The Effects of Two Computer-Assisted Career Guidance Programs--DISCOVER and SIGI PLUS-- on the Career Development of High School Students

Shu-chen Jane Yang

Department of Guidance, College of Education
National Changhua University of Education
Taiwan, R.O.C.

Abstract
This study examined the effectiveness of two computer-assisted career guidance programs, DISCOVER and SIGI PLUS, on high school students' career development with six dependent variables: career maturity, career salience, accuracy of self-knowledge, certainty of vocational preference, satisfaction of vocational preference, and vocational exploratory behavior. Subjects were 96 11th and 12th graders. Chosen for this study was a 2 x 3 (Group treatment x Learning ability level) randomized block design. Results revealed: (a) no significant multivariate interaction effect between treatment and learning ability level on scores of five of the dependent variables; (b) no differentiation between treatment groups with the best linear combination of 12 subscales of career development measures; (c) no significant difference between the two groups on the vocational exploratory behavior measure; and (d) no differentiation among the three categories of computer use time with the best linear combination of 12 subscales. Implications of practice are discussed.
on the Career Development of High School Students

Adolescents in high schools are at a juncture where they must decide whether to continue their education or enter the work force. This is an important turning-point, and the decisions they make may indeed affect the entire course of their lives (Jordaan & Heyde, 1979).

In counseling centers which serve the teenagers as well as others, the use of computers has become widespread as scientific technology has continued to expand. Computer-assisted career guidance systems are particularly helpful in facilitating career planning by aiding in the exploration of self and the world of work (Glaize, 1983; Myers, 1978). Since the mid-1960s, at least nine computer-assisted career guidance systems have evolved. Presently, two systems, DISCOVER and SIGI PLUS, predominate in the United States.

Past attempts to evaluate the effectiveness of computer-assisted career guidance systems have concentrated either on a single system or on a combination of one computer-assisted system with another type of career intervention. For instance, SIGI and SIGI PLUS have been used as treatments in many research studies, including comparisons of SIGI users with nonusers and comparisons of SIGI use with other career interventions. Both the pretest-posttest control group design and posttest-only control group design have been utilized. The dependent variables have included decision-making skills, locus of control, attitudes toward the use of SIGI, computer use time, and career maturity.

The major results of these studies indicated that there is a relationship between the use of SIGI or SIGI PLUS and decision-making skills; SIGI may be more helpful in the attainment of an immediate goal, such as choosing a college major, than in the attainment of a long-term goal, such as making a career decision; students highly favored the use of SIGI or SIGI PLUS over other treatments; the relationship between SIGI (or SIGI PLUS) and locus of control is inconclusive, as is the relationship between SIGI (or SIGI PLUS) and career maturity (Chapman, Katz, Norris, & Pears, 1977; Devine, 1976; Fadden, 1984; Garis & Niles, 1990; Grant, 1985; Hafer, 1987; Pelsma, 1982; Salters, 1985).

DISCOVER is the newest of the several computer-assisted career guidance systems used in present time and has been studied in numerous ways. The results of the studies surveyed revealed some positive effects in the use of DISCOVER. For example, both high school and college students and high school students' parents had positive attitudes toward the use of DISCOVER. There is a relationship between the use of DISCOVER and accuracy of self-knowledge. The relationships between the use of DISCOVER and career maturity, and between the use of DISCOVER and the subject's indecision are inconclusive. Intellectual development may affect the use of DISCOVER. DISCOVER can be used by the

To further understand and improve the use of existing systems, especially with the growth in application of computer-assisted career guidance systems, Cairo (1983) pointed out the need to compare the effects of existing systems. Since Cairo's recommendation, a number of comparative studies on the effects of SIGI or SIGI PLUS and DISCOVER have been conducted by researchers in the field. However, most of the comparative studies have taken the form of survey research. Only in a few studies were experimental methods utilized, and their samples were generally drawn from college volunteers.

Several conclusions can be drawn from these studies: (a) Subjects had positive attitudes toward the use of SIGI, SIGI PLUS, and DISCOVER, and there were no significant differences in attitudes between the SIGI and DISCOVER groups. (b) There may be a relationship between perceived effectiveness and state of career decidedness and need for career information. (c) The relationship between the use of SIGI or DISCOVER and career maturity is inconclusive (Brownfield, 1987; Peterson, Ryan-Jones, Sampson, Reardon, & Shahnasarian, 1987; Sampson, Peterson, Reardon, Evans, & Domkowski, 1988; Sampson, Shahnasarian, & Reardon, 1986).

The present study builds on recent previous research. Through the use of the experimental method, this study compares the effectiveness of the two most widely used computer-assisted guidance systems, DISCOVER and SIGI PLUS, on the career development of high school students. Based on the design of the study, answers were sought to the following research questions: (a) Which of these experiences, DISCOVER or SIGI PLUS, is the more effective career guidance intervention for what kinds of learners? (b) Are there any differential effects between DISCOVER and SIGI PLUS on high school students' career development? (c) Do computer-assisted career guidance systems have differential effects when computer use time is controlled?

Method

Subjects

The subjects for this study were 96 students enrolled in an urban high school in lower Manhattan, New York City. All the students were from business and physics classes, and all volunteered to participate in the study.

The sample was comprised of equal numbers of males and females, with all students from middle and low socioeconomic backgrounds. Their ages ranged from 15 to 19 years, and the mean
age was 17 (45.8% 11th graders and 54.2% 12th graders). Ethnically, all were from minority groups (52% Hispanic, 38.5% