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A Comprehensive Review of Research Evaluating the Effectiveness of DISCOVER in Promoting Career Development

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Abstract

DISCOVER is ACT's computer-assisted career guidance program. A comprehensive review of research on the effectiveness of DISCOVER found that it increases users' vocational identity, level of career development, and career decision-making self-efficacy. Somewhat mixed findings emerged regarding the effectiveness of DISCOVER as a tool for increasing career decidedness, occupational certainty, career maturity, and career exploration. DISCOVER appears to be most effective when used in conjunction with additional career exploration and planning activities (e.g., individual counseling and group workshops).

This report includes summaries of the 26 investigations evaluating DISCOVER's effectiveness that have been published between 1978 and 1998. The populations studied included middle school students, high school students, college students, and adults in career transition. Suggestions for future research are discussed, with a particular focus on improving methodological limitations of previous research in this domain.

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Historical Overview of DISCOVER's Development

In 1967, JoAnn Harris-Bowlsbey (then the Director of Guidance at Willowbrook High School in Villa Park, Illinois) and members of her staff began to develop a computerized program for career counseling. Their efforts resulted in the development of the Computerized Vocational Information System (CVIS), a program funded by a grant from the Illinois Board of Vocational Education. The College of DuPage, a nearby community college, became a collaborator in the project. The system was distributed to almost 200 sites throughout the Midwest.

Work began on DISCOVER, a second-generation system, in 1974 with funding support from the United States Office of Education and in-kind support from the IBM Corporation. DISCOVER was developed to run on IBM 370 and 4300 mainframe computers, and clients used a light pen and a terminal to interact with the program. The mainframe version of DISCOVER was much more comprehensive than CVIS or any other computer-based system available at that time. JoAnn Harris-Bowlsbey, Jack Rayman, and Doris Bryson conceptualized the guidance content of the system with input from leading career theorists and CVIS users. IBM helped market this version, but its distribution was limited partly by the need for an IBM mainframe computer and light pen terminals.

In the late 1970s and early 1980s, both microcomputers and minicomputers began to increase in popularity in schools, particularly for administrative applications. A microcomputer version of DISCOVER was released in 1982, which placed the major functionality of the system into four modules. This system ran under C/PM and Apple DOS configurations and required a 10MB hard drive—an unusual and costly requirement at the time. Two years later, a version of DISCOVER with reduced content was created for operation on Hewlett-Packard minicomputers.

This system, initially called EXPLORE, was modified to operate on DEC-VAX and IBM minicomputers under the name DISCOVER for Minicomputers. This system was used in many school systems until 1985, when larger numbers of schools began acquiring microcomputers.

In 1982 the DISCOVER Foundation, a non-profit agency established several years earlier by JoAnn Harris-Bowlsbey, merged with American College Testing (ACT), Inc. JoAnn Harris-Bowlsbey became the Director of ACT's DISCOVER Center, later called ACT's Educational Technology Center, in Hunt Valley, Maryland. This merger made it financially possible to continue the development and enhancement of DISCOVER, including versions for microcomputers, improved databases, the addition of ACT's career assessments (e.g., the Unisex Edition of the ACT Interest Inventory [UNIACT], the Inventory of Work-Related Abilities), and the linkage of ACT's assessments and other career-related inventories to the World-of-Work Map. Separate versions of DISCOVER, including DISCOVER for Junior High/Middle Schools, DISCOVER for Organizations, and DISCOVER for Retirement Planning, were developed to address the career decision-making process across the lifespan.

When IBM entered the microcomputer market and began selling personal computers that used the MS-DOS operating system, the C/PM operating system became obsolete. This change in technology led to the release of an MS-DOS version of DISCOVER in 1987. It looked much like the current DOS version of DISCOVER, which has seven modules in the high school version and nine in the college/adult version. Over the past 10 years, this version of DISCOVER has continued to be refined and enhanced by improved graphics, the addition of the Values Inventory, the capability for batch processing of student inventory scores, expanded databases, and many additional features.

Other programs also were developed based on the MS-DOS version of DISCOVER. Both an Apple II and MS-DOS version of DISCOVER for Junior High and Middle Schools were

released in 1987. In 1990, the state of Maryland contracted with ACT to develop its career information system, VISIONS. Versions of VISIONS for MS-DOS, Apple II, and microfiche were released in 1991. DISCOVER for Organizations was redeveloped under MS-DOS in 1988 (with a major revision in 1993), and DISCOVER for Retirement Planning was released in 1990.

In 1995 the Compact Disc-Interactive (CD-I) multimedia version of DISCOVER, operating on a Philips compact disc-interactive player, and a Macintosh version of DISCOVER were released. These versions reverted back to the four-module design that had been used in the early 1980s. In 1997 ACT released the Windows® 95 version of DISCOVER. The Windows® 95 version of DISCOVER maintains the four-module design, all of the multimedia features of the CD-i version (e.g., video clips, audio messages), hypertext links to Internet sites, expanded occupational information, and additional enhanced content and capability.

A comprehensive listing of previous and current versions of DISCOVER appears in Appendix A.

Purpose of the Report

Although vocational psychologists have reviewed and summarized published reports of research evaluating the effectiveness of career interventions in general (Oliver & Spokane, 1988; Whiston, Sexton, & Lasoff, 1998), there has not been an attempt to evaluate the efficacy of computer-assisted career guidance systems (CACGs) in a systematic fashion (Hinkelman & Luzzo, 1997). Despite the relatively large number of CACGs and the increasing number of Internet based career assessment services, there is a general absence of empirical literature available to support the use of many of these systems. We prepared this report to summarize and critically review previous research designed to evaluate the effectiveness of DISCOVER, one of the most widely used CACGs in high schools and colleges nationwide. The primary purpose of this report is to provide career counselors and vocational psychologists with empirically based

data on which to assess the merits of the program. In addition, it is hoped that the results of this literature review will be useful to both researchers and career counseling practitioners as they design effectiveness research in the future and determine the most appropriate methods for integrating DISCOVER into a comprehensive cadre of career development services.

Methodology

The research reviewed in this report was compiled from various sources. We conducted an extensive search of the ERIC and PSYCinfo data bases, obtained a bibliography of DISCOVER–related publications (Sampson & Reardon, 1993), and reviewed all references included in published articles to ensure a comprehensive review of the research literature. The results of this search yielded 62 published articles, theses, dissertations, professional papers, and corporate-sponsored research reports addressing some aspect of DISCOVER and its use as a career exploration and planning tool.

In order to ensure that we only included studies investigating the effectiveness of DISCOVER in promoting career development, we devised inclusion/exclusion criteria. Studies included in this review either specifically investigated the effects of DISCOVER on various career counseling outcome measures or compared the effectiveness of DISCOVER to other interventions and/or computer-assisted career guidance systems (CACGs). We excluded studies that dealt only with consumer satisfaction, cost effectiveness, or basic use of DISCOVER in various settings. Studies in which DISCOVER was used to test a hypothesis extraneous to the effectiveness of the system and studies that used quantitative outcome measures that lacked psychometric support also were excluded. From the 62 studies we initially identified, 26 met the criteria for inclusion. These studies consisted of 11 dissertations, 1 thesis, 1 ACT research report, 3 ERIC documents, and 10 empirical articles published in refereed journals.

Population Characteristics of Studies Reviewed

Studies evaluating the effectiveness of DISCOVER have drawn samples from a variety of populations. Table 1 depicts the sex and ethnicity of known participants. (It should be noted that not all studies provided a comprehensive description of participants; the population information provided herein reflects only those studies that provided such information.) In total, some 2,692 people have participated in DISCOVER effectiveness studies.

Table 1

Summary of Participants' Sex and Ethnicity as Reported in DISCOVER Effectiveness Research

Identified Groups	N	Percentage
SEX		
Males	827	44
Females	1062	56
ETHNICITY		
White	868	75
African American	103	9
Hispanic	85	7
Asian/Pacific Islander	41	4
Native American	1	< 1
Other unspecified minority	60	5

Of the 26 studies included in this review, 16 provided information on the sex of the participants. Among these participants, 1062 (56%) were women, and 827 (44%) were men. Only 11 studies provided information regarding the age of the participants, with a range from 12 to 50 years. Even fewer studies (n = 10) reported the ethnicity of the participants. For those studies that reported participants' ethnicity, Caucasians comprised nearly 75% of all participants, whereas African American, Hispanic, and Asian/Pacific Islander participants accounted for

approximately 9%, 7%, and 4% of the participants, respectively. Three studies classified non-white participants as either "ethnic minority" or "other," accounting for approximately 5% of the known participants. Surprisingly, none of the studies reviewed for this project investigated the differential effectiveness of DISCOVER among or between specific ethnic groups.

