RESEARCH REPORT No. 85

DISCOVER and the Counselor: Their Effects Upon College Student Career Planning Progress

Jeffrey Garis
JoAnn Harris-Bowlsbey

December 1984

ACT

DISCOVER and the Counselor: Their Effects Upon College Student Career Planning Progress

Jeffrey Garis
JoAnn Harris-Bowlsbey

ABSTRACT

This research report briefly reviews the development of computer-based guidance systems, the ways they can be categorized, and research findings related to these categories. A field study conducted with DISCOVER in the Career Development and Placement Center at Pennsylvania State University is reported in detail. In this study 67 students with career-related concerns were randomly assigned to four groups, each with a different treatment: (1) one-to-one counseling only, (2) one-to-one counseling and DISCOVER, (3) DISCOVER alone, and (4) no-treatment. Effects of the experimental group treatments were measured by four instruments of self-rated progress in educational/vocational planning which together yielded 14 scores.

The trends of the findings suggest that (a) all three treatments produced positive effects, (b) DISCOVER alone and one-to-one counseling alone were equivalent in their effects as treatment modalities, and (c) DISCOVER combined with one-to-one counseling produced the most positive effects. Using these and related findings, implications are drawn both for the use of computer-based systems with college students and for further research.

TABLE OF CONTENTS

Chapter 1
HISTORICAL PERSPECTIVE ON COMPUTER-BASED GUIDANCE AND INFORMATION SYSTEMS 1

Chapter 2
REVIEW OF THE LITERATURE ON COMPUTER-BASED GUIDANCE AND INFORMATION SYSTEMS 3

Chapter 3
INTEGRATION OF THE DISCOVER COMPUTER-BASED GUIDANCE SYSTEM INTO A COLLEGE COUNSELING CENTER: ITS EFFECTS UPON CAREER PLANNING 7

Chapter 4
IMPLICATIONS OF THE STUDY 17

REFERENCES 19

Chapter 1

HISTORICAL PERSPECTIVE ON COMPUTER-BASED GUIDANCE AND INFORMATION SYSTEMS

By the mid-sixties, the computer had proven its effectiveness in business and government and was beginning to do so in education. Early conceptualization of its use in career development was independently pursued by three career guidance theorists.

Donald E. Super, in collaboration with Frank Minor of IBM, designed and implemented the Education and Career Exploration System (ECES), which used student grades, ability measures, and interest assessments to suggest occupations for exploration. It helped students do this exploration by providing printed occupational descriptions and work task simulations on slides under computer control.

David V. Tiedeman, funded by the U.S. Office of Education, led a team at Harvard University in the development of the Information System for Vocational Decisions (ISVD). This system, using both natural language and audio-visual material under computer control, was designed to assist the user in internalizing a systematic decision-making process, the computer serving as a prosthetic device until the user no longer needed support.

Martin R. Katz, supported by the Educational Testing Service and foundation grants, developed the System for Interactive Guidance Information (SIGI). Basically this system is a computerized version of Katz's previously developed decision-making process, whereby selection and prioritization of personal work-related values lead the user to probability statements related to alternative career choices.

In addition to development by theorists, there were at this time practitioners in the field who were using the computer to provide new career guidance services. Joseph Impelleteri, professor of vocational education at Pennsylvania State University, developed Computer-Assisted Career Exploration (CACE), a system whereby junior high school students used their General Aptitude Test Battery (GATB) scores and viewed slides of activities performed in various curricula in order to select their high school vocational education program.

Tommy Bartlett of Oklahoma State University designed the Total Guidance Information and Support System (TGISS), which used the computer to do a variety of clerical tasks, including the maintenance of student records.

JoAnn Harris, director of guidance at Willowbrook (Illinois) High School, developed the Computerized Vocational Information System (CVIS), which provided search strategies for occupations, colleges, military programs, sources of financial aid, and local jobs.

Each of these six systems was heavily funded through external sources: IBM and other sources, in the case of ECES; state and federal government and private foundations for the others. Each development team devoted itself to building a prototype, a merger of the expression of the developer's theory or practice of career guidance with available computer technology. Four of the six systems expired upon completion of the prototype and some field testing: two with elaborate career development design, ISVD and ECES, were not distributed after field trial; two others, TGISS and CACE, ended when funding ceased. The remaining two, CVIS and SIGI, survived in the market place and are in fact still active in the field fifteen years later.

The early systems had several common characteristics. First, they were, for the most part, rich in theoretical base. Second, each took advantage of the computer's ability to store and process a large amount of information in a field where one-to-one human contact had always been considered imperative. Third, with the possible exception of ECES, they had not been developed for the purpose of distribution and marketing. Fourth, with the exception of CVIS, they were truly *guidance* systems, i.e., each included information about the user as the *sine qua non* for identification of occupations for exploration.

An additional guidance system was developed in the 1970s. With significant funding from the Office of Education and support from IBM, JoAnn Harris-Bowlsbey led the development of a line of DISCOVER products through the DISCOVER Foundation, now a part of The American College Testing Program (ACT).

The computer-based *information* system is also a product of the '70s. Enhanced cost-effectiveness and therefore greater marketability resulted from deletion of many of the computer functions found in guidance systems (i.e., generation and storage of self-information, teaching of decision-making skills, management of audio-visual material). Instead, the computer-based information systems emphasize the search of large data files by combinations of desired characteristics and the retrieval and display of requested information about options identified.

A company formed by individuals formerly part of Tiedeman's Harvard project developed a system now known as Guidance Information System (GIS).

Increased interest by the Department of Labor in computer delivery of current localized occupational information led to funding to Oregon for development of the Career Information System (CIS) and the use of that system as a prototype for approximately 20 additional state systems. These appear in the field with different names, as states may rename them as data and functions are localized. From the stream of development enhanced by federal and state funds came Computerized Heuristic Occupational Information and Career Exploration System (CHOICES) and the Coordinated Occupational Information Network (COIN). Early development on the former was funded by the Canadian Department of Manpower and Immigration. Early development on the latter was funded by the National Occupational Information Coordinating Committee (NOICC) and the state of Michigan.

In the '70s the information systems flourished and dominated the field in terms of the number of installations.

At present, both types of computer-based systems exist. *Guidance* systems, represented by SIGI and DISCOVER, help students to learn about themselves on-line—interests, abilities, and/or values—and to apply this self-knowledge to the identification of vocational options. This essential first step is followed by provision of occupational information as well as search strategies to identify appropriate schools, jobs, and training programs. Developers of these systems ally themselves with career development theory and with the field of guidance or counseling psychology.

