03</td>
<td>.02</td>
</tr>
<tr>
<td>Year in Program</td>
<td>-</td>
<td>.35&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-</td>
<td>-.07</td>
</tr>
<tr>
<td>Research Interest</td>
<td>-</td>
<td>.43&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-</td>
<td>-.09</td>
</tr>
<tr>
<td>Research Self-Efficacy</td>
<td>-</td>
<td>-</td>
<td>-.08</td>
<td>-.08</td>
</tr>
<tr>
<td>Research Productivity</td>
<td>-.10</td>
<td>-</td>
<td>-</td>
<td>-.12</td>
</tr>
</tbody>
</table>

*Note.* <sup>a</sup> significant at .01 level; <sup>b</sup> significant at .001 level; dashes indicate mediational relationships were not hypothesized in the model.
tested in order to present the results in a succinct manner. Guidelines for the specification of this model came from parameter estimates and modification indices obtained from the LISREL 8 program. This model fixed nonsignificant paths to 0 and freed paths that were significant yet not reflected in the hypothesized model. Please note that whereas the hypothesized model was based on an a priori, literature-based theory, the trimmed model is based on an a posteriori, data-based examination. As such, great caution should be taken before drawing definitive conclusions from this post hoc model. Conclusions about the accuracy of the trimmed model should await replication.

In specifying the trimmed model, two causal paths were added, two paths were removed, and the direction of one path was changed (see Figure 4). Specifically, causal paths between year in program and research self-efficacy, and between RTE and research interest were added. The nonsignificant path between research self-efficacy and career goals was removed, as was the causal path from research productivity predicting research self-efficacy. Although this latter path was significant in the hypothesized model, it was believed that the specification of the reciprocal path between research self-efficacy and research productivity in the hypothesized model was resulting in difficulty estimating the causal paths. Finally, the relationships among the variables seemed to suggest that it is not research productivity that leads one to choose a career in a research-related field. Rather, it appears that it is the decision to enter a research-related field that leads one to become more productive at research. Accordingly, the direction of the causal path between these two constructs was reversed.

The trimmed model provided a better fit to the data than did the hypothesized model, \( \chi^2(82, N = 267) = 197.46, \text{GFI} = .91, \text{CFI} = .92 \). Moreover, the trimmed model fit significantly better than the null model of independent factors, \( \Delta \chi^2(38) = 1407.61, \ p < .001 \). However, once again, the fit of the structural model reflected a significant departure from the fit of the measurement model, \( \Delta \chi^2(17) = 31.25, \ p < .05 \). The parameter estimates are depicted in
Figure 4. Parameter estimates for trimmed structural model.
Figure 4. Although the correlations among the exogenous variables did not change much between the hypothesized model and the trimmed model, the revised correlations are presented in Table 32. Once again, all factor loadings were highly significant. These are presented in Table 33.

Table 32

**Correlations Among Exogenous Variables in Trimmed Structural Model**

<table>
<thead>
<tr>
<th></th>
<th>HI/HS</th>
<th>HI/LS</th>
<th>LI/HS</th>
<th>RTE</th>
<th>Gender</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>VPI-B-HI/HS</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VPI-B-HI/LS</td>
<td>-0.32*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VPI-B-LI/HS</td>
<td>-0.40*</td>
<td>-0.36*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTE</td>
<td>0.05</td>
<td>0.07</td>
<td>0.02</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.05</td>
<td>-0.16*</td>
<td>0.12*</td>
<td>-0.21*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Year in Program</td>
<td>0.02</td>
<td>-0.03</td>
<td>-0.04</td>
<td>-0.33*</td>
<td>-0.03</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note. * indicates significant at .05 level.

The results from the structural equation analysis revealed that several direct effects were significant at the .05 level. First, unlike in the hypothesized model, research self-efficacy was significantly predicted by gender in the trimmed model, with men reporting greater research self-efficacy than women. Students' perceptions of the RTE were positively related to research self-efficacy. In addition, the student's year in the doctoral program was related to research self-efficacy, net of gender and RTE. This positive relationship suggests that graduate students' research self-efficacy increases as they progress through their doctoral program. Gender, RTE, and year in program accounted for almost one-fourth of the variance in research self-efficacy ($R^2 = .23$).
Table 33

Factor Loadings, Standard Errors, and Random Errors of Indicator Variables in Trimmed Structural Model

<table>
<thead>
<tr>
<th>Construct and Indicator</th>
<th>Standardized Factor Loading</th>
<th>Raw Factor Loading</th>
<th>Standard Error</th>
<th>Random Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int-SR</td>
<td>.91</td>
<td>0.33</td>
<td>.03</td>
<td>.18</td>
</tr>
<tr>
<td>Int-P</td>
<td>.78</td>
<td>1.00</td>
<td>--</td>
<td>.40</td>
</tr>
<tr>
<td>Research Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDS</td>
<td>.85</td>
<td>1.00</td>
<td>--</td>
<td>.28</td>
</tr>
<tr>
<td>PRS</td>
<td>.75</td>
<td>0.73</td>
<td>.05</td>
<td>.43</td>
</tr>
<tr>
<td>QCS</td>
<td>.70</td>
<td>1.09</td>
<td>.09</td>
<td>.51</td>
</tr>
<tr>
<td>WS</td>
<td>.81</td>
<td>0.91</td>
<td>.06</td>
<td>.34</td>
</tr>
<tr>
<td>Research Interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRP</td>
<td>.46</td>
<td>1.00</td>
<td>--</td>
<td>.78</td>
</tr>
<tr>
<td>CRI</td>
<td>.51</td>
<td>0.85</td>
<td>.18</td>
<td>.74</td>
</tr>
<tr>
<td>Perceptions of RTE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTE-Str</td>
<td>.94</td>
<td>18.06</td>
<td>1.13</td>
<td>.12</td>
</tr>
<tr>
<td>RTE-Per</td>
<td>.79</td>
<td>14.22</td>
<td>1.07</td>
<td>.38</td>
</tr>
</tbody>
</table>

Note. Factor loadings of all single indicators of latent constructs were fixed to 1.00; dashes indicate the standard error was not estimated.
Second, interest in research was again significantly predicted by two of the three Holland-personality variables. As before, Investigative interests were positively related to interest in research, regardless of the level of one's Social interests. Unlike the hypothesized model, in the trimmed model RTE was allowed to predict research interest; this effect was significant, suggesting that the perception of the presence of RTE ingredients facilitative of developing students' interest in research was directly related to an increase in research interest. Finally, research self-efficacy significantly predicted research interest. Nearly one-third of the variance in research interest was explained by these three variables ($R^2 = .32$).