As shown in Table 2, college student volunteers accounted for approximately 45% of all participants and were the focus of 11 of the 26 DISCOVER effectiveness studies published prior to 1999. Four of the studies we reviewed investigated the utility of DISCOVER with high school students, accounting for 22% of the total participants. Junior college and four-year college/university students seeking career guidance services participated in six studies and made up 18% of the known population, whereas one study investigated the use of DISCOVER with college students in a career planning class. Other specific populations (e.g., middle school students, injured workers, students with physical disabilities, and adults in career transition) collectively accounted for approximately 16% of the total populations studied.

Table 2

Summary of Populations Studied in DISCOVER Effectiveness Research

Populations Studied	Number of Studies	Total Number of Subjects	Population Percentage
Middle School Students	1	38	1.4
High School Students	4	582	21.6
Junior College Career Clients	1	27	1.0
College Student Career Counseling Clients	5	461	17.1
College Student Volunteers	11	1217	45.2
College Students in a Career Planning Class	1	46	1.7
Adults in Career Transition	1	188	7.0

(table continues)

Populations Studied	Number of Studies	Total Number of Subjects	Population Percentage
College Students with Physical Disabilities	1	50	1.9
Injured Workers	1	83	3.1
Total	**26**	**2692**	**100.0**

Review of Research Results

This section of the report provides readers with a summary of the various outcomes that DISCOVER effectiveness studies have revealed. The summary is divided according to distinct variables that previous investigations have evaluated. The variables addressed in this review include the following: career decidedness/occupational certainty, career maturity, vocational identity, level of career development, career decision-making self-efficacy, and career exploration behavior. For each variable, we include a brief definition, a description of the measures used to evaluate DISCOVER's effectiveness, and a summary of the relevant research findings.

Career Decidedness/Occupational Certainty

Brief definition of the constructs. In the context of career decision making, *career decidedness* refers to the degree to which an individual is decided on entering a particular career. Similarly, *occupational certainty* is concerned with one's commitment to an occupational choice. As shown in Table 3 (see pages 39 to 43), several researchers have evaluated the effectiveness of DISCOVER as a vehicle for increasing the career decidedness and/or occupational certainty of users.

Description of measures. One of the most popular assessments of career decidedness that has been used in DISCOVER effectiveness studies is the *Career Decision Scale* (CDS; Osipow,

Carney, Winer, Yanico, & Koschier, 1976). The CDS is a 19 item scale designed to assess barriers preventing individuals from making career decisions (Osipow, 1987). Items 1 and 2 comprise a certainty scale that ranks the degree to which one is certain of her or his career or educational decision. Items 3 through 18 provide an index of career indecision. The 19th item is open-ended so that the person completing the scale can write down a more accurate description of her or his career decidedness. Respondents are asked to rate the degree to which an item describes their thinking about career and educational choices. Responses are rated on a Likert scale from *Exactly like me* (4) to *Not at all like me* (1). *The Career Decision Scale Manual* (Osipow, 1987) reports a test-retest reliability of .70 for a 6 week interval. Additionally, the manual provides numerous studies to support the convergent, construct, and discriminant validity of the CDS.

Another measure of career decidedness used to evaluate the effectiveness of DISCOVER is the *Career Factors Inventory* (CFI; Chartrand, Robbins, Morrill, & Boggs, 1990). The CFI was developed with a theoretical rationale, which posits that personal-emotional and informational factors interact to promote or hinder the career decision-making process. The inventory includes four factors. The first factor is Career Choice Anxiety, which assesses the degree of anxiety associated with the process of making decisions about vocational choices. The next factor, Generalized Indecisiveness, examines the pervasiveness of one's inability to make decisions in general. Need for Career Information makes up the third factor and consists of items pertaining to the perceived need for factual data relevant to various occupations before making a commitment to a vocation. The final factor, Need for Self-Knowledge, assesses the need for self-definition and discovery. Cronbach's alpha coefficients range from .73 to .86 for each of the scales and .87 for the total inventory. The developers also report that the instrument has demonstrated adequate discriminant and convergent validity (Chartrand et al., 1990).

The Occupational Alternatives Questionnaire (OAQ; Zener, & Schnuelle, 1972; modified by Slaney, 1978, 1980) also has been used as measure of career decidedness and occupational certainty in DISCOVER effectiveness studies. The measure consists of two items that require written responses. The first item asks respondents to "List all of the occupations you are considering now." The second item asks the respondent to denote "Which occupation is your first choice? (If undecided write 'undecided')." The scoring method was developed by Slaney (1980): 1 point for first choice listed and no alternatives; 2 points for a first choice listed and alternatives; 3 points for just alternatives listed; and 4 points for having neither a primary choice or alternatives listed. This method of scoring also permits an evaluation of decidedness with 1 representing *most decided* and 4 representing *least decided.* Redmond (1972) reported a test-retest reliability of .93 for the OAQ, and Slaney, Palko-Nonemaker, and Alexander (1981) found substantial support for the measure's validity.

The *Assessment of Career Decision Making* (ACDM; Harren, 1985) also has been used as a measure of certainty and commitment to occupational choice in DISCOVER research. The ACDM contains four scales that can be administered in any combination. An *Agree-Disagree* response format is used. The four scales that comprise the ACDM include a Decision-Making Styles Scale, College Scale, Major Scale, and an Occupational Scale. The only scale that has been used from the ACDM to evaluate the effectiveness of DISCOVER has been the Occupational Scale. This scale assesses the degree of certainty and commitment to an occupational choice. The scale represents a bipolar continuum from the negative (lower scores) pole indicating awareness for the need to explore and make decisions to the positive pole (higher scores) indicating a sense of direction and commitment. Daniels and Buck (1985) reported a test-retest reliability of .79 and an internal consistency coefficient of .89. Johnson (1987) and others (see Harren, 1985) have demonstrated support of the ACDM's content validity.

One other assessment that has been used to measure career decidedness in DISCOVER effectiveness research is the *Vocational Decision-Making Difficulty Scale* (VDMDS; Holland, Gottfredson, & Nafziger, 1973). The VDMDS is a 13-item true/false scale that measures self-estimates of ability to make vocational decisions, knowledge of personal preferences, and world of work demands. The Kuder Richardson (KR)-20 reliabilities for the instrument range from .63 to .84 (Holland & Holland, 1977).

Summary of Research Findings. The results of the effectiveness of DISCOVER as an intervention for increasing career decidedness and occupational certainty have been somewhat mixed. Nevertheless, several studies have supported the effectiveness of DISCOVER as a means of increasing users' career decidedness. Glaize and Myrick (1984) compared the effectiveness of DISCOVER and a group career exploration workshop, both combined and separately, to assess their relative impact on the career decision making of 11th grade students. The results of the study indicated that DISCOVER—whether used alone or in conjunction with the group workshop—increased participants' decidedness relative to a no-treatment control group. Similarly, Fukuyama, Probert, Neimeyer, Nevill, and Metzler (1988) found that DISCOVER alone, when compared to a control group, increased the career decidedness of first-year college students.

Gilman's (1987) results indicated that DISCOVER alone reduced adults' career indecision and performed as well as SIGI PLUS and a career guidance group in this regard. Similarly, a study by Brownfield (1987) compared the effectiveness of DISCOVER and SIGI PLUS as interventions for increasing career decidedness. The findings indicated that both systems effectively assisted participants in increasing in their decidedness.

Sampson et al. (1993) found somewhat superior effects for DISCOVER relative to the effects of SIGI PLUS in the area of occupational certainty. Adults using DISCOVER increased

in their occupational certainty (as measured by the OAQ), whereas SIGI PLUS failed to produce the same effect in participants. A more recent study with rural youth (Hinkelman, 1997) evaluated the effectiveness of DISCOVER on career decidedness using the CFI as the criterion measure. The results of Hinkelman's study revealed that DISCOVER failed to assist boys with their career indecision. However, girls who perceived that they possessed a lack of self-knowledge and that this lack of self-knowledge was a barrier to career decision making demonstrated a decrease in their need for self-knowledge after using DISCOVER.

Kapes, Borman, and Frazier (1989) conducted a meta-analysis of three studies designed to evaluate the differential effects of DISCOVER and SIGI with undergraduate students. On the basis of their meta-analysis, Kapes et al. concluded that both systems are most effective when used in conjunction with other career guidance activities, such as one-on-one counseling. In a similar vein, recent results reported by Barnes and Herr (1998) indicated that DISCOVER—when used in conjunction with individual counseling—provided modest (although not statistically significant) gains in improving the career decidedness of college students compared to individual counseling alone.

Marin and Splete (1991) found similar results when they used DISCOVER as a treatment for autoworkers in the midst of a career transition. Using DISCOVER with counseling support was superior to using DISCOVER alone in increasing career decidedness. Similarly, in the only DISCOVER effectiveness study that coupled the use of DISCOVER with a cognitive restructuring intervention, Shahnasarian and Peterson (1986) exposed participants to a videotape explaining Holland's scheme of occupational organization in the world of work prior to their use of DISCOVER. The results of the study indicated that those exposed to the cognitive structuring condition who then used DISCOVER became more focused and homogenized in their career choice options.

Despite the results of various studies that have found DISCOVER to be effective in increasing career decidedness and occupational certainty, other studies have failed to support these findings. For example, Yang (1988) conducted a study with injured workers in career transition and found that DISCOVER failed to enhance career decidedness in this population even when used in conjunction with other career guidance interventions. These findings are similar to those reported by Garis and Niles (1990), who compared DISCOVER and SIGI in two university samples. They found that DISCOVER-only and SIGI-only groups failed to produce any significant differences in Career Decision Scale post-test scores compared to the control group. These researchers concurred with other investigators that the best use of CACGs is probably in conjunction with other interventions and that such systems are less effective when they are used exclusively (i.e., as the *sole* means of intervention).

Leboeuf (1990) compared the effectiveness of DISCOVER and SIGI PLUS on the career decidedness of a sample of students enrolled in a career planning class. Students were randomly assigned to use either system or to a wait list control group. Similar to the findings Yang (1988) and Garis and Niles (1990) reported, there were no significant differences in career decidedness across conditions for either system. Similarly, Conrad (1990) compared DISCOVER and Virginia VIEW (a career information system). Both systems were used separately and jointly in the study. No significant differences in career decidedness were revealed for any of the groups.

In one of the only studies evaluating the effectiveness of DISCOVER among special populations, Alston and Burkhead (1989) examined the impact of DISCOVER on the career decidedness of physically disabled students. Again, those in the treatment group did not demonstrate any decrease in their CDS indecision scores when compared to a control group. Similarly, Engel (1991) compared a DISCOVER-only treatment group, DISCOVER with group analysis, DISCOVER with group analysis and individual counseling, and a control group among

a sample of college students. The results suggested that DISCOVER had no effect on participants' career decidedness.

The results of studies assessing the effectiveness of DISCOVER as a method for increasing persons' career decidedness appear to be somewhat contradictory. Thus, it is difficult to make any definitive statements regarding DISCOVER's impact upon career indecision. A possible explanation could be that DISCOVER may not be as effective for some clients (e.g., those who perceive particularly salient barriers to career decision making) as it is for others. Similarly, DISCOVER may be an effective treatment for some types of career indecision and yet ineffective (especially as a stand-alone treatment) for other types of indecision. Also important to consider is the argument that an increase in career decidedness may not always be the optimal career intervention outcome for all clients (Mitchell, Levin, & Krumboltz, 1999).

Nevertheless, there does seem to be at least partial support for DISCOVER's utility as an intervention tool for increasing the career decidedness and occupational certainty of users. Several studies that have evaluated DISCOVER in conjunction with other interventions have found statistically significant and meaningful, positive effects (Kapes et al., 1989; Shahnasarian & Peterson, 1986) and modest gains (Barnes & Herr, 1998). One consistent finding is that DISCOVER appears to be at least as effective as (and sometimes superior to) other CACG and informational systems as a method for increasing the career decidedness of users.

Career Maturity

Brief definition of the construct. Career maturity has been defined by Savickas (1984) as one's "readiness to cope with vocational developmental tasks" (p. 222). The assessment of this construct involves the exploration of where a client is in terms of her or his vocational development and comparing that rate of progress with an expected degree of vocational

development. Additionally, task coping, or the implementation of behavior that leads to a satisfactory outcome of the developmental task, is often examined in studies of career maturity.

Description of measures. Several measures have been used to assess career maturity in DISCOVER effectiveness research. One such assessment is the *Career Development Inventory* (CDI; Super, Thompson, Lindeman, Jordaan, & Myers, 1981). There are two forms of the CDI: a school form targeted for use with students in grades 8 through 12 and a college and university form for students enrolled in postsecondary institutions. Both forms contain eight scales: Career Planning (CP), Career Exploration (CE), Decision Making (DM), World of Work Information (WW), Knowledge of Preferred Occupational Group (PO), Career Development Attitudes (CP and CE combined), Career Development Knowledge (DM and WW combined), and Career Orientation Total (CP, CE, DM, and WW combined). Thompson and Lindeman (1981) reported Cronbach's alpha coefficients ranging from .78 for the CE scale to .89 for the CP scale. The DM and PO scales, which focus more on opinion than behavior, have only moderate internal consistencies: .67 and .60, respectively. Thompson, Lindeman, Super, Jordaan, and Myers (1984) cited substantial support for the validity of the CDI.

The *Career Maturity Inventory* (CMI; Crites, 1973, 1978) contains two parts: an Attitude Scale and a Competence Scale. Only the Attitude Scale has been used to assess career maturity in DISCOVER effectiveness studies (Glaize & Myrick, 1984; Luzzo & Pierce, 1996). The CMI Attitude Scale contains 50 true/false items that yield a single score obtained through summing the number of correct answers (i.e., "mature" responses). KR-20 internal consistency of the CMI Attitude Scale ranged from .65 to .84 in studies cited by Crites (1971). Temporal stability for the inventory has been reported as .71 for a one-year interval (Crites, 1978). Crites (1978) and others (e.g., Jepsen & Prediger, 1981; Luzzo, 1993a) have demonstrated the validity of the CMI.

The *Career Development Questionnaire* (CDQ; Langley, 1990) is a career maturity inventory developed for use in South Africa. Development of the CDQ was based on the integration of the models forwarded by Crites (1973), Super, Thompson, Lindeman, Jordaan, and Myers (1981), and Westbrook and Parry-Hill (1975). The inventory assesses the following constructs: self-knowledge, decision making, career information, integration of self-knowledge and career information, and career planning. The internal consistency (KR-20) reliabilities range from .76 to .82 for English speaking students, .78 to .82 for Afrikaans speaking students, and .66 to .74 for those speaking other African languages (Langley, du Toit, & Herbst, 1992). Content validity for the instrument was established through the use of expert judges and item and scale correlations (Langley et al., 1992).

Summary of Research Findings. Results of studies investigating the effectiveness of DISCOVER as a means for enhancing career maturity have been somewhat contradictory. Several studies have found that DISCOVER does, in fact, increase career maturity both when used alone and when used in conjunction with other interventions. For instance, Nocella (1985) compared a DISCOVER-only group to DISCOVER-and-counselor group among college students. The participants in both groups used DISCOVER for one 2-hour session. Participants assigned to the DISCOVER-and-counselor group received one 50-minute career counseling session within one week after using DISCOVER. During the counseling session they received feedback relating to the use of the system and were given the choice of using other interventions to complement their use of DISCOVER. Both treatment groups demonstrated statistically significant post-test gains on the Career Attitudes, Career Exploration, Career Planning, and Career Orientation scales of the CDI.

Similarly, Garis and Bowlsbey (1984) compared DISCOVER-alone, counseling alone, DISCOVER and counseling, and a control group. Results revealed statistically significant

differences in the treatment group and gains for each treatment condition (related to the control group) on the career planning and career exploration scales of the CDI. Results indicated that DISCOVER was as likely as one-on-one career counseling to elicit involvement in career planning activities.

More recently, Luzzo and Pierce (1996) found a statistically significant treatment effect for DISCOVER on the career maturity of middle school students. Participants in this study were randomly assigned to either a treatment or a control condition. Those in the treatment condition had access to all of the modules in DISCOVER for 1 hour each day over a 2-week period. DISCOVER produced statistically significant gains in career maturity in a relatively short amount of time. Similarly, Langley and Schepers (1990), using a Solomon four group experimental design with a sample of 106 first year South African college students, found statistically significant effects of DISCOVER on the career maturity of participants. Students in the DISCOVER-only treatment condition showed statistically significant gains in career maturity relative to the participants in the control condition. Finally, in a study comparing DISCOVER for Microcomputers and the mainframe version of DISCOVER relative to a wait-list control group of college students, Yonkovig (1987) found that both versions of DISCOVER demonstrated statistically significant gains on the CDI at post-test contrasted with the CDI post-test scores of participants in the control group.

Despite the evidence supporting the effectiveness of DISCOVER as a method for enhancing users' career maturity, three studies have resulted in findings that question the effectiveness of DISCOVER as a stand-alone career intervention. Rayman, Bryson, and Harris-Bowlsbey (1978) conducted one of the first experiments evaluating the effectiveness of DISCOVER in increasing career maturity among a sample of junior and senior high school students. They failed to find significant post-test differences in career maturity between the

group using DISCOVER and a control group. However, they noted that the results may have been due to compromises in the research design (e.g., using a smaller-than-intended sample size, reduction in the amount of time students used the system, the use of only one or two modules in DISCOVER rather than the use of the complete system).

In an investigation of the effectiveness of DISCOVER on career time perspective and decision making, Schlossman (1990) used modules 3, 4, and 5 (the career guidance components) of DISCOVER. Again, no significant increases in career maturity were found using the Career Planning and Career Exploration scales of the CDI as outcome measures. More recently, Hinkelman (1997), in her study of the effectiveness of DISCOVER among rural high school youth, failed to find any treatment effects on participants' career maturity.

Several additional studies have compared the effectiveness of DISCOVER with other CACGs regarding their effectiveness in enhancing career maturity. Yang (1991), for example, compared the effectiveness of DISCOVER and SIGI PLUS on the career maturity of urban 11th and 12th grade students. Results indicated no effect for either CACG system on career maturity. Yang suggested that the brief duration of treatment may not have been long enough to produce any change or quite possibly that using a CACG system as a stand-alone treatment may not be adequate for all students.

Leboeuf (1990) compared SIGI PLUS with DISCOVER to evaluate their effects on the career development of college students enrolled in a career planning class. Students were randomly assigned to either one of the CACGs or to a wait-list control group. Results showed post-test gains on CDI scales for the treatment groups, but gains did not differ significantly from the scores of participants in the wait-list control group. Similarly, Conrad's (1990) study comparing Virginia VIEW and DISCOVER did not find any significant differences at post-test on the CDI for participants in any of the treatment conditions relative to participants in a control

group. Finally, Glaize and Myrick (1984), using a post-test-only research design with 11th grade students, compared DISCOVER to a career exploration treatment, combination of DISCOVER and career exploration treatment, and a control group. Results indicated that DISCOVER alone was as effective as the group career exploration treatment and the combined DISCOVER and group career exploration treatment in increasing the career maturity of participants over a 9-week period.

There are several plausible explanations for the apparent contradictions in the research on the effectiveness of DISCOVER as an intervention for enhancing career maturity. One possible explanation is that most studies have used only one method of assessing career maturity. As a result, the many facets encompassing career maturity may have been inadequately represented in previous research. Luzzo (1993a) advocated the use of multi-trait, multi-method approaches to career development outcome studies. This may be of considerable importance when evaluating the effectiveness of DISCOVER and other CACGs on users' career maturity, especially given the complexity of career maturity as a vocational construct.

Another possibility is that participants did not make full use of all DISCOVER modules. Studies have been inconsistent in reporting which modules were used by subjects and the duration for which they were used, and not a single study to date has reported behavioral observations of participants to verify DISCOVER use.

As with career decidedness, it is also possible that DISCOVER is a useful intervention for increasing the career maturity of some users but not for others. Further research taking these issues into account may help clarify some of the ambiguity regarding DISCOVER's impact on career maturity.

Vocational Identity

Brief definition of the construct. Vocational identity refers to the degree to which one has a clear idea of her or his interests, abilities, goals, and personality. Those with a clear vocational identity generally have a small number of occupational goals and have well-defined and consistent interest profiles, whereas those who possess a poorly differentiated identity have varied goals and less occupational certainty (Holland, 1997).

Description of the measure. The sole method used to assess vocational identity in DISCOVER effectiveness research has been the *My Vocational Situation* (MVS; Holland, Daiger, & Power, 1980a). The MVS assesses three areas that Holland believes are especially important challenges to address in career decision making: lack of vocational identity, need for information, and personal and environmental barriers to making career decisions. The Vocational Identity (VI) scale is often used to assess the clarity of one's career identity. The VI scale contains 18 items with a *true/false* response format. Scores for the scale are obtained by summing the number of false responses. Higher scores reflect a greater degree of vocational identity. KR-20 reliabilities reported by Holland, Daiger, and Power (1980b) for both high school and college samples revealed internal consistencies for high school students, men in college, and women in college of .86, .89, and .88, respectively. Construct validity for the vocational identity scale was obtained through research demonstrating that scores increase with age, training, and degree of specialization. Frazier (1987) established concurrent validity of the scale in a study revealing negative relationships between Career Decision Scale and MVS scores.

Summary of research findings. Unlike research on career decidedness and career maturity, there is little ambiguity regarding DISCOVER's ability to enhance users' vocational identity. Except for the results of a single doctoral dissertation to the contrary, research

evaluating the effectiveness of DISCOVER on persons' vocational identity has consistently revealed positive effects of the program.

For example, in an investigation by Shahnasarian and Peterson (1986), the vocational identity of participants who used DISCOVER was significantly higher at post-treatment than the vocational identity of participants who did not use DISCOVER. Similarly, Kirschner (1989), who investigated the role of treatment-congruent interventions in career development, found statistically significant gains in vocational identity for students with Realistic and Investigative orientations who used DISCOVER. These gains were not observed in the no-treatment comparison group after a two-week period.

Comparative evaluations of CACGs have revealed similar results. For example, in a comparative study evaluating SIGI PLUS, DISCOVER, and a group career guidance system on a variety of career development outcome measures, Gilman (1987) had student participants (who were randomly assigned to each condition) complete both pre-test and post-test measures of vocational identity. Results indicated that users of both CACG systems demonstrated an increased level of clarity in their vocational identity.

In a similar line of inquiry, Sampson et al. (1993) investigated the impact of DISCOVER and SIGI PLUS on adult career development. Participants were randomly assigned to either one of the CACGs or a control group, in which participants were allowed access to a career resource library and permitted to use materials pertinent to their career concerns. The vocational identity of DISCOVER and SIGI PLUS users increased relative to the vocational identity of participants in the control group.

More recently, Barnes and Herr (1998) compared DISCOVER and counseling, individual counseling, and counseling with the Strong Interest Inventory to investigate the effectiveness of these interventions on career progress. College students who used DISCOVER in conjunction

with counseling demonstrated modest gains in vocational identity compared to participants who did not receive the DISCOVER treatment and participated only in counseling.

The only exception to the substantial evidence supporting DISCOVER as a method for enhancing users' vocational identity was a study reported by Yang (1988). Results of that investigation revealed that displaced workers who worked with DISCOVER did not experience an increase in their vocational identity.

There appears to be a fair amount of evidence that DISCOVER (either alone or when used in conjunction with other interventions) is an effective intervention for clarifying a person's vocational identity. This is probably due to DISCOVER's self-exploration components, which provide users the opportunity to examine their interests, values and abilities—core components of vocational identity. At the same time, however, research targeted at determining the effectiveness of DISCOVER as a method for increasing the vocational identity of diverse populations is lacking.

Level of Career Development

Brief definition of the construct. Level of career development is another variable that has been extensively studied in DISCOVER effectiveness research. Similar to the construct of career maturity, level of career development is based on Donald Super's theoretical construct of career development. It provides a developmental yardstick to determine the particular stage of career development in which a person is currently operating (Rayman & Super, 1978).

Description of the measure. The Survey of Career Development (SCD) was developed by Rayman and Super (1978), specifically for use with DISCOVER, to assess users' deficiencies in specific areas of career development. Five scales comprise the inventory, and each scale contains six items. The scales consist of statements regarding clarification of values, understanding interests and competencies, knowledge of decision-making skills, knowledge of

career information, and understanding how to achieve goals. Responses to statements range from *I have not thought much about it* (1) to *I have already done this* (5). A scale score of 21 or less in any of the scales indicate specific areas for which a client may benefit from intervention. A composite score of 105 or below indicates a relatively low level of career development. Split-half reliability for the inventory is .95 (Garis & Bowlsbey, 1984). Evidence of the construct and criterion-related validity of the SCD has been repeatedly reported (Cooper, 1987; Garis & Bowlsbey, 1984; Garis & Niles, 1990).

Summary of research findings. With only *one* exception, research evaluating DISCOVER's effectiveness (when used either alone or in conjunction with other interventions) has shown that users experience modest-to-significant improvement in their level of career development. For example, to assess the effectiveness of DISCOVER in a sample of college students, Campbell (1983) randomly assigned participants to a DISCOVER-only group, a career exploration workshop and DISCOVER group, or to a no-treatment control group. Participants in the DISCOVER-only group were required to use the first four DISCOVER modules that focused on values, decision-making, organization of occupations, and evaluation of interests and abilities. As expected, participants in the treatment groups realized statistically significant gains on several of the SCD scales relative to participants in the no-treatment control group.

In a somewhat more elaborate study, Garis and Bowlsbey (1984) examined the effects of DISCOVER with volunteer clients seeking career guidance services at a university career development center. Their study compared the relative effectiveness of DISCOVER alone, counseling alone, DISCOVER combined with counseling, and a wait list control group. Participants were encouraged to use at least three DISCOVER modules with no specifications regarding which modules to use. Post-treatment results on the SCD revealed that all treatment groups made significant gains when compared to the control group, and participants using

DISCOVER demonstrated somewhat higher (although not statistically significant) gains than the group that received counseling alone.

Nocella (1985) randomly assigned student participants to a DISCOVER-only group and a group where participants used DISCOVER and then participated in a single counseling session following their use of the system. Results of the study indicated that both groups made significant gains on the SCD and that a single session with a counselor following use of the system did not result in any additional gain for the participants.

In Yonkovig's (1987) comparison of the DISCOVER for Mainframes and DISCOVER for Microcomputers, participants in both groups demonstrated significant progress in their level of career development when compared to a wait-list control group. However, some differential effects were found between the two systems. The mainframe version of DISCOVER proved to be significantly better at increasing the level of self-awareness of values than did the microcomputer version. Additionally, participants in the mainframe group made significant gains over the microcomputer user group on the decision-making scale of the SCD. The explanation for this finding is probably that those in the mainframe condition used the system almost twice as long as those participants in the other treatment condition.

The only study evaluating the relative effectiveness of DISCOVER and SIGI on SCD scores (Kapes et al., 1989) revealed that both systems were effective in promoting career development. As noted earlier, however, results of the Kapes et al. study showed that CACG systems are most effective when used in conjunction with other interventions. Similarly, Garis and Niles (1990), using two university student samples, found that both SIGI PLUS and DISCOVER (when used either separately or in combination with a career planning course) were effective in promoting career development as measured by the SCD.

Finally, in a recent study conducted by Barnes and Herr (1998), a sample of university students seeking career assistance either received counseling alone, counseling and administration of the Strong Interest Inventory, or counseling in conjunction with DISCOVER. Results revealed that all treatment groups demonstrated positive gains on the SCD.

The clear trend in the literature is relatively strong support for the use of DISCOVER as a viable intervention for promoting the level of career development of users. These findings probably stem from the fact that DISCOVER's components provide a means of intervention directly linked to the factors assessed by the SCD. As such, DISCOVER appears to be effective as an intervention in the specific areas of career development it is intended to address.

Career Decision-Making Self-Efficacy

Brief definition of the construct. Regardless of the method of career intervention, it is hoped that clients seeking guidance services become more confident in their ability to personally manage the career exploration and planning process. Therefore, assessing clients' perceptions of their ability to successfully engage in the career decision-making process (i.e., career decision-making self-efficacy) is of interest to career counselors and vocational psychologists alike.

Description of the measure. The *Career Decision-Making Self-Efficacy Scale* (CDMSES; Taylor & Betz, 1983) is a 50-item measure designed to evaluate the degree to which an individual believes she or he can successfully perform tasks associated with career decision making. The inventory contains five content areas based on Crites's (1978) career maturity construct: accurate self-appraisal, gathering occupational information, goal selection, making plans for the future, and problem solving. Respondents are asked to rate their confidence in their ability to perform tasks associated with career decision making from *No Confidence* (0) to *Complete Confidence* (9). Internal consistency (Cronbach's alpha) of .97 for the total inventory and for the five sub-scales ranging from .86 to .89 has been reported (Betz & Taylor, 1994). A

test-retest reliability of .83 over a 6-week period was reported by Luzzo (1993b). Furthermore, the CDMSES manual (Betz & Taylor, 1994) cites numerous studies supporting the inventory's content, construct and criterion validity.

Summary of research findings. The only study examining the impact of DISCOVER on career decision-making self-efficacy was conducted by Fukuyama et al. (1988). In their study, undergraduate, non-client volunteers enrolled in an introductory psychology course were randomly assigned to either work with DISCOVER alone or to participate in a no-treatment control condition. Results of the study indicated that participants who used DISCOVER significantly increased their career decision-making self-efficacy relative to the participants in the control condition.

Although this finding suggests that using DISCOVER may be a promising method for increasing college students' career decision-making self-efficacy, generalizing these findings to other, more diverse populations requires additional research. Until this study is replicated, one can not conclude unequivocally that DISCOVER is an effective intervention for improving users' confidence in their ability to engage in the career decision-making process.

Career Exploration Behavior

Brief definition of the construct. Another outcome variable of interest to career counselors and vocational psychologists is career exploration. Career exploration generally refers to the frequency with which a person engages in career information-seeking behavior, including making use of career resource libraries and other media resources, consulting with others regarding career/educational information, and engaging in activities to gather relevant educational and occupational information.

Description of the measures. Numerous checklists, questionnaires, and surveys have been developed in an attempt to gauge career exploratory behavior. Many of these are

inventories designed by individual researchers for particular studies on the effectiveness of DISCOVER. Leboeuf (1990), for example, developed the *Career Exploration Activity Inventory* as a means to assess how often participants used career resources (e.g., library, career resource center) and consulted or discussed their career concerns with others. A similar type of instrument is a career exploration log, wherein research participants are asked to keep track of their use of a career library, resources outside the library, and consultations with others regarding their career concerns. Semi-structured interviews also have been used to evaluate career exploration. Kirschner (1989), for example, used an interview protocol that contained questions asking participants about consulting with others, making use of career information, and exploring the world of work.

The only quantitative assessment of career exploration behavior for which detailed psychometric data are available is the *Career Exploration Survey* (CES) developed by Stumpf, Colarelli, and Hartman (1983). The CES contains 59 items and assesses 16 dimensions of career exploration behavior that cluster into three groups. One of the groups assesses career search behaviors as they pertain to both self and environmental exploration, number of occupations considered, intended-systematic exploration, frequency, and amount of information and focus. Another group relates to reactions to the exploration process and contains three scales: satisfaction with information, exploration stress, and decisional stress. The last group contains scales that examine an individual's beliefs about future exploration. These scales pertain to career exploration outcomes, external and internal search instrumentality, method instrumentality, and importance of obtaining preferred position. All scales have demonstrated internal consistency ranging between .67 to .89. Factor analytic studies have generally supported the construct validity of the instrument (Stumpf et al., 1983).

Summary of research findings. Initial studies investigating the impact of DISCOVER upon career exploration behavior demonstrated promising results of the system's ability to promote a positive course of action in gathering career relevant information (Rayman et al., 1978). Significant gains are often found among DISCOVER users (contrasted with those who are assigned to a control group) in terms of how much time they spend at career libraries and the number of career-related materials they read (Campbell, 1983). Similarly, Garis and Bowlsbey (1984) found that participants who used DISCOVER alone or in conjunction with individual counseling produced significant gains in career exploration behavior over participants who did not use DISCOVER. Additional evidence of DISCOVER's efficacy in promoting career exploration behavior was reported by Gilman (1987). Results comparing SIGI PLUS and DISCOVER with traditional career guidance groups revealed that those using CACGs made more substantial gains in career exploration behavior relative to participants who did not use either system.