Information systems, represented by GIS, CIS, and others, provide search strategies through occupational and educational files and provide detailed information about the options identified. There is no explicit attempt to assist the user in learning about the self or about decision making, though these may be side effects, but rather to provide the user with quality information. Developers of these systems tend to be specialists in labor market information.

Over the 15 years of history here reviewed, considerable research has been done on the effectiveness of computer treatment in isolation, without consideration of its use compared to other treatments or combined with them. A number of such studies evaluating the effectiveness of guidance systems are reviewed in the following chapter. The study reported in chapter 3 is significant in that it examines how computer-based systems can be integrated into a total career guidance program.

Chapter 2

REVIEW OF THE LITERATURE ON COMPUTER-BASED GUIDANCE AND INFORMATION SYSTEMS

In chapter 1, computer-based systems are classified as either information or guidance oriented; CVIS, GIS, and CIS fit the former category, while ECES, SIGI, and DISCOVER fit the latter. In organizing the research in this chapter, those broad categories will be used.

Evaluations of Information Systems

In analyzing the effects of the Computerized Vocational Information System (CVIS), Harris (1973) compared CVIS users to a no-treatment control group, reporting significantly higher scores for the users on the Career Development Inventory (1971). The treatment group also reported that they had acquired more occupational information. No effects, however, were found in the number of occupations considered or the congruence of occupational plans with personal attributes.

Another study involving CVIS (Maola, 1976) and dealing with disadvantaged vocational students at the secondary level, compared its use to counselor service alone and to a no-treatment control group. The dependent measure was the amount of occupational information acquired, as shown on a posttest. Group one, receiving information through CVIS, produced the highest scores; group two, receiving information from counselors, scored lower than group one but scored higher than the control group.

Ryan and Drummond (1980) investigated the impact of the Guidance Information System (GIS) upon public school students and public agency clients. Questionnaires were given to subjects immediately after use and six to eight weeks later. Subjects reported positive attitudes toward the system and indicated an increase in their knowledge of occupations. The study concluded that GIS had a variety of positive effects on users and that its level of effectiveness depended upon how it was integrated into the comprehensive career education program. Although the study was described as a time series design, no pretest information was presented and self-report questionnaires alone served as the dependent measure.

Evaluations of Guidance Systems

Myers, Lindeman, Thompson, and Patrick (1975) investigated the effects of ECES upon the vocational maturity of 729 tenth grade students, as measured by the Career Development Inventory (1975). Significant differences favoring the treatment group were found in both planning orientation and use of resources for gathering information; no significant differences were found, however, in knowledge of decision making or in the amount of career information processed.

The effects of computer-mediated vocational guidance procedures on the appropriateness of vocational preferences were studied by Pilato and Myers (1975). The study included a control group and three treatment groups: one was provided with computer-generated feedback regarding the accuracy of self-knowledge, the second was taught an occupational classification scheme but given no substantive occupational information, and a third group received both treatments. Groups one and three, which received computer-generated feedback, did significantly better at making appropriate occupational choices than group two or the control. A particular strength of this study was the inclusion of group two, which controlled the expectancy effect and served as a placebo.

Chapman, Katz, Martin, Norris, and Pears (1977) evaluated the effectiveness of SIGI during field test at six colleges and universities, using pre/post self-report questionnaires as well as interviews with college professionals in order to measure the users' ability to apply a rational process to the career decision. In reporting their findings, Chapman et al. state:

> The SIGI users, as compared with the controls, displayed ($p < .01$) a greater knowledge of their values, explored more occupations, knew which occupations met their values, had more definite career plans, thought they could predict their grades better, knew better which program to enroll in for their occupational goal, had greater confidence in their career decision-making ability, used the college reference library more frequently, talked with guidance counselors more often, used career-related audio-visual materials more frequently, used a computer-based guidance system more frequently, rated themselves higher as decision-makers and higher in their knowledge of occupations, knew more about the occupation they might enter, had seen a counselor in greater numbers within the last two weeks, and were more willing to interact with a computer. Moreover, they would be ($p > .05$) less inclined to follow the advice of

others, were less inclined to be flummoxed by conflicting advice, were less persuaded that knowledge of marriage plans were crucial to career decision-making, and had a clearer knowledge of their values. They did not significantly differ from controls in their amount of reading and talking about occupations, in their talking to people already engaged in an occupation, in their attendance at workshops, in their doubt that change played a large part in their occupational choice, in their belief that they would make their own decisions, in their recognition that deciding could not be long delayed, in the frequency of their planning sessions, and in their confidence that they generally made correct decisions. (p. 646)

Also, in summary, results of interviews with SIGI users revealed a definite tendency to organize career decision making around a rational model.

Willingham (1978) evaluated the effect of SIGI through the use of self-report questionnaires. Compared to a control group, SIGI users showed significant differences in rating their values, choice of major, and confidence in career plans. A similar study by Frederickson and Fullerton (1978) showed favorable user progress between pretest and posttest, without benefit of a control group.

In a more complex study, Devine (1976) used a Soloman (1949) four-group design which enabled the study to determine both the main effects of testing as well as the interaction of testing and SIGI use. No significant effects were found on the Career Maturity Inventory Attitude or Competence Test scales, but the author noted that limited time (4 weeks) between pretests and posttests may have been a factor in this result.

While the above evaluations of SIGI have considered effects in relation to no-treatment control groups, a number of other researchers have attempted to compare SIGI to other counseling methods. Risser and Tully (1977) provided subjects in one group with SIGI and traditional testing-oriented counseling. A second group received only traditional counseling. Results obtained through counselor ratings revealed that the group receiving both treatments scored significantly better in various indices of career development. The study might have provided more useful data had it included a SIGI only and no-treatment control group.

Pyle and Stripling (1976) used a nonequivalent control group design and divided 97 subjects into three groups. One group received SIGI use only. A second participated in group career counseling, and a third group served as controls. The attitude scale of the Career Maturity Inventory (Crites 1973) was used as a dependent measure, and only group one which used SIGI produced significant positive changes from pretest to posttest scores. Clearly, the results of this study are in contrast with Devine's results in that Pyle and Stripling found significant changes on Career Maturity Inventory attitude scores in just three weeks.

Sampson and Stripling (1979) were interested in the levels of traditional counseling intervention required to maximize the effectiveness of SIGI use. Subjects were divided into three groups varying in terms of counselor involvement. One group received structured counseling with SIGI use, another received unstructured counseling with SIGI use upon request, and a third group used SIGI but did not interact with a counselor during the time that they utilized the computer-assisted guidance system. Two self-report questionnaires served as dependent measures and mixed results were found regarding significant differences among groups. Students in the structured and control groups tended to evaluate SIGI similarly while significant differences were found between the structured and control groups and the nonstructured group on questions dealing with interest in and effectiveness of SIGI.