Third, career goals were only specified to be predicted by research interest. This relationship was significant, accounting for one-third of the variance in career goals ($R^2 = .33$). Finally, research productivity was found to be a function of research interest, career goals, and year in the doctoral program; the path between research self-efficacy and research productivity was nonsignificant. These paths were all positive and accounted for over half of the variance in research productivity ($R^2 = .57$).

As before, several indirect, or mediational, relationships were specified by the trimmed model (see Table 34). First, several mediational relationships between the exogenous and endogenous variables were significant. Both of the Holland-personality groups that included the high-Investigative students were indirectly related to research productivity (as mediated by research interest and career goals) and career goals (as mediated by research interest). RTE had significant indirect effects on research productivity (as mediated by research interest and research self-efficacy) and on research interest (as mediated by research self-efficacy), and career goals (as mediated by research self-efficacy and research interest). Year in doctoral program had significant indirect effects on research interest (as mediated by research self-efficacy) on career goals (as mediated by research self-efficacy and research productivity), and on research productivity (as mediated by research self-efficacy, research interest, and career goals). Gender did not indirectly predict any of the endogenous
Table 34

**Indirect Relationships (Correlations) Among Constructs in Trimmed Model**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Research Interest</th>
<th>Research Self-Efficacy</th>
<th>Research Productivity</th>
<th>Career Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Investigative/High-Social</td>
<td>—</td>
<td>—</td>
<td>.16&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.16&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>High-Investigative/Low-Social</td>
<td>—</td>
<td>—</td>
<td>.21&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.22&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Low-Investigative/High-Social</td>
<td>—</td>
<td>—</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td>RTE</td>
<td>.05&lt;sup&gt;a&lt;/sup&gt;</td>
<td>—</td>
<td>.29&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.22&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Gender</td>
<td>-.02</td>
<td>—</td>
<td>-.05</td>
<td>-.01</td>
</tr>
<tr>
<td>Year in Program</td>
<td>.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>—</td>
<td>.11&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Research Interest</td>
<td>—</td>
<td>—</td>
<td>.19&lt;sup&gt;b&lt;/sup&gt;</td>
<td>—</td>
</tr>
<tr>
<td>Research Self-Efficacy</td>
<td>—</td>
<td>—</td>
<td>.08&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.09&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Note:**<sup>a</sup> significant at .05 level; <sup>b</sup> significant at .01 level; <sup>c</sup> significant at .001 level; dashes indicate mediational relationships were not hypothesized in the model.
variables.

Second, mediational relationships among the endogenous variables were observed. The indirect relationship between research interest and research productivity (as mediated by career goals) was significant. The indirect relationship between research self-efficacy and research productivity (as mediated by research interest and career goals) was also significant. Finally, research self-efficacy showed a significant indirect relationship with career goal (as mediated by research interest). No other indirect relationships among the endogenous variables were specified in the model.

Summary of causal models. The hypothesized model fit the data well, yet slight adjustments led to an improvement in fit. The revised, trimmed model suggested that, as hypothesized, Holland personality was related to research interest. This model also suggests that a favorable RTE leads to interest in research, both directly and via research self-efficacy. As predicted, gender was also directly related to research self-efficacy, and year in doctoral program was directly related to both research involvement and research self-efficacy, the latter effect being unpredicted. Career goals were strongly predicted by research interest, and research productivity was ultimately predicted by a combination of year in program, research interest, career goals, and research self-efficacy. This trimmed model represented a very good fit to the data.
CHAPTER 5
DISCUSSION

The results from the present investigation revealed that the career goals and research productivity of counseling psychology graduate students can be predicted by Holland personality, perceptions of the RTE, research interest, and research self-efficacy. Moreover, it was demonstrated that the student's gender and year in graduate program help to predict the two outcome variables above and beyond the other four predictors. This model largely confirmed that the interrelationships among the factors commonly reported in the research-training literature can be explained within the context of a general causal model. This causal model suggests that graduate students' research productivity and interest in research-related careers may be increased if factors such as Holland personality, perceptions of the RTE, research interest, and research self-efficacy are present or increased. This structural model provided a good fit to the data, explaining 91% of the covariation among the measured variables.

In addition to this major result, several other findings are noteworthy. A discussion of findings with respect to means, frequencies, and group differences is presented after a more detailed discussion of the causal modeling procedure. This focus on descriptive statistics is followed by a discussion of the factor analyses. Chapter 5 concludes with an examination of the limitations of the present study as well as a discussion of the contributions that this project makes to the field of research training.

Discussion of the Causal Model

Several conclusions may be drawn from the structural equation modeling procedure. These conclusions are organized below by the endogenous factors included in the model. Included is a discussion of significant predictors of each endogenous factor.

Research self-efficacy. It was initially hypothesized that research self-efficacy is a function of the RTE, gender, and research productivity. The RTE was directly related to research self-
efficacy in the present study, thus supporting previous findings and theory (Gelso, 1993; Gelso, Mallinckrodt, & Judge, 1996; Phillips & Russell, 1994). In addition, gender was directly related to research self-efficacy. Moreover, the trimmed model specified that the students' year in program was also directly related to research self-efficacy.

The relationship between research self-efficacy and research productivity was more equivocal. The estimates from the hypothesized model (illustrated in Figure 3, p. 82) did not support the hypothesis that these two constructs share a reciprocal relationship. Rather, based on the trimmed model (illustrated in Figure 4, p. 87), it seems that research self-efficacy leads to research productivity, although the magnitude of this path was just below the threshold of statistical significance. It is important to note that the direction of causality is a theoretical distinction and not an empirical one; cause-and-effect relationships could not be determined with these correlational data. Part of the reason for interpreting the nature of the relationship in this way lies in the difficulty in identifying causal models with reciprocal paths. In other words, it is much more difficult to arrive at an estimate for relationships between two constructs when reciprocal paths are specified. Thus, it is possible that a reciprocal relation exists between these two constructs, yet the nature of that relation could not be accurately estimated. Perhaps future investigations assessing these constructs at several points over time would yield better estimates of the causal direction of this relationship.