A few studies, however, have yielded less promising results. For instance, Yonkovig (1987) found the absence of any statistically significant gains in the career exploration behavior of participants using either the mainframe or microcomputer version of DISCOVER when compared to a control group. Likewise, Kirschner (1989) did not find any statistically significant differences in career exploration behavior between DISCOVER users and those in a career workshop. However, Kirschner (1989) did find that DISCOVER users talked to their parents more about career concerns than those in the workshop-only condition did. More recent studies by Leboeuf (1990) and Yang (1991) also found no differences in career exploration behavior between participants using DISCOVER and those participating in another career planning intervention.

One possible reason for the lack of consistency in the results of studies of DISCOVER's effectiveness in the promotion of career exploration behavior could be the under-utilization of psychometrically supported quantitative instruments for assessing career exploration behavior. Also, several of the studies reviewed did not take into account the motivation of participants. It is possible that several of the participants in these studies did not have any actual career concerns and, therefore, were not compelled to engage in any career exploration following their use of DISCOVER. It will be important for researchers who conduct similar investigations in the future to take into account these and other possible explanations for previous findings.

Limitations of Current Research and Future Directions

As with much of the research in the behavioral sciences, DISCOVER effectiveness studies have methodological limitations that future researchers should try to avoid. One issue in particular that needs to be more appropriately addressed in future research is duration of treatment. Several studies included in this review limited DISCOVER use among participants to less than two hours. Two hours may not provide ample time for the effects of DISCOVER to be fully realized among client populations. On a similar note, it might be beneficial for researchers to follow-up with participants several weeks—and maybe even a month or two—after their use of DISCOVER (i.e., after the intervention) to evaluate the potential long-term impact of DISCOVER on users' career development.

Future studies should also scrutinize more closely the effectiveness of specific modules or components of DISCOVER rather than evaluating DISCOVER in general. Only two studies conducted to date have specified the precise DISCOVER modules used by participants. By evaluating the effectiveness of specific DISCOVER components, researchers will be better able to suggest specific areas of the program in need of modification and improvement. On a related note, it is imperative that researchers clearly indicate the precise DISCOVER features (i.e.,

modules or activities) that are being evaluated. Published reports of several DISCOVER effectiveness studies conducted in recent years have failed to provide readers with detailed information about the specific DISCOVER components (e.g., career assessments, occupational information) to which participants were exposed.

Researchers conducting DISCOVER effectiveness research also need to attend more adequately to several statistical issues. All of the investigations reviewed in this report—both those that reported statistically significant effects of DISCOVER and those that resulted in the absence of a statistically significant effect of DISCOVER—failed to report power analysis results (e.g., effect sizes) or take issues of power into consideration when discussing results. Similarly, studies that resulted in statistically significant treatment effects for DISCOVER failed to discuss issues such as the variance in outcomes attributed to DISCOVER use or the incremental validity of using DISCOVER as part of a comprehensive career counseling intervention.

Almost 20 years ago, Fretz (1981) argued that additional research is necessary to investigate the interaction between client attributes and methods of career intervention. Unfortunately, factors such as gender, ethnicity, personality, and learning ability have received little attention in the DISCOVER effectiveness literature. Using an attribute/treatment interaction design could prove quite beneficial in determining the types of clients who tend to benefit most from DISCOVER use. Such investigations would be especially worthwhile given that most studies that have used DISCOVER in conjunction with either individual or group career counseling have consistently demonstrated positive results. It would be advantageous, for example, to determine the point at which having a counselor interact with DISCOVER users becomes useful to clients.

Researchers interested in expanding our understanding of the effectiveness of DISCOVER should consider evaluating the program's impact on variables that have heretofore been neglected (e.g., career decision-making attributional style, academic achievement, persistence) or evaluated in only a single study (e.g., career decision-making self-efficacy). Researchers also need to consider replicating previously published investigations, ensuring established principles of research methodology and the use of psychometrically supportable outcome assessments. Furthermore, despite the widespread use of the Windows® version of DISCOVER in a variety of educational and work settings, no study to date has specifically evaluated its effectiveness. Research is clearly needed to establish the efficacy of the Windows® version of DISCOVER and to evaluate its use among diverse populations.

Perhaps the most important recommendation we have to offer regarding future evaluations of DISCOVER's effectiveness involves the use of multiple methods for assessing outcome variables of interest to researchers. Rather than using a single inventory or assessment to measure a dependent variable, researchers should consider using several assessments to measure the same construct. For example, in an investigation designed to evaluate the effectiveness of DISCOVER on participants' social cognitive career beliefs, it would be ideal to evaluate participants' social cognitive career beliefs with two or more measures of the construct (e.g., career decision-making self-efficacy and career decision-making attributional style).

Finally, there is no question that additional DISCOVER effectiveness research is needed to evaluate its effectiveness with career counseling clients. The vast majority of studies conducted to date in this domain have used non-client volunteers—usually high school or college students—who may not possess many of the career decision-making needs that DISCOVER is designed to address. Those who seek career counseling services may be at different stages

developmentally and may possess very different types of career-related concerns than those who volunteer to participate in a research study as part of a class assignment or course requirement.

References

Alston, R. J., & Burkhead, E. J. (1989). Computer-assisted career guidance and the career indecision of college students with physical disabilities. *Rehabilitation Counseling Bulletin, 32,* 248-253.

Barnes, J. A., & Herr, E. L. (1998). The effects of interventions on career progress. *Journal of Career Development, 24,* 179-193.

Betz, N. E., & Taylor, K. M. (1994). *Manual for the Career Decision-Making Self-Efficacy Scale*. Columbus, OH: Department of Psychology, The Ohio State University.

Brownfield, K. N. (1987). A comparative study of career decision making with two computer-assisted career guidance systems (Doctoral dissertation, University of Tulsa, 1987). *Dissertation Abstracts International, 48,* 306A.

Campbell, R. B. (1983). *Assessing the effectiveness of DISCOVER in a small campus career development program*. ERIC Document Reproduction Service No. ED 253 782.

Chartrand, J. M., Robbins, S. B., Morrill, W. H., & Boggs, K. (1990). Development and validation of the Career Factors Inventory. *Journal of Counseling Psychology, 37,* 491-501.

Conrad, D.W. (1990). A community college evaluation of DISCOVER and Virginia VIEW (Doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksberg) *Dissertation Abstracts International, 51,* 1117A.

Cooper, M. (1987). *Cross validation of two career assessment instruments: My Vocational Situation and the Survey of Career Development*. Unpublished master's thesis. The Pennsylvania State University.

Crites, J. O. (1971). *The maturity of vocational attitudes in adolescence.* Washington, DC: American Personnel and Guidance Association.

Crites, J. O. (1973). *Career Maturity Inventory Attitude Scale*. Monterey CA: CTB/ McGraw-Hill.

Crites, J. O. (1978). *Career Maturity Inventory*. Monterey CA: CTB/ McGraw-Hill.

Daniels, M. H., & Buck, J. N. (1985). *Reliability and validity of the Harren ACDM: A reassessment.* Unpublished manuscript, Southern Illinois University-Carbondale.

Engel, E. F. (1991). *The Effectiveness of DISCOVER.* Unpublished masters thesis Fort Hays State University. ERIC Document Reproduction Service No. ED 339 957.

Frazier, N. (1987). *Norms, reliability, and validity of four career maturity/development instruments*. Unpublished master's thesis. Texas A & M University.

Fretz, B. R. (1981). Evaluating the effectiveness of career interventions. *Journal of Counseling Psychology, 18,* 77-90.

Fukuyama, M. A., Probert, B. S., Neimeyer, G. J., Nevill, D. D., & Metzler, A. E. (1988). Effects of DISCOVER on career self-efficacy and decision making of undergraduates. *Career Development Quarterly, 37,* 56-62.

Garis, J. W., & Bowlsbey, J. H. (1984). *DISCOVER and the counselor: Their effect upon college student career planning and progress* (ACT Research Report No. 85). Iowa City, IA: ACT Publications.

Garis, J. W., & Niles, S. G. (1990). The separate and combined effects of SIGI and DISCOVER and a career planing course for undecided university students. *Career Development Quarterly, 38,* 261-274.