In discussing implications of their findings, Sampson and Stripling noted that computer-assisted guidance systems can be made available to students who wish to use them without counselor assistance. It was pointed out, however, that following SIGI use, approximately one-half of the control subjects requested individual counseling. Sampson and Stripling conclude:

This suggests that even though group approaches seem to meet student needs during their use of the system, individual counseling is perceived by many students as a necessary follow-up to the experience. Counselors seem to be a necessary component of computer-assisted guidance. (p. 237)

DISCOVER Evaluations

Rayman, Bryson, and Harris-Bowlsbey (1978) field tested the DISCOVER system with a sample of 30 treatment and 30 control public school students. Pretests and posttests using the Assessment of Career Development (1973) and the Career Development Inventory (1975) were given to both the treatment and control groups. The differences in scores between experimental and control groups on the Assessment of Career Development and the Career Development Inventory were not significant.

Self-report questionnaires were provided at the beginning and end of the study to treatment subjects only, and follow-up interviews were also given to only the treatment group after completing the DISCOVER system. Results of the questionnaires indicated that students felt more confident of their educational and career plans after using DISCOVER. This finding was supported by the follow-up interview with counselors.

Summary: Evaluation of Computer-assisted Guidance Emphasis Systems

When viewed collectively, the results of research on the effects of computer-assisted guidance on career development have been mixed. Generally, almost all studies included self-report measures on which subjects tended to respond favorably to computer-assisted counseling and to report progress in their career planning. This finding was also supported by follow-up interviews which were a part of a number of the studies. However, when standardized instruments of career development such as the Career Maturity Inventory or the Career Development Inventory were used, and effects on experimental and control groups compared, the results have been inconsistent. For example, of the studies reviewed, standardized measures of career development were included on six occasions, and three of those indicated significant effects.

Another conclusion is that many of the studies which were reviewed suffer from limitations in experimental design. For example, many did not use a variety of dependent measures and relied simply on self-report questionnaires. Such measures were often designed by the researcher to serve only for the evaluation of the particular system. Also, in many studies, the researcher was heavily involved in the development of the computerized guidance system which introduces the possibility of experimenter bias. Furthermore, as mentioned throughout the review, many studies lacked sufficient controls. Rayman, Bryson, and Harris-Bowlsbey state:

> The results of specific effects studies are more difficult to interpret. Most of the field trials and operational evaluations have been conducted by institutions that have a strong, vested interest in the successful operation and evaluation of the system. This lack of developer/evaluator independence probably leads to somewhat exaggerated positive findings. In addition, the evaluation procedures and instruments used for the evaluation of computerized systems leave much to be desired. (p. 350)

It is important to note, however, that many studies were really field tests which are initial attempts at generally evaluating systems. Many studies, therefore, were necessarily concerned with practical issues related to implementing computer-assisted guidance systems in public schools and colleges. Also, since many systems were still under development, evaluation often required subject feedback through questionnaires and interviews in order to evaluate their general impact and make necessary revisions to the computer-assisted guidance process. Such studies then often focused on system implementation and evaluation for further development rather than empirical studies intended to expand understanding of the career counseling process. It is apparent that computer-assisted guidance has evolved from initial system development to field testing in the 1970s and currently is becoming integrated with many existing career counseling services. Such infusion of computer-assisted guidance into various counseling environments will enable more specific and empirical investigation of its impact with a larger number of users and its effects upon career development when combined with traditional counseling services.

The study presented in the following chapter represents an attempt to evaluate the effectiveness of computer-assisted guidance within a comprehensive career counseling service of a large university. While the study was conducted entirely in the field, a number of empirical controls were included to evaluate the impact of computer-assisted guidance alone and in conjunction with traditional counseling services upon college student career planning progress.

Chapter 3

THE INTEGRATION OF THE DISCOVER COMPUTER-BASED GUIDANCE SYSTEM INTO A COLLEGE COUNSELING CENTER: ITS EFFECTS UPON CAREER PLANNING

Introduction

College students in the process of career exploration need a variety of information as well as effective decision-making skills. They need an easily accessible, up-to-date, and reliable source of career information which is part of a comprehensive career development system; preferably, the system should be based upon a decision-making model that includes information about the self and relates it to the world of work.

This need is often difficult to meet, as an unfavorable counselor-student ratio can make one-to-one assistance virtually impossible. For example, the Career Development and Placement Center of The Pennsylvania State University provides services to approximately 33,000 students; and the professional staff of the center is comprised of 12 persons, five of whom are designated as full-time counselors. Since such counselor-student ratios are not uncommon, computer-assisted guidance has been increasingly used as a career planning intervention in college and public school counseling services.

Current computerized guidance systems are capable of performing comprehensive counseling functions including assistance in gathering self-information such as individual interests, values, and abilities; learning a career decision-making process; and gathering information concerning careers and educational programs. Furthermore, some computer-assisted guidance systems enable the user to interact with the computer, thus requiring minimal staff involvement for effective use.

Interactive guidance systems can be used in support of traditional career counseling or with little or no counselor involvement. The Pennsylvania State University Career Development and Placement Center believed that computerized guidance should not be considered a counselor replacement; rather, computer systems should serve to augment counselor functions and provide an additional resource for career planning assistance in counseling centers.

Therefore, the Career Development and Placement Center proposed that DISCOVER, a computer-based career guidance and counselor support system, be leased and integrated into the career counseling services of The Pennsylvania State University for a two-year pilot program. This proposal was implemented and the DISCOVER system was installed at the University Park Career Development and Placement Center as well as the New Kensington and York campuses during spring term, 1981.

The University Park system was integrated with a central IBM 370 computer in the University's Management Services Office; hardware/software refinements were made during the summer of 1981. Two IBM 3270 cathode ray tube terminals with light pens were installed in a specifically designed DISCOVER room at the Center.

Before DISCOVER was made available for unlimited student use, an initial study was developed to determine the system's effectiveness in assisting college students in career planning. This study of DISCOVER's effects upon career planning was the focus of an evaluation conducted during the 1981-82 academic year.

Subjects

Sixty-seven (67) clients (13 men and 49 women, ranging in age from 17 to 21 years) of the Career Development and Placement Center volunteered to participate as subjects in this study. All subjects were first- through seventh-term, full-time undergraduate students attending the University Park campus of The Pennsylvania State University. Subjects varied in college enrollment and specific academic major.

Subjects were assigned randomly to the wait-list control group or to one of three experimental treatment groups. The DISCOVER group had 16 subjects, the counseling group 19 subjects, and the DISCOVER/counseling group 16 subjects. The wait-list control group had 16 subjects.

Subjects were recruited for participation in the study through intake-screening interviews. During the fall term of 1981, all first- through seventh-term students requesting counseling at the Career Development and Placement Center completed the Survey of Career Development and were scheduled for an intake-screening interview. Students who were invited to participate

in the study were those who (a) expressed a need to progress further in educational/career planning, (b) expressed no concerns in social/personal development, (c) were not currently in academic difficulty, (d) had at least an overall grade point average of 2.0 on a 4.0 scale, and (e) obtained a score of 21 or less on three of the five scales of the Survey of Career Development, or a total score of 105 or less. Students failing to meet any of these criteria were referred to individual counseling and were not included in the study.

The study sample, then, was comprised of students whose primary reason for requesting counseling services was a need to progress in educational/career planning, and who had ample time for participation. All subjects were informed of the research activity and treatment conditions to which they would be randomly assigned. Their participation was voluntary.

Measures

Progress in educational/career planning was measured by four dependent variables which yielded 14 scores.

Survey of Career Development (SCD)

The Survey of Career Development was designed specifically for use with the DISCOVER system and contains 30 items which comprise five scales:

1. Statements About Myself I (Clarification of Values)
2. Statements About Myself II (Understanding Interests and Competencies)
3. Statements About Decision Making (Knowledge of Effective Career Decision-making Skills)
4. Statements About Occupations (Knowledge of Career Information)
5. Statements About My Career Planning (Understanding How to Achieve Career Goals)

Each of the five scales is designed to assess the user's need for experience in career development tasks that can be obtained from various modules of the DISCOVER system. The user responds to each of the items with a number from 1 to 5, with 5 meaning "I have already done this" and 1 meaning "I have not yet thought much about it." If the user's point score totals less than 21 in any of the five categories of items, DISCOVER modules that provide assistance in the appropriate area are recommended. The instrument is on-line in the DISCOVER system, but in this study the survey was administered to subjects in paper and pencil form.

Since each scale directly reflects desired outcomes of Career Development and Placement Center activity as well as indications for DISCOVER use, the measure was included for all treatment groups. A split-half reliability was calculated on the total pretest scores of this study's sample. The results yielded a measure of internal consistency of $r = .95$.

Confidence and Progress in Educational/Career Planning

A 10-item questionnaire was devised to obtain self-reports and ratings of subjects regarding their confidence and progress in educational/career planning. The measure includes items reflecting confidence in clarity of self-information, i.e., interests, values, and abilities; decision-making ability; knowledge of career information; and present ability to choose appropriate majors or careers.

Behavior Log

A log requiring subjects to record specific activities concerning their use of resources in gathering educational/career information was developed for this study. Part I of the log reports the amount of time in which the subject used the Career Development and Placement Center Library; in Part II the subject lists contacts, other than the Career Development and Placement Center, that were used in obtaining career planning assistance.

Career Development Inventory

The Career Development Inventory was originally developed for use with secondary school students. Recently, a college version containing 120 items was developed by Super, Thompson, Lindeman, Jordaan, and Myers (1981). Data from norm groups have been collected and the instrument marketed by Consulting Psychologists Press, Inc. Data collected by the authors of the instrument (CM Form) suggest that it has satisfactory levels of internal consistency. Indices of reliability, as estimated by Cronbach's alpha coefficient, range from .56 to .92 on all scales for college freshmen and sophomores.

The Career Development Inventory User's Manual notes that the college form is recommended for assessing the readiness of college students to make career decisions. It is designed to identify students who need awareness,

decision-making training, exploratory attitudes, occupational exploration in breadth, or in-depth exploration of a preferred field. This form can also be used in evaluating career counseling programs and services. The scales of the Career Development Inventory are: (A) Career Planning: involvement in thinking about the future and making career plans, (B) Career Exploration: ability to find and use good sources of career planning information, (C) Career Decision Making: ability to solve problems involving vocational and educational choices, (D) World-of-Work Information: knowledge about jobs and what it takes to find and succeed at a job, and (E) Knowledge of Preferred Occupation: knowledge of what working at a preferred occupation is like.

Procedures

The study was conducted in a university career counseling center, using actual counselors and clients. Following the screening interview, subjects were assigned randomly to a treatment group or the wait-list control group. All students were pretested and oriented to their treatments.

DISCOVER Group

DISCOVER is a systematic career guidance treatment that consists of 21 modules of content and is based on a decision theory model. The DISCOVER system has five major components: (1) self-information including values, interests, and competencies, (2) exploration of occupations, (3) instruction and practice in decision making, (4) relationship of self-information to occupational alternatives, and (5) development of a plan for implementation of career choice. The Survey of Career Development recommends modules based upon scores on various scales; however, users can access any or all of the 21 modules at any time. Each module requires approximately one-half hour to complete.

Subjects assigned to the DISCOVER group were oriented to the system's content and instructed in its use. No structured package of DISCOVER modules was imposed upon subjects; they could complete as few or as many modules as desired during the five-week treatment period. Completion of one module, however, was required of subjects in order to remain in the study, and records were kept of the modules completed by each subject. Subjects scheduled DISCOVER time on a weekly basis during the study.

Individual Counseling Group

The Career Development and Placement Center employs five full-time staff members and three one-half time graduate assistants. Their primary responsibility is to provide career counseling. All staff counselors and graduate assistants have a minimum of a master's degree in counselor education, human development, or clinical psychology.

Clients receive one-hour counseling appointments scheduled on a weekly basis. The average number of counseling appointments completed during the 1980-81 academic year was 1.31 sessions per client. It should be noted, however, that there is substantial variability in the number of counseling sessions that clients receive; many, for example, require only one contact hour while others may return for several counseling sessions.

Career counseling within the Career Development and Placement Center generally reflects developmental and decision-making approaches to counseling. Clients are assisted in clarifying their self-concept, identifying interests, values, and abilities, improving decision-making skills, and gathering educational/career information. These counseling functions are parallel to the goals of the DISCOVER system.

Although counseling activity was expected to reflect accepted career decision-making approaches, counselors were able to use specific procedures that they believed to be appropriate. Therefore, individual career counseling activities, as well as DISCOVER use, were unstructured. Counselors were instructed to notify the researchers of any counseling activities (with subjects in the study) that were beyond the scope of developmental career counseling.

Subjects assigned to the counseling group were scheduled on a random basis with an initial one-hour appointment. Follow-up appointments were available. Therefore, counseling proceeded in normal fashion with subjects receiving any treatments and any number of counseling sessions that the counselor and client believed were required. Records were kept of the number of counseling contact hours of each subject. Each subject had to keep at least the first counseling appointment to be retained in the study. Counselors did not use DISCOVER as a support function with subjects in this group.

Individual Counseling/DISCOVER Group

Subjects received the same treatment as the counseling group, except that they were asked to use DISCOVER in support of their individual work with

counselors. This group, therefore, was simply a combination of the two treatments previously discussed (DISCOVER and individual counseling).

Logs were kept of both individual counseling contacts and DISCOVER use; any subject who did not complete at least one module of the DISCOVER system and one counseling appointment was deleted from the study.

Wait-List Control Group

Subjects randomly assigned to the Wait-List Control Group were asked to wait five weeks before receiving DISCOVER use or Career Development and Placement Center individual counseling. They were, however, encouraged to engage in other career planning activities during the waiting period, such as meeting with an academic advisor or using the career library.

Findings

Analysis of variance was used to test the equality of group means for all pretests. No significant ($p < .05$) *F*s resulted, indicating that treatment groups were not significantly different at the outset of the study. Analyses of covariance were completed to compare posttest scores of the four groups for each of the 14 dependent variables. Type of group was used as the factor to be analyzed and pretest scores were included as the covariate. Individual means were compared with the LSD follow-up test. To ensure overall level of statistical significance for reported results, only probabilities associated with preplanned comparisons are reported.

Initially, 67 students who requested assistance with career planning from the Career Development and Placement Center during fall term, 1981, comprised the sample of subjects for this study. However, five subjects failed to complete the study, resulting in a final sample of 62 students. The group assignments of subjects were: DISCOVER = 15, counseling = 17, DISCOVER/counseling = 15, and no-treatment control = 15.

Table 1 shows the means and standard deviations for the number of DISCOVER modules and the number of hours of counseling used by students within each treatment group.

Survey of Career Development

Table 2 shows that for all scales and total score of the Survey of Career Development, statistically significant ($p < .01$) treatment effects were found through analyses of covariance. Post hoc comparisons of means indicated that all treatment groups obtained significantly ($p < .01$) higher scores than did the no-treatment control group on all scales and the total score of the Survey of Career Development. No significant ($p < .05$) differences on Survey of Career Development scores were found among the DISCOVER, Counseling, and DISCOVER/Counseling groups.

TABLE 1

Means and Standard Deviations of DISCOVER Modules and Counseling Appointments Completed for Each Treatment Group

Treatment Group[a]	DISCOVER Modules		Counseling Appts.	
	Mean	SD	Mean	SD
DISCOVER	4.0	2.59	--	--
Counseling	--	--	1.82	.88
DISCOVER/Counseling	3.87	2.59	2.33	.90
No-Treatment Control	--	--	--	--

[a]*n* = 15 (DISCOVER), 17 (Counseling), 15 (DISCOVER/Counseling), and 15 (No-Treatment Control)

TABLE 2

Analysis of Covariance of Treatment Group to Posttest Scores (Survey of Career Development)

Treatment Group[a]	Scale 1 Values		Scale 2 Interests/ Abilities		Scale 3 Decision Making		Scale 4 Occupations		Scale 5 Career Planning		Total Score	
	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value
DISCOVER	26.12	4.54*	24.54	9.75*	23.83	9.19*	23.44	4.84*	19.15	5.60*	117.30	9.83*
Counseling	25.84		24.28		21.47		22.41		19.65		113.67	
DISCOVER/ Counseling	27.33		25.27		25.93		23.34		21.54		123.36	
No-Treatment Control	23.49		18.73		17.63		18.21		14.70		93.05	

Note. *F* value is for the overall significance level on comparison of group posttests adjusted for the covariate pretest score.

[a] n = 15 (DISCOVER), 17 (Counseling), 15 (DISCOVER/Counseling), and 15 (No-Treatment Control)

[b] Adjusted for pretest score

$*p < .01$

Confidence and Progress in Educational/Career Planning

A statistically significant ($p < .01$) treatment group effect was found on posttest self-rating scores of confidence and progress in educational/career planning (Table 3). Post hoc comparisons of means revealed that all treatment group means were significantly ($p < .01$) greater than that of the no-treatment control group. However, no significant ($p < .05$) differences were found among the DISCOVER, counseling, or DISCOVER/counseling groups on adjusted posttest scores of Confidence and Progress in Educational/Career Planning.

Behavior Log

Posttest means for Part I (number of hours using the career library) of the Behavior Log were investigated and a statistically significant ($p < .05$) treatment group effect was found (Table 4). Post hoc comparisons of treatment group means indicated that the DISCOVER group mean was significantly ($p < .05$) higher than that of the no-treatment control group. Also, the mean of the DISCOVER/counseling group was significantly ($p < .01$)

TABLE 3

Analysis of Covariance of Treatment Group to Posttest Scores (Confidence and Progress in Educational/Career Planning)

Treatment Group[a]	Mean Posttest Score[b]	*F*-Value
DISCOVER	33.24	5.85*
Counseling	32.17	
DISCOVER/Counseling	34.09	
No-Treatment Control	27.34	

Note. *F* value is for the overall significance level on comparison of group posttests adjusted for the covariate pretest score.

[a] n = 15 (DISCOVER), 17 (Counseling), 15 (DISCOVER/Counseling), and 15 (No-Treatment Control)

[b] Adjusted for pretest score

$*p < .01$

TABLE 4

Analysis of Covariance of Treatment Group to Posttest Scores (Alternative-Generating and Information-Gathering Behavior Log)

Treatment Group[a]	Part I Hours of career library use		Part II Career resource contacts	
	Mean Posttest Score[b]	*F*-Value	Mean Posttest Score[b]	*F*-Value
DISCOVER	4.00	3.88*	5.48	5.13*
Counseling	2.58		8.88	
DISCOVER/ Counseling	5.87		7.19	
No-Treatment Control	1.23		6.36	

Note. *F* value is for the overall significance level on comparison of group posttests adjusted for the covariate pretest score.

[a] n = 15 (DISCOVER), 17 (Counseling), 15 (DISCOVER/Counseling), and 15 (No-Treatment Control)

[b] Adjusted for pretest score

$^{*}p < .01$

higher than that of the control group. The counseling group mean, however, was not significantly ($p < .05$) different from the control or other treatment groups.

As can be seen from Table 4, a statistically significant ($p < .01$) treatment group effect was found for Part II (Career Resource Contacts) of the Behavior Log. A post hoc examination of this finding indicated that the counseling group mean was significantly ($p < .01$) higher than those of the no-treatment control and DISCOVER groups. Also, the DISCOVER/counseling group mean was significantly ($p < .05$) higher than that of the DISCOVER group. No other group means yielded significant ($p < .05$) differences.

Career Development Inventory

A statistically significant ($p < .01$) treatment group effect was found for posttest scores of Scale A (Career Planning) and Scale B (Career Exploration) of the Career Development Inventory (Table 5). No statistically significant ($p < .05$) group effects were found for Scale C (Decision Making), Scale D (Work Information), or Scale E (Knowledge of Preferred Occupation) of the Career Development Inventory. Post hoc comparisons of means for the significant ($p < .01$) findings for Scales A and B found statistically significant ($p < .01$) differences between all treatment groups and the no-treatment group on Scale A of the Career Development Inventory. Also, on Scale A, the mean of the DISCOVER/counseling group was significantly ($p < .05$) higher than the counseling group mean. No other comparisons of group means were found to be significant. Post hoc examination of Scale B means indicated that the counseling and DISCOVER/counseling group means were significantly ($p < .01$) higher than the no-treatment control and DISCOVER groups. No further significant differences between group means were found for Scale B.

Discussion

The average number of counseling appointments for subjects in the counseling only group (1.82 sessions) was comparable to the average number of one-hour appointments per client for all Career Development and Placement Center counseling during the 1980-81 academic year (1.31 sessions). It appears, therefore, that participation as subjects in nonstructured career counseling approximated the quantity of client activity typically observed at the center. It is interesting to note that, although the difference was not statistically significant,

TABLE 5

Relationship of Treatment Group to Posttest Scores (Career Development Inventory)

Treatment Group[a]	Scale A Career Planning		Scale B Career Exploration		Scale C Decision Making		Scale D Work Information		Scale E Knowledge of Preferred Occupation	
	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value	Mean Posttest Score[b]	*F* Value
DISCOVER	71.55	6.20*	182.04	5.73*	14.25	2.33	16.82	.64	23.75	1.14
Counseling	68.51		199.26		14.94		16.75		22.42	
DISCOVER/ Counseling	76.31		199.57		16.17		16.86		23.79	
No-Treatment Control	58.57		179.63		16.18		16.40		24.65	

Note. *F* value is for the overall significance level on comparison of group posttests adjusted for the covariate pretest score.

[a] $n = 15$ (DISCOVER), 17 (Counseling), 15 (DISCOVER/Counseling), and 15 (No-Treatment Control)

[b] Adjusted for pretest score

$*p < .01$

the average number of counseling appointments per client for subjects in the DISCOVER/counseling group (2.33 sessions) was slightly higher than for subjects who participated in the counseling only group. It appears that DISCOVER use did not inhibit subject interest in meeting with a counselor; in fact, subjects receiving both services averaged approximately .5 counseling sessions more than subjects participating in counseling only. Furthermore, subjects receiving both treatments completed approximately the same number of DISCOVER modules as subjects using DISCOVER alone. Therefore, it appears that participation in both DISCOVER and individual career counseling does not reduce subject involvement in either service.

It is difficult to make totally accurate comparisons of subject time exposure to DISCOVER and counseling. However, the number of modules completed by DISCOVER users was recorded. As shown in Table 1, the DISCOVER group completed 4.0 modules and the DISCOVER/counseling group completed 3.87 modules. Since each module requires about one-half hour for completion, it appears that subjects invested about the same amount of time in DISCOVER use and in individual career counseling during the five-week treatment period.

Subjects in groups using DISCOVER were encouraged to complete at least three modules. However, there were no requirements for completion of specific modules. Rather, subjects were oriented to DISCOVER use, provided with a review of module content and permitted to make decisions concerning module use. A review of subject use of specific DISCOVER modules shows that a wide variety of modules were completed. Also, little difference was apparent in usage patterns between DISCOVER only or combined DISCOVER/counseling groups.

Results of posttests on the Survey of Career Development indicated that all treatment groups scored significantly higher on all scales on the total score on the survey than did the no-treatment control group. No significant differences on any Survey of Career Development score were found among the three treatment groups. However, it is worth noting that a review of Table 2 reveals that trends of scores on all scales and total of the Survey of Career Development consistently favor subjects in the combined treatment condition receiving individual counseling coupled with DISCOVER use.

Group differences on posttest scores of the Confidence and Progress in Educational/Career Planning were

quite similar to those observed on the Survey of Career Development. All treatment groups scored significantly higher on the questionnaire than did the control group. Also, no differences were found among treatment groups on this measure. Although differences were not significant, the combined DISCOVER/counseling group once again exhibited the highest posttest scores among treatments on the self-rated questionnaire.

Posttest scores on Part I of the Behavior Log indicated that subjects in the DISCOVER and DISCOVER/counseling conditions spent significantly more time using the career library during the five-week treatment period than did controls. No significant difference was found in the amount of library use between DISCOVER only and the combined condition. The counseling-only group was no different from the control group in career library use. This finding indicates that DISCOVER was an active agent in stimulating career library use while individual counseling alone did not influence this aspect of information seeking.

A number of factors may have contributed to this finding. For example, although counselors typically orient clients to the use of the career library, subjects in the counseling treatment may have become more involved in dealing with clarification of self-information and were not as inclined as DISCOVER users to seek career information in support of their counseling activities. The DISCOVER system refers users to the Career Development and Placement Center's career library for further information. Therefore, subjects who used DISCOVER in their treatment often received some basic career information on-line, which may have stimulated them to engage in more in-depth information seeking behavior in the career library.

The differences observed among treatment groups on Part I of the Behavior Log were reversed in Part II (Career Resource Contacts). According to this portion of the log, subjects in the counseling and DISCOVER/counseling groups made significantly more contacts during the treatment period than members of the DISCOVER or the control group. Apparently, individual career counseling rather than DISCOVER fostered greater subject tendency to contact other individuals and/or services that could provide assistance in career planning. The most plausible explanation for the findings is that counselors make direct referrals to other specific persons or appropriate student services for additional assistance. To date, however, DISCOVER does not have referrals to specific individuals or other campus student services on-line. Thus, DISCOVER users as well as controls were left on their own in seeking career planning resources other than those available through the Career Development and Placement Center.

Career Development Inventory posttest scores of each treatment group were significantly higher than those of the control group on Scale A (Career Planning: Involvement in Thinking about the Future and Making Career Plans). Also, the combined DISCOVER/counseling group scored significantly higher on Scale A than the group receiving individual career counseling only. Although not statistically significant, the combined group posttest score on Scale A was larger than that of the DISCOVER only group. This trend coupled with the significant difference of the combined treatment group over counseling alone suggests that use of DISCOVER combined with individual career counseling maximized thinking about future career plans. These results indicate that DISCOVER was as likely to elicit subject involvement in career planning as was individual career counseling.