Research interest. It was initially hypothesized that research interest results from a combination of Holland personality and research self-efficacy. The observed relationship between Holland personality and research interest replicates the findings of Mallinckrodt, Gelso, and Royalty (1990), who found that Investigative scores were positively related to research interest, whereas Social scores were not. Moreover, the indirect relationship between the RTE research interest supports Gelso's (1993) mediation hypothesis (i.e., that the RTE influences research self-efficacy, which in turn influences research interest). However, it became clear in the trimmed model that the RTE both indirectly and directly
influences research interest. In other words, an RTE that contains many of the elements that Gelso found to be important in influencing research interest and research productivity fosters both a sense of research self-efficacy and interest in research. The direct relationship between the RTE and research interest seems to add an additional element to Gelso's formulations about the role of the RTE on research interest.

Research productivity. It was hypothesized that research productivity is a function of research interest, research self-efficacy, and the student's year in their doctoral program. All three of these relationships were positive, although the relationship between research self-efficacy and research productivity failed to reach statistical significance in the final trimmed model. The relationship between RTE and research productivity replicated findings reported by Krebs, Smither, and Hurley (1991).

Perhaps most interesting was the relationship between research productivity and career goals. It was initially believed that research productivity would lead one to choose a career in research. The rationale behind this hypothesis was that if a student was producing research then a career in research may be more plausible. However, it seems that this causal relationship is opposite of what was hypothesized: Intentions to pursue a research-related career lead students to increase their research productivity. In retrospect this is a reasonable notion. Unfortunately the cross-sectional nature of the present study's design prohibited determining the absolute causal direction; longitudinal data would be more appropriate for establishing the direction of causality. Although it is most likely these two factors share a reciprocal relationship, the model was most interpretable with career goals predicting research productivity.

Career goals. It was hypothesized that career goals could be predicted by research productivity, research interest, and research self-efficacy. The relationship between career goals and research productivity has been explained in the previous subsection. The relationship between research interest and career goals was highly significant, thus
supporting a basic tenet of Holland's (1985a) theory of career choice. Contrary to hypothesis, research self-efficacy was not found to directly influence career goals, although research self-efficacy did have an indirect effect on career goals (via research interest).

**Discussion of Means, Frequencies, and Group Differences**

**Holland personality.** Students in the present sample had higher scores on the Social subscale of the VPI-B than they did on the Investigative subscale, suggesting that, in general, this sample had stronger interests in working with and helping people than they did in engaging in theoretical or academic problem-solving (Holland, 1985a). This finding confirmed Holland's (1986) hypothesis that counseling psychology graduate students tend to have greater Social interests than Investigative interests, thus resulting in most graduate students seeking non-research careers.

Sex differences were observed on the VPI-B. This pattern of results in the present study was similar to that found by Betz and Taylor (1982), who reported that men scored significantly higher than women in Investigative interest, yet the two groups did not differ in Social interests. However, Mallinckrodt et al. (1990) did not find this gender difference. No differences in VPI-B were found as a function of stage of doctoral program or training site.

**Research training environment.** Examination of means of the RTES-R subscales suggested that students in the present sample reported similar perceptions of their respective RTE as did the sample in Gelso et al.'s (1996) study. Gender differences were evident on four of the nine RTE ingredients measured by the RTES-R. These sex differences found on the dimensions of the RTE were unexpected, as Gelso et al. failed to detect any gender differences on the RTES-R total score in their study of graduate students. These gender differences may reflect true differences in how women and men are treated in training programs, or they may reflect differences in the way in which men and women perceive their environment. Although this distinction has theoretical importance, for the purposes of increasing research interest and research productivity in an actual training program the
distinction may not be important.

In addition to gender differences, the students' stage of their doctoral program was related to all but one of the RTE ingredients, with beginning students commonly reporting more research-favorable RTEs than their intermediate or advanced counterparts. It is possible that beginning students enter graduate school with idealized, positive perceptions about how they expect their training to be. Indeed, all of the first-year students were surveyed at the beginning of their first semester, thus creating some difficulty in accurately measuring the RTE. As such, it is possible that expectations, and not reality-based perceptions, are what were measured in these beginning students. A real-versus-ideal measure of the RTE, in which students are asked to indicate their actual perceptions of the RTE versus their ideal perceptions, may help to examine this possibility. Such an examination could prove to be a valuable addition to the literature.

Perhaps most expected were differences in RTE perceptions across the 15 training sites sampled. In fact, if differences were not observed then one would have to question the validity of the RTES-R. Preservation of the confidentiality of the training programs prohibited speculation regarding why these RTE differences may have existed.

**Research self-efficacy.** Students reported the most self-efficacy with respect to practical research skills, such as keeping records during a research project, utilizing resources needed for help, and defending a thesis or dissertation. Students reported the least self-efficacy in the area of computer and quantitative skills, such as understanding computer printouts, using multivariate statistics, and using statistical software packages. This finding may point to a need to help students to become more confident in the area of computer and quantitative skills. Although early involvement in statistics courses may help to introduce these skills to students, it may be that many students become intimidated in their first year. Perhaps a more individualized, hands-on approach to quantitative and computer skills may ultimately be the most useful way of helping to instill students with a basic sense of self-efficacy in this
Gender differences in research self-efficacy were striking. Men reported greater self-efficacy in research design skills, writing skills, and quantitative and computer skills than did women. These differences replicate those found in university faculty (Landino & Owen, 1988; Vasil, 1992, 1993), thus suggesting that differences in research self-efficacy begin at least as early as graduate school. In accord with the thinking of Betz and Fitzgerald (1987), it is possible that many women in graduate school have difficulty finding female role models in their doctoral program. However, the ratio of female to male faculty members of the 15 training programs surveyed was not ascertained, thus making this hypothesis purely speculative.

Differences in self-efficacy with respect to research design skills, practical research skills, and writing skills were apparent across students in different stages of their doctoral programs, such that advanced students (those in their fifth year or beyond) reported greater self-efficacy than beginning or intermediate students. These findings are perhaps largely due to advanced students' greater opportunities for learning about and becoming involved in research. No differences in research self-efficacy across the 15 training sites were found.