Gilman, K. A. (1987). A comparison of computer-assisted and noncomputer-assisted group career guidance experiences using SIGI PLUS and DISCOVER for adult learners (Doctoral dissertation, Texas A&M University, 1987). *Dissertation Abstracts International, 49,* 201A.

Glaize, D. L., & Myrick, R. D. (1984). Interpersonal groups or computers? A study of career maturity and career decidedness. *Vocational Guidance Quarterly, 32,* 168-176.

Harren, V. A. (1985). *Assessment of Career Decision Making.* Los Angeles CA: Western Psychological Services.

Hinkelman, J. M. (1997). *The effects of DISCOVER on the career maturity and career indecision of rural high school students: A randomized field experiment.* Unpublished doctoral dissertation, University of Missouri-Columbia.

Hinkelman, J. M., & Luzzo, D. A. (1997). Computer-assisted career guidance systems: Bridging the science-practitioner gap. *Career Planning and Adult Development Journal, 13,* 41-50.

Holland, J. L. (1997). *Making vocational choices* (3rd ed.). Odessa, FL: Psychological Assessment Resources, Inc.

Holland, J. L., Daiger, D. C., & Power, P. G. (1980a). *My Vocational Situation.* Palo Alto, CA: Consulting Psychologist Press, Inc.

Holland, J. L., Daiger, D. C., & Power, P. G. (1980b). *My Vocational Situation: Description of an experimental diagnostic form for the selection of vocational assistance.* Palo Alto, CA: Consulting Psychologist Press, Inc.

Holland J. L., Gottfredson, G. D., & Nafziger, D. H. (1973). *A diagnostic scheme for specifying vocational assistance* (Rep. No. 164). Baltimore MD: Johns Hopkins University, Center for Social Organization of Schools.

Holland, J. L., & Holland, J. E. (1977). Vocational indecision: More evidence and speculation. *Journal of Counseling Psychology, 22,* 411-422.

Jepsen, D. A., & Prediger, D. J. (1981). Dimensions of adolescent career development: A multi-instrument analysis. *Journal of Vocational Behavior, 19,* 350-368.

Johnson, R. W. (1987). Review of Assessment of Career Decision Making. *Journal of Counseling and Development, 65,* 567-569.

Kapes, J. T., Borman, C. A., & Frazier, N. (1989). An evaluation of the SIGI and DISCOVER microcomputer-based career guidance systems. *Measurement and Evaluation in Counseling and Development, 22,* 126-136.

Kirschner, J. E. (1989). Congruent versus incongruent vocational treatments for career indecision in college students: A comparison of DISCOVER and a career workshop (Doctoral dissertation, University of Maryland College Park, 1989). *Dissertation Abstracts International, 50,* 3163A.

Langley, R. (1990). *Career Development Questionnaire.* Pretoria: Human Sciences Research Council.

Langley, R., du Toit, R., & Herbst, D. L. (1992). *Manual for the Career Development Questionnaire (CDQ).* Pretoria: Human Sciences Research Council.

Langley, R., & Schepers, J. M. (1990). Computerized career guidance: An evaluation of the DISCOVER system. *South African Journal of Psychology, 20,* 287-293.

Leboeuf, C. A. (1990). The effects of gender and two micro-computer systems—SIGI PLUS and DISCOVER—on career development (Doctoral dissertation, Arizona State University, 1990). *Dissertation Abstracts International, 50,* 3926A.

Luzzo, D. A. (1993a). A multi-trait, multi-method analysis of three career development measures. *Career Development Quarterly, 41,* 367-374.

Luzzo, D. A. (1993b). Reliability and validity testing of the Career Decision Making Self-Efficacy Scale. *Measurement and Evaluation of in Counseling and Development, 26,* 137-142.

Luzzo, D. A., & Pierce, G. (1996). Effects of DISCOVER on the career maturity of middle school students. *Career Development Quarterly, 45,* 170-172.

Marin, P. A., & Splete, H. (1991). A comparison of the effect of two computer based counseling interventions on the career decidedness of adults. *Career Development Quarterly, 39,* 360-371.

Mitchell, K. E., Levin, A. S., & Krumboltz, J. D. (1999). Planned happenstance: Constructing unexpected career opportunities. *Journal of Counseling and Development, 77,* 115-124.

Nocella, T. K. (1985). Computer assistance in career counseling (DISCOVER) (Doctoral dissertation, University of Denver, 1985). *Dissertation Abstracts International, 46,* 199A.

Oliver, L. W., & Spokane, A. R. (1988). Career-intervention outcome: What contributes to client gain? *Journal of Counseling Psychology, 35,* 447-462.

Osipow, S. H., Carney, C. G., Winer, J., Yanico, F., & Koschier, F. (1976). *The Career Decision Scale* (3rd rev.). Columbus, OH: Marathon Consulting and Press.

Osipow, S. H. (1987). *Career Decision Scale manual.* Odessa, FL: Psychological Assessment Resources, Inc.

Rayman, J. R., Bryson, P. L., & Harris-Bowlsbey, J. (1978). The field trial of DISCOVER: A new computerized interactive guidance system. *Vocational Guidance Quarterly, 26,* 349-360.

Rayman, J. R., & Super, D. E. (1978). *Survey of Career Development.* Westminster, MD: DISCOVER Foundation, Inc.

Redmond, R. E. (1972). Increasing vocational information seeking behaviors of high school students. *Dissertations Abstracts International, 34,* 2311.

Sampson, J. P., & Reardon, R. C. (1993). *Computer-assisted career guidance: DISCOVER bibliography. Revised.* Tallahassee, FL: Florida State University, Center for the Study of Technology in Counseling and Career Development.

Sampson, J. P., Reardon, R. C., Norris, D. S. Wilde, C. K., Slaten, M. L., Greeno, B. P., Garis, J. W., Strausberg, S. J., Sankofa-Amammere, K. T., Peterson, G. W., & Lenz, J. G. (1995). *A differential feature-cost analysis of eighteen computer–assisted career guidance systems: Technical report number 10.* Tallahassee, FL: Florida State University, Center for the Study of Technology in Counseling and Career Development.

Sampson, J. P., Reardon, R. C., Lenz, J. C., Ryan-Jones, R. E., Peterson, G. W., & Levy, R. (1993). *The impact of DISCOVER for Adult Learners and SIGI PLUS on the career decision making of adults.* ERIC Document Reproduction Service No. ED 363 824.

Savickas, M. L. (1984). Career maturity: Career maturity: The construct and its measurement. *Vocational Guidance Quarterly, 32,* 222-231.

Schlossman, C. K. (1990). Career time perspective and career decision making in users of DISCOVER: A latent variable analysis (Doctoral dissertation, City University of New York, 1990). *Dissertation Abstracts International, 51,* 1122A.

Shahnasarian, M., & Peterson, G.W. (1986). *The use of computer-assisted guidance with prior cognitive structuring intervention. Technical Report Number 3.* ERIC Document Reproduction Service No. ED 272 678.

Slaney, R. B. (1978). Expressed and inventoried interests: A comparison of instruments. *Journal of Counseling Psychology, 25,* 520-529.

Slaney, R. B. (1980). Expressed vocational choice and vocational indecision. *Journal of Counseling Psychology, 27,* 122-129.

Slaney, R. B., Palko-Nonemaker, D., & Alexander, R. (1981). An investigation of two measures of career indecision. *Journal of Vocational Behavior, 18,* 92-103.

Stumpf, S. A., Colarelli, S. M., & Hartman, K. (1983). Development of the Career Exploration Survey (CES). *Journal of Vocational Behavior, 22,* 191-226.

Super, D. E., Thompson, A. S., Lindeman, R. H., Jordaan, J. P., & Myers, R. A. (1981) *The Career Development Inventory.* Palo Alto CA: Consulting Psychologist Press, Inc.

Taylor, K. M., & Betz, N. E. (1983) Applications of self-efficacy theory to the treatment of career indecision. *Journal of Vocational Behavior, 22,* 63-81.

Thompson, A. S., & Lindeman, R. H. (1981) *The Career Development Inventory: Vol. 1: User's manual.* Palo Alto CA: Consulting Psychologist Press, Inc.

Thompson, A. S., Lindeman, R. H., Super, D. E., Jordaan, J. P., & Myers, R. A. (1984). *The Career Development Inventory: Technical manual.* Palo Alto CA: Consulting Psychologist Press, Inc.