Subjects in all treatment groups also scored significantly higher than controls on Scale B posttest scores of the Career Development Inventory (Career Exploration: Ability to Find and Utilize Good Sources of Career Planning Information). In addition, both the DISCOVER/counseling and the counseling only groups scored significantly higher than the DISCOVER use group. This posttest finding supports the conclusion, associated with Part II (Career Resource Contacts) of the Behavior Log, that counseling appeared to be more effective than DISCOVER in stimulating use of sources of career planning assistance other than the Career Development and Placement Center.

Scale B attempts to measure the quality as well as the quantity of sources used for career planning assistance, while Part II of the Behavior Log is purely a quantitative measure of career resource contacts. Therefore, results associated with Scale B indicate that counseling not only contributed to the amount of career resources utilized but also to the quality of the resources utilized.

No significant differences were found among posttest scores of any treatment group and controls for the following Career Development Inventory Scales: C (Career Decision Making), D (World of Work Information), E (Knowledge of Preferred Occupation). It is important to point out that Scales C, D, and E are competency-based. Therefore, it appears that, as measured by the Career Development Inventory, treatments had no effect on subjects' decision-making ability or occupational knowledge. The treatments' inability to increase competencies may have been the result of the relatively brief five-week period between testing occasions. However,

standardized instruments such as the Career Development Inventory may not be sufficiently sensitive to measure competency effects that might have resulted from this study's treatments. Other studies that have included computer guidance systems as independent variables have found mixed effects using the Career Development Inventory or the Career Maturity Inventory. Furthermore, Scales C, D, and E may have been inappropriate for inclusion as outcome measures in this study. For example, a portion of Scale D deals with understanding of jobs and job search skills. Scale E taps knowledge of preferred occupation. If, between testing occasions, subjects were influenced to change their choice of a preferred occupation, they may have demonstrated reduced understanding of an occupation that just recently had come into consideration.

Summary

A review of the results leads to the following conclusions:

- All treatment groups, i.e., DISCOVER only, individual career counseling only, and combined DISCOVER/counseling showed positive effects in self-rated educational/career planning progress,
- DISCOVER use alone and individual career counseling alone were equivalent in exerting a positive influence upon subjects' self-rated progress in educational/career planning,
- Both groups using DISCOVER used the career library more than did the counseling only group,
- The career counseling treatment was more effective than DISCOVER use in stimulating contacts with career resource persons or services which could provide further assistance with educational/career planning,
- There were no significant differences among groups in competency in decision making or knowledge of the occupational world,
- The combined DISCOVER/counseling treatment produces stronger effects upon career planning progress than either of its components used separately, including greater information seeking and use of career resources.

Furthermore, the results suggest that the combined use of DISCOVER and counseling is more effective in improving students' perceptions of their progress in career planning than either approach used separately.

However, it is important to recall that the subjects in this study were prescreened; their primary concern was career planning, they were well adjusted personally, and they were not experiencing academic difficulty. Therefore, results of this study should not be interpreted as supporting a computerized system as a replacement for counselors in assisting clients. Rather, the results indicate that computers can be used effectively without counselor involvement to accomplish various specific career planning activities with certain populations. Furthermore, in some career planning tasks, optimal effectiveness appears to be obtained when computerized guidance is used in conjunction with individual career counseling.

Chapter 4

IMPLICATIONS OF THE STUDY

The Pennsylvania State University study has implications (a) for practice, (b) for future research, and (c) for the future of the field.

For Practice

At least four implications for practice can be made from results of the study. First, the screening of counseling center clients for the purpose of identifying those who have relatively "pure" career concerns appears to be a useful practice in order to divide clients into those who will receive high benefit from use of computer-based systems and those who may presumably receive lesser benefit. Such screening will allow counselors to spend available time with those who may have highest need for their services.

Second, results of this study indicate that the most productive career guidance treatment for college students with "pure" career concerns would be a combination of a computer-based guidance system and one-to-one counseling. The extra "payoff" from using both modes, however, was relatively small. A cost-benefit analysis might be appropriate to determine whether the added benefits warrant the added expense of using the combination treatment.

Third, treatment for career-concern clients by computer alone was found to be significantly more effective (that is, it produces gains in desirable vocationally-related behaviors) than no treatment at all. Therefore, the computer-based guidance system might be considered for sites with few or no counselors.

A fourth implication is that more powerful treatments than those utilized in this study must be provided in order to produce significant changes in competency-based areas such as decision-making skill, career knowledge, and world-of-work information; or that more sensitive instruments to measure change must be developed. The more powerful treatment, not offered in this study, may consist of much more time at the computer terminal (i.e., utilizing many more modules of DISCOVER) and/or of many more in-depth interviews with counselors. We would also expect that much more time would be needed in these developmental areas of vocational maturity than was present in this study.

For Further Research

The findings in this research study suggest at least four areas in which further research would fill in important gaps in our understanding of how best to combine computer and counselor modes of delivery. The first area relates to the degree of effectiveness which could be attained with a combination of a group mode of delivery (i.e., curriculum or group workshops) and the computer. In this combination of modes of delivery, the counselor (or trained paraprofessional) could provide needed support in a group mode by providing some or all of the following services: (a) general orientation to the computer-based system, (b) didactic material on the process of career development, (c) awareness of factors to consider when making choice, (d) review and reaction to the self-assessment instruments provided at the terminal, (e) assistance in getting additional information about identified occupations, and (f) support in the decision-making process. Since such services could be provided to individuals in groups of 10-20 this mode of support would be much less expensive per student than individual counseling. In this model the computer is used as "homework" for those parts of a structured career guidance process which it does best, and the counselor support person is used for those functions which humans can do best. The research question relates to how support delivered in a structured way to a group would compare to that produced by the one-to-one and computer model.

A second research study could be designed to examine what kinds of treatment are required to produce significant gains in the cognitive skill areas of vocational maturity, such as career information, world-of-work information, and decision-making skill. Alternatives might be longer-term use of a sophisticated career development system like DISCOVER, more one-to-one counseling, and/or addition of a group/curriculum approach as a mode of delivery. Since vocational maturity is a developmental, long-term phenomenon, judgment would indicate that more of any combination of these potential delivery modes could produce significant gains in vocational maturity, as measured by the cognitive scales in the Career Development Inventory (Super et al., 1981) or similar instruments.

A third question related to this research is whether computer-based *information* systems (rather than a comprehensive *guidance* system) would have produced

positive effects similar to those identified in this study. In other words, does the use of a computer and software that forces attention to the vocational choice problem produce gains in awareness and exploratory behaviors, or is it the unique content of the computer-based *guidance* system that produces these effects?

Fourth, long-term research with larger populations is needed. To date no system developers have had the resources to do longitudinal research. Besides the resource problem, there are research-design questions. Since most career guidance and information systems state that providing a framework for exploration of occupational alternatives is a major goal, research to ascertain whether an individual is still in a chosen occupation years later is *not* a good test of the effectiveness of the system. Finding out whether the user learned a career-choice process which could be reused at later decision points is a more relevant question, but a much more difficult one to address in a systematic way.

Fifth, most research to date has viewed the computer-based system as a global entity. Research now needs to be done to look at specific pieces of the treatment. In other words, how do the effects of search strategies compare with those of data files, on-line assessment, or instructional content?

Finally, the profession needs much more precise information about cost-benefit tradeoffs. For example, it seems that the "best" mode of delivery of career guidance services might be one-to-one counseling plus computer; the second "best," group (or curriculum) counseling plus computer; the third, group- or curriculum-alone counseling; and the fourth, use of computer alone. Research is needed to establish the actual order of these various modes in effectiveness (producing gains in desirable vocationally-related behaviors) and in cost per hour and per student of delivery, as well as in some combination of these two. Such data could become the basis for programmatic decision making.

For the Future of Computer-based Guidance Systems

The evidence of effectiveness of computer-based systems combined with the lower cost and increased availability of microcomputer software and hardware suggests that use of computer-based systems will increase significantly in the next five years. While only one in twenty high schools and fewer postsecondary institutions currently have access to either a computer-based guidance or information system (Shatkin, L., 1980), this ratio may increase to 1 out of 3 in the next five years.

Evidence for the effectiveness of computer delivered career guidance services (even without counselor support) combined with the advent of the home computer and the telephone/TV/minicomputer connection, suggests that computer-based guidance services will be delivered in new settings. Primary examples of these settings will be the home, the library, business and industry, and the community learning center. The guidance profession will need to attend to the ethical guidelines for this movement and to find effective ways to impact the development of systems which will surely become available.

Third, the rapid development of videodisc technology may make the dreams of the early developers (specifically Donald Super, David Tiedeman, and Joseph Impelleteri) come true. These early developers were utilizing visual materials without adequate and cost-feasible technology for doing so. Now that technology is available and may soon become cost-feasible, there will be a movement toward the addition of videodiscs to computer-based career guidance software. These discs will present job tasks and settings, describe the organization of the world-of-work, and depict the atmosphere on college campuses in audio-visual form. This medium will allow the user to engage in a more thorough and realistic exploration than is currently possible at the computer terminal.

Finally, counselors will probably make greater use of computer-based systems in their work. To an increasing extent, counselor education programs will provide counselors with basic computer literacy, with knowledge of existing systems, and with models for their assimilation into systematic programs for individuals of all ages and in a variety of settings. With this will come some changes in the role of the counselor, but these changes should enhance that role rather than diminish it.

REFERENCES

The American College Testing Program (1973). *Handbook for the ACT Assessment of Career Development.* Iowa City, IA.

Chapman, W., Katz, M. R., Martin, R., Norris, L., & Pears, L. (1977). *Field test and evaluation of a computer-based system of interactive guidance and information* (Vols. 1-2). Princeton, NJ: Educational Testing Service.

Crites, J. O. (1973). *The career maturity inventory.* Monterey, CA: McGraw-Hill.

Devine, H. F. (1976). The effects of a computer-based career counseling program on the vocational maturity of community college students (Doctoral dissertation, University of Florida, 1976). *Dissertation Abstracts International, 36,* 7865A.

Frederickson, G. E., & Fullerton, T. F. (1978). *The report of the pilot project to evaluate the system of interactive guidance and information.* Pomona: California State Polytechnic University, Career Planning and Placement.

Harris, J. (1973). Analysis of the effects of a computer-based vocational information system on selected aspects of vocational planning (Doctoral dissertation, Northern Illinois University, 1973). *Dissertation Abstracts International, 33,* 4089A-4090A.

Katz, M. R., & Shatkin, L. (1980). *Computer-assisted guidance: Concepts and practices.* Princeton, NJ Educational Testing Service. (ERIC Document Reproduction Service No. ED 187 851)

Maola, J. (1976). Comparison of computer-based versus counselor-based occupational information systems with disadvantaged vocational students. *Journal of Counseling Psychology, 23*(2), 163-165.

Myers, R. A., Lindeman, R., Thompson, S., & Patrick, T. (1975). Effects of educational and career exploration system on vocational maturity. *Journal of Vocational Behavior, 6*(2), 245-253.

Pilato, G. T., & Myers, R. A. (1975). The effects of computer-mediated vocational guidance procedures on the appropriateness of vocational preferences. *Journal of Vocational Behavior, 6*(1), 61-72.

Pyle, K. R., & Stripling, R. O. (1976). The counselor, the computer and career development. *Vocational Guidance Quarterly, 25*(1), 71-75.

Rayman, J. R. (1978). *DISCOVER: A college-level computerized career guidance and information system* (Final report). Westminster, MD: DISCOVER Foundation, Inc.

Rayman, J. R., & Bowlsbey, J. H. (1977). DISCOVER: A model for a systematic career guidance program. *Vocational Guidance Quarterly, 26*(1), 3-12.

Rayman, J. R., Bryson, D. L., & Harris-Bowlsbey, J. (1978). The field trial of DISCOVER: A new computerized interactive guidance system. *Vocational Guidance Quarterly, 26*(4), 459-460.

Risser, J., & Tulley, J. (1977). *SIGI project research summary report.* Pasadena, CA: Pasadena City College.

Ryan, C. W., & Drummond, R. J. (1980). *MOICC and GIS: An impact study* (Final evaluation report). Orono, ME: College of Education, Maine University. (ERIC Document Reproduction Service No. ED 189 513)

Sampson, J. P., & Stripling, R. O. (1979). Strategies for counselor intervention with a computer-assisted career guidance system. *Vocational Guidance Quarterly, 27*(3), 230-238.

Shatkin, L. (1980). *Computer assisted guidance: Description of systems* (ETS RR-80-23). Princeton, NJ: Educational Testing Service.

Soloman, R. L. (1949). An extension of control group design. *Psychological Bulletin, 46,* 137-150.

Super, D. E., Thompson, A. S., Lindeman, R. H., Jordaan, J. P., & Myers, R. W. (1981). *The career development inventory.* Palo Alto, CA: Consulting Psychologists Press, Inc.

Willingham, A. (1978). *Evaluation of SIGI program.* Trenton, NJ: Mercer County Community College.