Research interest. Overall, the sample indicated a moderately high level of interest in research. This was reflected both in their reported interest and in the percent of time that they hoped to spend in research activities in their career after graduation. This latter figure (28%) was higher than that reported by Perl and Kahn (1983), which was 16%. Thus, it seems that students may be more interested in research than they were just over a decade ago.

One gender difference was observed in research interest, with men reporting a greater interest in research than women. Despite reaching statistical significance, the magnitude of this difference was small. Moreover, women and men did not differ in the percent of time they hoped to spend in research activities in their career. Thus, although there does seem to
be a gender difference in at least one aspect of research interest, gender differences in research interest as a whole seem to be small.

Stage of doctoral program was related to both reported research interest and to percent of time planning to devote to research activities in the future. Research interest increased as a function of stage of program. Given the differences in research self-efficacy as a function of stage of training, these differences are not surprising. This finding may point to a need for training programs to take steps to help beginning students develop a greater interest in research. The more favorable ratings beginning students made of their RTEs versus advanced students may suggest that these steps are already being taken in many respects.

Finally, comparisons of students across the 15 training sites revealed differences in self-reported interest in research, yet not for the percent of time students hoped to spend in research activities in their career after graduation. Two explanations are possible for this finding. First, it may be that some programs select students who are interested in research more than do others. Alternatively, it is possible that some programs engender research interests in their students more than do others. Observed differences in RTEs among the training sites lend support to this latter explanation.

Research productivity. In general, research productivity was low in this sample. However, the productivity reported in the present study was comparable with other measures of research productivity, even in samples of doctoral level psychologists (Barrom, Shadish, & Montgomery, 1988; Conway, 1988; Watkins, Lopez, Campbell, & Himmell, 1986). An examination of the frequency distribution of research activities revealed some noticeable outliers in the data. It is possible that some respondents may have interpreted research involvement items differently, especially those within the Research in Clinical Practice domain. Thus, it is possible that, as low as the research productivity appeared to be, it may be even lower than reported.

No gender differences were found on any of the research productivity measures.
However, stage of doctoral program was related to some aspects of research productivity. Quite predictably, the percent of students who had been involved in a given research activity at some point increased from beginning through advanced stages. Interestingly, reports of currently collecting data not related to their thesis or dissertation were most common in beginning students and least common in advanced students. This possibly suggests that beginning students are becoming involved in research early on in their training, either through assistantship activities or through other collaborative efforts.

Career goals. Students in the present sample were most interested in careers in private practice, followed by both an academic job in a small college and a counseling-center position (these latter two were reported with equal frequency). Just over half of the sample was interested in a primarily practice-related setting versus only 29% being interested in a primarily research-related setting. These preferences were similar to those obtained by Fitzgerald and Osipow (1988), who found that private practice, academia, and a counseling-center position were the top three career choices of counseling psychology graduate students. Using a similar categorization scheme as in the present study, approximately 25% of the Fitzgerald and Osipow sample was interested in a primarily research-related setting. Recent estimates of initial employment settings for counseling psychology graduates suggest that fewer than these 25-29% of graduates find themselves actually employed in research settings (American Psychological Association, 1996).

Men and women differed in their second choice for employment setting. Specifically, more men than would be expected reported that they wanted a research position as their second choice of setting. It is unclear why this result occurred for students' second choice yet not for their first choice.

Students' stage of doctoral training was related to first choice of career setting. Fewer advanced students than expected reported that they wanted a research career. This is not surprising given the lower interest in research that advanced students reported relative to
beginning or intermediate students. It is possible that many of these advanced students were in the midst of finishing a long dissertation project and were becoming less interested in a research career than perhaps they once were.

**Discussion of Factor Analyses**

**Research productivity exploratory factor analysis.** The exploratory factor analysis (EFA) of the research-productivity items revealed that three slightly correlated factors explained a large percentage of variation among the research-productivity items. These factors were named Past Research Productivity, Current Research Involvement, and Research in Clinical Practice. These three factors roughly correspond to the three alternative measures of scholarly production outlined by Barrom et al. (1988). However, the latent variable measurement model suggested that the Research-in-Clinical-Practice factor was itself not highly correlated with the research-productivity construct. As such, research productivity may best be operationalized as consisting of non-clinical research activities.

The measurement of research productivity remains a difficult issue. Barrom et al. (1988) argued that a broad measure of research productivity should be used, as opposed to one that just measures the number of publications. However, it seems clear from the present study that broad measures lack the internal consistency one would want in a measure. Although there is certainly a good theoretical reason to include additional indicators of research productivity beyond number of publications, future researchers may continue to struggle to adequately define and measure this construct. Researchers must decide whether to (a) conceptualize research productivity as a construct that includes activities common to clinical practice or (b) continue to dichotomize research and practice as is often the case in the literature.

**VPI-B confirmatory factor analysis.** The two-factor model, specifying Social and Investigative factors, did not fit the data very well. Although this model fit much better than a one-factor model, it seemed that the two-factor model was not sufficient to explain the
pattern of responses on the 14 VPI-B items. An examination of the modification indices (quantitative estimates of the ways in which the fit of the model to the data may be improved) suggested that many of the errors of the 14 items were correlated. This finding may suggest that factors other than or in addition to Social and Investigative would improve the description of the data from this specific sample. Given the relative homogeneity of the sample, it is not surprising that some items within each subscale (e.g., scientific research worker and independent research scientist) would correlate better with each other than they did with others (e.g., chemist or astronomer).

These findings point to an important measurement issue. When one uses an instrument designed for the general population with a specific population, the validity of the measure may be in jeopardy. In the present study, it is likely that the sample of counseling psychology graduate students responded to the VPI-B in idiosyncratic ways when compared to the general population. As such, the VPI-B may not have been the most useful way to measure the Holland themes of these students.

**RTES-R exploratory and confirmatory factor analyses.** The exploratory factor analysis of Gelso et al.'s (1996) data suggested that two second-order factors effectively group the nine subscales of the RTES-R into two categories. First, what may be called an *interpersonal* factor can account for such RTE ingredients as students becoming involved in research early in one's training, faculty modeling appropriate scientific behavior, faculty positively reinforcing student research, and teaching that science can be a social experience. These ingredients are collectively interpersonal in that they are largely the product of interactions between faculty and students, or interactions among students themselves. Second, what may aptly be labeled an *instructional* factor accounts for RTE ingredients such as teaching students (a) that all experiments are flawed, (b) to look inward for research ideas, (c) relevant statistics and research design, (d) varied investigative styles and approaches to research, and (e) that science can indeed be wed with clinical practice. These ingredients are collectively
instructional in that they are the product of more didactic or experiential training experiences.

The results from the confirmatory factor analysis of the present data confirmed this second-order factor structure, yet only when examining the first-order factors as manifest variables. When considering the first-order factors as latent variables, estimates could not be calculated. Nonetheless, the EFA and CFA results suggest that it may be useful to consider the nine RTE ingredients measured by the RTES-R as being the results of two higher-order dimensions. Note that this interpretation suggests that the subscales of the RTES-R, and not necessarily the latent constructs purportedly measured by each, can be subsumed into two factors. This distinction is important, as evidence from the CFA conducted at the level of the item pairs suggested that, although the items loaded very well onto their respective subscales, the model fit would have been improved by allowing many item pairs to load on other RTE factors. Despite the ambiguity in how the items should load onto specific subscales, when the subscale totals were used as indicator variables, the data fit very well within a two-factor second-order structure. Thus, factor scores reflecting instructional and interpersonal factors may be computed in situations in which the RTES-R is administered and subscale totals are computed. However, the strong correlation between these two subscales suggest that using the two factor scores as independent predictors in a causal model or other type of regression procedure would be contraindicated. (This is also true of using the nine subscale scores as independent predictors.) Thus, the real value in the second-order factor structure is in offering an overarching taxonomy to theories about the role of the RTE in graduate student research training.

SERM confirmatory factor analysis. The four-factor SERM model fit the data very well, suggesting that the four subscales do explain the variation among the 12 SERM items very well. However, these factors were highly correlated, suggested a great degree of overlap in what the four factors measure. Despite these correlations among the factors, the four-factor model fit better than the one-factor model. Thus, it seems that the revised version of the
SERM used in the present study measured four related dimensions of research self-efficacy to the extent that the full scale SERM does.

Limitations of the Work

Any results observed in the present study need to be qualified by the study's limitations. First of all, the response rate in the present study was 55%. As a consequence, the ability to generalize results from this study to all counseling psychology graduate students is severely limited. It is possible that only students who were interested in research returned the questionnaire, thereby affecting the means and distributions of the measures. Although the random selection of 15 training programs exemplified a new level of representativeness of a population in the research-training literature, the response rate must be considered before interpreting the data.

A second important limitation of the present study, as well as any study that includes more than one graduate student within a given program in its sample, concerns the issue of independence of the observations. Despite the random sampling across programs, the observations are not independent because students within a given program are likely to share similar qualities (i.e., participants are "nested" within programs). As a consequence, the error variance of the variables may be reduced, thus increasing the likelihood of finding a significant relationship in a regression-based analysis. Analyses conducted at the level of the program, such as a multiple group analysis, may help to address this issue. Small sample sizes from many of the programs prohibited the use of such techniques in the present study. However, future studies may wish to consider such group factors when conducting studies of this sort.

Third, data from the present study were not experimental nor were they longitudinal; they were correlational and cross-sectional. As such, cause-and-effect relationships are impossible to establish. Although structural equation modeling allows one to postulate causal relationships, this model specification is done based on previous research and theory, not on
the actual data. As a consequence, one should be reminded that the cause-and-effect relationships suggested by the causal model in the present study may not be the true nature of the relationships among the constructs. Future researchers may wish to collect longitudinal data in order to more precisely measure change across time and cause-and-effect relationships. Alternatively, it may be useful to experimentally manipulate factors of interest, thereby being able to draw more definite conclusions about causal relationships.

Finally, although several significant findings were revealed in the present analyses, the clinical significance, or in this case the educational or occupational significance, of the findings needs to be considered. Although only statistically significant results have been discussed, some of those findings may not have any educational or occupational significance on a students' research training. Although measures such as research productivity have real-life significance, perhaps even more educationally or occupationally significant outcomes, such as job offers in research-related fields, would ultimately be most helpful in this type of research.

Contributions to Research-Training Theories and Research

The present study examined the development of research productivity and aspirations to enter a research career within the framework of a causal model. Causal models of research productivity have appeared in the literature (Helmreich, Spence, Beane, Lucker, & Matthews, 1980; Rodgers & Maranto, 1989), yet these models have focused on research productivity among faculty members. The present study was the first causal model examining the research training of graduate students.

The use of causal modeling introduces a new level of sophistication of data-analytic techniques in the examination of research training. The benefits of examining influences of research productivity and science-related career goals within a structural equation model is that direct, indirect (mediational), and spurious effects can be examined simultaneously. Such a model is a helpful contribution to theories of counseling psychology research training.
and applied psychology research training. Specifically, the present investigation may help to bring together various influences hypothesized to affect various outcomes important in graduate research training. Although the influence of factors such as Holland personality, the RTE, research self-efficacy, and research interest on research productivity have been investigated independently, the present study was the first to examine all of these relationships at one time. Moreover, the present study was the first to include career goals as an additional outcome variable.

A benefit to being able to comprehensively examine (through causal modeling) the relative predictive ability of such factors as (a) student personality, (b) research training environment, (c) student gender, (d) year in the doctoral program, (e) interest in research, and (f) research self-efficacy on (a) research productivity and (b) science-related career goals is it enables one to examine individual relationships between specific variables. The reporting of several of these relationships provided a unique contribution to the literature. First of all, although a few studies have examined predictors of research productivity among doctoral-level psychologists (e.g., Krebs et al., 1991), no study to date has examined these predictors of research productivity among graduate students. Second, no examination of predictors of science-related career goals among graduate students has appeared in the literature. Third, the mediating roles of such factors as research self-efficacy and interest in research have been theorized (e.g., Gelso, 1993) yet never empirically examined. In sum, the present study was unique in that no prior study has previously examined the interrelationships among such a comprehensive group of variables in a sample of graduate students.

An additional benefit of this model is it may be of heuristic value to the field, potentially encouraging others to research these issues. As such, the present study may not have answered existing questions about research training and scientist development, but it may provide a base from which new, more comprehensive theories of research training could be
developed. Although the present study brought previously isolated relationships together into one model, the theories guiding the model development are still piecemeal. Perhaps this model may serve as an important first step toward developing a more comprehensive theory of research training.

Aside from the use of latent variable modeling, the present study had additional strengths. First, the geographic and demographic diversity represented in the present sample was optimal. Nearly one-fourth of all APA-accredited counseling psychology programs, spanning the Northeast, Southeast, Southwest, Northwest, and Central United States, were included in the sample. In addition, the demographics with respect to ethnicity indicated that 21% of respondents were of minority groups, and students from all stages of graduate training were well represented. As such, the present study may paint a relatively distinct nationwide portrait of the status of research training.

Second, the factor analyses conducted on the RTES-R represented great strides towards improving the utility of the instrument and by helping to define more global elements of the RTE. Gelso's (1979, 1993) theory of the RTE has steadily gathered empirical support since its introduction 17 years ago. The ingredients that seem to play a large role in the development of scientists among applied psychology graduate students have been more clearly defined, and the construct and concurrent validity of these ingredients have been established (see Gelso, 1993). Moreover, the present investigation suggests that these nine ingredients are largely due to the interpersonal and instructional elements of research training. Perhaps these two global dimensions of the RTE will lend themselves to training enhancement better than the nine ingredients theorized by Gelso.

**Directions for future research.** Although theories of research training have continued to develop, varied approaches to studying the effects of factors such as the RTE and Holland personality on research-relevant outcomes have not progressed as quickly. First of all, although concurrent validity of the RTE, Holland personality, research self-efficacy, and
research interest has been established, the predictive validity of these constructs needs to be investigated. Longitudinal studies examining the role of these factors on future indicators of research productivity and career goals would be helpful. In addition, it may be fruitful to assess how these variables change and develop throughout students' graduate training, and why they may change. Although the present study provided a cross-sectional snapshot of differences across stages of graduate training, an examination of within-student change would be ideal. Second, interventions targeted to improving the RTEs of graduate programs may be developed based on the growing body of research on the nine RTE factors. As empirical investigations of the RTE continue to point to the importance of the nine ingredients in developing student researchers, it becomes increasingly appropriate to attempt to incorporate this information in the way in which graduate research training is conducted. At the most basic level, attention to the importance of both interpersonal and instructional components of research training needs to be stressed. Outcome studies examining the effects of interventions such as research seminars, informal research teams, and curricula modification would help to establish an important application of the RTE theory.

Implications for Research Training

The present study may have considerable applied value for graduate training programs. Specifically, the development of a model of research training may benefit counseling psychology graduate training programs, or any applied psychology training program, by identifying points in students' development at which various aspects of research training should be emphasized and subsequently would be most beneficial. Training programs may benefit from the present findings by identifying ways in which they may achieve program-wide goals for their students. For example, if a training program has a goal of increasing research productivity across the program, training directors may look to this model for ideas regarding how to increase the probability that students will become involved in research.

More distally, it seems important to select students with high Investigative interests,
regardless of their Social interests. Because Investigative interests are related to research interest, selecting beginning graduate students with these interests should help to increase the number of students with an interest in research (Holland, 1986). Because a student's level of Social interest was not related to research interest in the present study, programs may wish to select students who have both strong Investigative and Social interests, thus maximizing the possibility that students will become true scientist-practitioners. It also seems important to follow Gelso's (1993) recommendations with respect to the RTE. Although one or two faculty members may make a large difference in the RTE, it is likely that all faculty members in a program must make both formal and informal improvements in both instructional and interpersonal aspects of research training in order to have a strong effect on students. Faculty may also encourage students to seek out elements of the RTE that the students feel are lacking. This may include interpersonal elements, such as seeking out additional faculty to work with on research teams and finding positive role models, and it may include instructional elements, such as taking additional courses in research design and statistics.

More proximally, either selecting students with interests in research and/or students with a sense of research self-efficacy may help to increase program-wide research productivity. Of course, facilitating the development of these interests and self-efficacy cognitions in current students would also be possible by enhancing the RTE. Alternatively, given the strong relationship between the number of years a student has been in the program and that student's research self-efficacy, mentoring programs pairing beginning and advanced students may be a useful idea. Such a program may help beginning students to feel more comfortable with the research process, thereby increasing their research interest and research self-efficacy.

Finally, research productivity may be increased by encouraging students who may be ambivalent about selecting a research-related career to pursue that career. Paradoxically,
this may help improve the qualifications of students who are not actively pursuing a research
career because they feel underqualified; a research-related career goal should help to
increase their research productivity. It also seems important to emphasize that students who
are committed to careers in clinical practice may also benefit from conducting research
during and after graduate school. If the RTE teaches that science is indeed wed to clinical
practice, then perhaps these students will also find a place for conducting research in their
careers.

Conclusions

The present study examined predictors of research productivity and choice to enter a
research-related career among counseling psychology graduate students. Although many
predictors in the present model were individual difference variables, it seems clear that
graduate training programs can play a large role in helping students to become scientists.
Ideally, the model outlined in the present study will serve at least two purposes. First,
hopefully it will serve as a basis for doing more and better research on research training in
counseling psychology graduate students. Second, hopefully the present study will serve as
a useful aid in helping training programs find ways to improve the research training of
counseling psychology graduate students.
APPENDIX A

VOCATIONAL PREFERENCE INVENTORY — FORM B

(SOCIAL AND INVESTIGATIVE SUBSCALES)
This is an inventory of your feelings and attitudes about many kinds of work. Fill out your answer sheet by following the directions given below:

1. Show the occupations which interest or appeal to you by circling Y for "Yes."
2. Show the occupations which you dislike or find uninteresting by circling N for "No."

1. Y N Chemist
2. Y N Youth Camp Director
3. Y N Astronomer
4. Y N Vocational Counselor
5. Y N Editor of Scientific Journal
6. Y N Social Science Teacher
7. Y N Meteorologist
8. Y N School Principal
9. Y N Independent Research Scientist
10. Y N High School Teacher
11. Y N Scientific Research Worker
12. Y N Director of Welfare Agency
13. Y N Zoologist
14. Y N Clinical Psychologist
APPENDIX B

RESEARCH TRAINING ENVIRONMENT SCALE – REVISED
Below is a series of statements concerning research training.

Please note: We define research broadly. "Research" when used in this survey includes the following types of activities: designing and executing research projects, preparing manuscripts of a theoretical nature or a critical review of literature, conducting program evaluations or needs assessments, making presentations at professional conferences, participating as a member of a research team engaged in any of the above activities, and advising the research projects of others.

Please respond to the following statements in terms of the doctoral program in which you are currently receiving your training. (Note: If you are currently on internship, please rate the graduate program in which you were previously trained.) Consider each statement using the following scale:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In general, my relationship with my advisor is both intellectually stimulating and interpersonally rewarding. (If your advisor has been newly assigned or chosen, respond in terms of what you expect the relationship to be.)</td>
</tr>
<tr>
<td>2</td>
<td>My graduate program rarely acknowledges the scholarly achievements of students.</td>
</tr>
<tr>
<td>3</td>
<td>Many of our faculty do not seem to be very interested in doing research.</td>
</tr>
<tr>
<td>4</td>
<td>The faculty does what it can to make research requirements such as the thesis and dissertation as rewarding as possible.</td>
</tr>
<tr>
<td>5</td>
<td>The faculty here only seem to notice a few selected students in terms of reinforcing scholarly achievements.</td>
</tr>
<tr>
<td>6</td>
<td>My graduate program provides concrete support for graduate student research (e.g., access to computers, travel money for making presentations, research supplies, or free postage for mailing surveys).</td>
</tr>
<tr>
<td>7</td>
<td>I feel that my advisor expects too much from my research projects.</td>
</tr>
<tr>
<td>8</td>
<td>There is informal sharing of research ideas and feelings about research ideas in my program.</td>
</tr>
<tr>
<td>9</td>
<td>My advisor understands and accepts that any piece of research will have its methodological problems.</td>
</tr>
<tr>
<td>10</td>
<td>Faculty members often invite graduate students to be responsible collaborators in the faculty members' own research.</td>
</tr>
<tr>
<td></td>
<td>1 disagree</td>
</tr>
<tr>
<td>---</td>
<td>------------</td>
</tr>
<tr>
<td>11</td>
<td>I was encouraged to get involved in some aspects of research early in my graduate training.</td>
</tr>
<tr>
<td>12</td>
<td>Because of the diversity of research approaches among faculty members in my program, I would be able to find help learning about virtually any major research approach, e.g., field, laboratory, experiential, qualitative.</td>
</tr>
<tr>
<td>13</td>
<td>In my graduate training program there are opportunities to be part of research teams.</td>
</tr>
<tr>
<td>14</td>
<td>I have felt encouraged during my training to find and follow my own scholarly interests.</td>
</tr>
<tr>
<td>15</td>
<td>My training program faculty tends to produce research that is not clinically relevant.</td>
</tr>
<tr>
<td>16</td>
<td>The research climate here is one in which students can get in touch with their own curiosity and with the research questions they themselves want to ask.</td>
</tr>
<tr>
<td>17</td>
<td>Many different research styles (e.g., field vs. laboratory) are acceptable in my graduate program.</td>
</tr>
<tr>
<td>18</td>
<td>The faculty members of my graduate program enjoy discussing ideas.</td>
</tr>
<tr>
<td>19</td>
<td>Much of the research we become involved of prior to the thesis is organized in a way that is highly anxiety provoking to students.</td>
</tr>
<tr>
<td>20</td>
<td>Students in my program receive sound training in how to design and logically analyze research studies.</td>
</tr>
<tr>
<td>21</td>
<td>I have gotten the impression in my graduate training that my research work has to be of great value in the field to be worth anything.</td>
</tr>
<tr>
<td>22</td>
<td>The faculty in my graduate training program is involved in the conduct and publication of high quality research (or theory).</td>
</tr>
<tr>
<td>23</td>
<td>Statistics courses here are taught in a way that is insensitive to students' level of development as researchers.</td>
</tr>
<tr>
<td>24</td>
<td>We do not receive sound training in my program on applied, practical, and less traditional approaches to research.</td>
</tr>
<tr>
<td>25</td>
<td>The statistics courses we take do a good job, in general, of showing students how statistics are actually used in psychological research.</td>
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</tbody>
</table>
There is a sense around here that being on a research team can be fun, as well as intellectually stimulating.

Students here are encouraged to at least begin thinking about one or more topics upon which they would like to conduct programmatic research (i.e., a series of studies in which one builds upon another).

My graduate training program has enabled me to see the relevance of research to clinical service.

The faculty members of my graduate program encourage me to pursue the research question in which I am interested.

My advisor offers much encouragement to me for my research activities and accomplishments.

Faculty members in my program use an extremely narrow range of research methodologies.

In my research training, the focus has been on understanding the logic of research design and not just statistics.

Some of the faculty teach students that during a phase of the research process, it is important for the researchers to "look inward" for interesting research ideas.

Generally, students in my training program do not seem to have intellectually stimulating and interpersonally rewarding relationships with their research advisors.

It is unusual for first-year students in this program to collaborate with advanced students or faculty on research projects.

There seems to be a general attitude here that there is one best way to do research.

I have the feeling, based on my training, that my thesis (or dissertation) needs to be completely original and revolutionary for it to be acceptable to the faculty.

The faculty does not seem to value clinical experience as a source of ideas for research.

We get high quality training here in the use of statistics in applied research, e.g., counseling research.
40. **disagree** I get the impression from my training that, although a single study does not revolutionize thinking in the scientific community, such a study can contribute a useful piece to an unfolding body of knowledge.

41. **somewhat disagree** This training environment promotes the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues.

42. **neutral** Our statistics instructors are generally sensitive to students' anxieties and feelings about statistics.

43. **somewhat agree** Our faculty seems interested in understanding and teaching how research can be related to counseling practice.

44. **agree** Most faculty do not seem to really care if students are genuinely interested in research.

45. **somewhat agree** During our coursework, graduate students are taught a wide range of research methodologies, e.g., field, laboratory, survey approaches.

46. **somewhat agree** During their first year in the program, students take a research course aimed at developing research skills, interests, and confidence.

47. **agree** I feel that I need to choose a research topic of interest to my advisor at the expense of my own interests.

48. **somewhat agree** There is a prevalent viewpoint in my training program that research findings can be used to improve clinical practice.

49. **agree** Students in our program feel that their personal research ideas are squashed during the process of collaborating with faculty members, so that the finished project no longer resembles the student's original idea.

50. **neutral** Students here seem to get involved in thinking about research from the moment they enter the program.

51. **neutral** Students in this program are rarely taught to use research findings to inform their work with clients.

52. **somewhat agree** The faculty members here are quite open in sharing their research with their students.

53. **agree** The faculty members of my graduate program show excitement about research and scholarly activities.
<table>
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<th>1</th>
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<th>4</th>
<th>5</th>
</tr>
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<tbody>
<tr>
<td>disagree</td>
<td>somewhat disagree</td>
<td>neutral</td>
<td>somewhat agree</td>
<td>agree</td>
</tr>
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</table>

54. Much of the research we become involved in prior to the thesis is intellectually challenging and stimulating.
APPENDIX C

SELF-EFFICACY IN RESEARCH MEASURE (BRIEF FORM)
The following items are tasks related to research. Please indicate your degree of confidence in your ability to successfully accomplish each of the following tasks on a scale of 0 - 9 with 0 representing no confidence and 9 representing total confidence.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>no confidence</td>
<td>total confidence</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

1. ____ Keeping records during a research project
2. ____ Designing an experiment using traditional methods (e.g., experimental, quasi-experimental designs)
3. ____ Writing the introduction and literature review for a dissertation
4. ____ Writing the introduction and discussion sections for a research paper for publication
5. ____ Formulating hypotheses
6. ____ Writing the method and results sections of a thesis
7. ____ Utilizing resources for needed help
8. ____ Understanding computer printouts
9. ____ Defending a thesis or dissertation
10. ____ Using multivariate statistics (e.g., multiple regression, factor analysis, etc.)
11. ____ Using statistical packages (e.g., SPSS-X, SAS, etc.)
12. ____ Operationalizing variables of interest
APPENDIX D

RESEARCH PRODUCTIVITY ITEMS
The following items assess research accomplishments and current involvement in research activities. Please answer the following questions based on your past and current research involvement.

1. _____ How many published manuscripts (either empirical or otherwise) have you authored or coauthored in a refereed journal? (include manuscripts in press)
2. _____ How many unpublished empirical manuscripts have you authored or coauthored (not including your thesis or dissertation)?
3. _____ How many articles have you submitted to refereed journals?
4. _____ How many manuscripts are you currently in the process of preparing to submit for publication (i.e., writing the manuscript)?
5. _____ How many presentations have you made at local, regional, or national conventions?
6. _____ How many presentations are you currently in the process of preparing to submit for presentation (i.e., writing an abstract)?
7. _____ How many local, regional, or national research conventions have you attended?
8. _____ How many intensive case studies of clients, groups, or consultations have you conducted?
9. _____ How many program evaluations have you participated in?
10. _____ How many informal comparative counseling outcome studies have you participated in?
11. Y N Are you currently involved in gathering data (do not include your thesis or dissertation)?
12. Y N Are you currently conducting statistical analyses on data (do not include your thesis or dissertation)?
The following eleven job settings are possible occupational choices for many counseling psychology graduates. Please rank order your top three choices by placing either a 1, a 2, or a 3 next to your first, second, and third choice for occupational setting, respectively.

1. Academic (large university)
2. Academic (small college)
3. Counseling center
4. Veterans Administration hospital
5. Research facility
6. Government agency
7. Industry
8. Community mental health center
9. Private practice
10. Full-time consultation
11. Other (please indicate________________________)
APPENDIX F

DEMOGRAPHIC QUESTIONNAIRE
Please respond to the following demographic items.

1. What is your sex?    female    male
2. What is your age?    ______
3. What is your ethnicity?    ________________
4. What year in the doctoral program are you in?
   1 2 3 4 5 6+ internship post-internship
5. Have you finished your masters's thesis?    yes    no    not required
6. How many statistics courses have you taken in graduate school?    ______
7. How many research methods courses have you taken in graduate school?    ______
8. Approximately how many total practicum hours do you have?    ______
APPENDIX G

COVER LETTER
Dear Counseling Psychology student:

I am a fourth-year counseling psychology graduate student and am currently working on my dissertation, a study that examines research training in counseling psychology graduate programs. Your program director has given me permission to contact you and ask for your help in completing this project. I have tried to send this to you as early in the semester as possible because I know that your schedule can get very busy as the semester progresses.

I believe that this study is a very important one, as questions about research training may ultimately have an impact on you and your graduate school training. Certainly as a counseling psychology graduate student, you are in a unique position to be able to reflect on some of these issues, and your opinions are very important for the completion of this study. Enclosed you will find a questionnaire that assesses various aspects of you and your training program. Please take some time to complete the questionnaire. Graduate students here at Iowa State tell me that it takes no longer than 20 minutes to complete.

I will do everything possible to preserve your confidentiality. As a way to insure that confidentiality, I'm asking that you do not write your name on the questionnaire. Instead, please mail the enclosed postcard to me separately. This postcard will let me know that you have turned in the questionnaire, and the postcard will never be associated with the questionnaire data. The questionnaire itself may be returned in the stamped business envelope included in your package.

To thank you for your assistance, I would like to enter your name in a drawing. When you return the questionnaire and postcard to me you will become eligible for one of two $50 prizes to be raffled off. This drawing will be on October 31, 1995, so be sure to turn in your questionnaire and postcard as soon as possible.

I understand that a graduate student's time is valuable. However, I would greatly appreciate it if you would take the time to complete the questionnaire and return it to me. I believe that this is an important study that can benefit us both by helping to make our training as effective as possible.

Thank you very much.

Sincerely,

Jeffrey H. Kahn, M.S.
Principal Investigator

Norman A. Scott, Ph.D.
Faculty Advisor

Camilla P. Benbow, Ed.D.
Chair, Department of Psychology
REFERENCES