Westbrook, B. W., & Parry-Hill, J. W. (1975). The construct and validation of a measure of vocational maturity. *Catalog of Selected Documents in Psychology, 5,* 526.

Whiston, S. C., Sexton, T. L., & Lasoff, D. L. (1998). Career-intervention outcome: A replication and extension of Oliver and Spokane (1988). *Journal of Counseling Psychology, 45,* 150-165.

Yang, S. J. (1991). The effects of two computer assisted guidance programs—DISCOVER and SIGI PLUS—on the career development of high school students (Doctoral dissertation, Columbia University Teachers College, 1991). *Dissertation Abstracts International, 52,* 2417A.

Yang, R. J. (1988). The differential effects of computer interventions on selected client career development behaviors (Doctoral dissertation, Ohio State University, 1988). *Dissertation Abstracts International, 50,* 367A.

Yonkovig, M. J. (1987). A comparison of the effects of the DISCOVER computer-assisted guidance system for mainframes and for microcomputers upon college students (Doctoral dissertation, The Pennsylvania State University, 1987). *Dissertation Abstracts International, 48,* 3083A.

Zener, T. B., & Schnuelle, L. (1972). *An evaluation of the Self-Directed Search: A guide to educational and vocational planning.* Baltimore, MD. Johns Hopkins University, Center of Social Organization of Schools. (ERIC Document Reproduction Service No. ED 061 458).

Appendix A

DISCOVER Chronology

Version of DISCOVER	Years of Operation
Mainframe	1976-1987
Microcomputers (DISCOVER II)	1982-1987
Organizations (DISCOVER III)	1983-present
Minicomputers	1984-1995
Adult Learners	1985-1987
Junior High and Middle Schools	1987-present
High Schools	1987-present*
Colleges and Adults	1987-present*
Special Version	1988-present*
Retirement Planning	1990-1997
Maryland VISIONS and VISIONS Plus	1991-present
Compact Disc Interactive (Multimedia)	1995-present
Macintosh	1995-present
Windows®	1997-present

*The high schools, colleges and adults, and special version of DISCOVER were combined in 1997.

Table 3

A Chronological Summary of DISCOVER Effectiveness Studies (1978-1998)

Author(s)	Year	Population (N)	Relevant DV(s)*	Main Findings
Rayman, Bryson & Bowlsbey	1978	Junior and senior high school students (96)	Career maturity; career exploration behavior	No significant differences between control and experimental group in career maturity; DISCOVER users reported an increase in career exploration behavior.
Campbell	1983	College students (46)	Level of career development; career exploration behavior	Participants in the DISCOVER-only group exhibited the same degree of increases in level of career development and engagement in career exploration behaviors as participants in the DISCOVER-and-career exploration workshop group. Post-treatment data revealed significantly higher level of career development and career exploration scores among the treatment groups compared to the participants in the control condition.
Garis & Bowlsbey	1984	College students (67)	Career maturity; level of career development; career exploration behavior	Participants who received the DISCOVER-only or DISCOVER with counseling treatments exhibited significant gains in level of career development (relative to participants in the control group). Participants who used DISCOVER also reported increased career exploration activity relative to participants in the control group. Those participants who used DISCOVER and met briefly with a counselor made significant gains in career maturity.

(table continues)

Author(s)	Year	Population (N)	Relevant DV(s)*	Main Findings
Glaize & Myrick	1984	Eleventh graders (104)	Career decidedness; career maturity	DISCOVER used alone was as effective as the DISCOVER-and-counseling combined treatment in increasing the career decidedness and career maturity of participants.
Nocella	1985	College students (60)	Career maturity; level of career development	Significant increases in career maturity and level of career development occurred in participants who used DISCOVER (relative to participants in the control condition). Participation in a single counseling session after using DISCOVER did not enhance the treatment effects.
Shahnasarian & Peterson	1986	University career center clients (90)	Occupational certainty; vocational identity	Participants exposed to cognitive restructuring prior to using DISCOVER increased their occupational certainty. Participants who received the DISCOVER-only treatment also increased their vocational identity relative to non-DISCOVER users in the study.
Brownfield	1987	Junior college career services clients (66)	Career decidedness	Groups using DISCOVER increased in their career decidedness.
Gilman	1987	College students (66)	Career decidedness; vocational identity; career exploration behavior	Participants who received the DISCOVER treatment increased their level of career decidedness, improved their vocational identity, and engaged in more career exploration behaviors than the participants in the control condition.

(table continues)

Author(s)	Year	Population (N)	Relevant DV(s)*	Main Findings
Yonkovig	1987	College students seeking career services (66)	Career maturity; vocational identity; level of career development; career exploration behavior	Treatment groups (i.e., participants using DISCOVER) showed significant increases in career maturity and level of career development when compared with the control group participants. No significant differences for vocational identity or career exploration behavior were observed.
Fukuyama et al.	1988	College students (77)	Career decidedness; career decision making self-efficacy	Participants assigned to the DISCOVER treatment group demonstrated higher levels of career decision-making self-efficacy and exhibited greater career decidedness when compared to participants in the control group.
Yang, R.J.	1988	Injured workers (83)	Career decidedness and occupational certainty; vocational identity	No significant differences were found for any of the variables among a group of recently injured workers.
Alston & Burkhead	1989	College students with disabilities (50)	Career decidedness	No significant differences in career decidedness emerged between physically disabled participants in the control and treatment groups.
Kapes, Borman, & Frazier	1989	Meta-analysis of several small-scale studies	Career decidedness; level of career development	DISCOVER was most effective when used in conjunction with other career guidance activities. Only small gains in career decidedness and level of career development were realized for participants in the DISCOVER-only treatment group.

(table continues)

Author(s)	Year	Population (N)	Relevant DV(s)*	Main Findings
Kirschner (dissertation)	1989	College students (75)	Vocational identity; career exploration behavior	Post-treatment gains in vocational identity were observed for students who used DISCOVER. Participants using DISCOVER also were more likely than those who only participated in a career planning workshop to talk with their parents about career-related issues.
Conrad	1990	College students seeking career services (100)	Career decidedness; career maturity	No differences among treatment groups emerged for either of the dependent variables.
Garis & Niles	1990	College students (118)	Career decidedness; level of career development	The career decidedness of participants in the DISCOVER-only treatment group did not differ from the career decidedness of participants in the control group. Levels of career development increased among participants in the DISCOVER treatment group relative to those participants who did not receive either treatment.
Langley et al.	1990	College students in South Africa (105)	Career maturity	The career maturity of participants who used DISCOVER increased significantly compared to the career maturity of participants assigned to a control group.
Leboeuf	1990	College students enrolled in career planning classes (46)	Career decidedness; career maturity	No differential treatment effects were found; all groups demonstrated gains.
Schlossman	1990	College students (432)	Career maturity	No significant differences in career maturity were found among participants in the DISCOVER treatment group compared to those in the control group.

(table continues)

Author(s)	Year	Population (N)	Relevant DV(s)*	Main Findings
Engel	1991	College students (44)	Career decidedness	No significant career decidedness differences were found among the various treatment groups.
Marin & Splete	1991	Adult workers in career transition (188)	Career decidedness and occupational certainty	Participants in the DISCOVER-and-counseling treatment group demonstrated higher mean gains in career decidedness and occupational certainty than participants in the DISCOVER-only group.
Yang, S.J.	1991	Eleventh and twelfth graders (96)	Career maturity; occupational certainty; career exploration behavior	No significant effects in the dependent variables emerged among participants who received the DISCOVER and SIGI PLUS treatments.
Sampson et al.	1993	University career center clients (95)	Career decidedness; vocational identity	DISCOVER was superior to SIGI PLUS in increasing participants' career decidedness. DISCOVER also increased vocational identity.
Luzzo & Pierce	1996	Middle school students (38)	Career maturity	The career maturity of participants who used DISCOVER significantly increased compared to participants in the control group.
Hinkelman	1997	High school students (286)	Career decidedness; career maturity	DISCOVER had no effect on career maturity. In terms of career decidedness, females who used DISCOVER demonstrated a decrease in the need for self-knowledge.
Barnes & Herr	1998	University career counseling clients (110)	Career decidedness; vocational identity	Participants who used DISCOVER and received counseling exhibited modest gains in career decidedness, vocational identity, and level of career development relative to the gains of participants who received individual counseling without DISCOVER use.

Note. *List refers only to those dependent variables (DVs) discussed in the literature review.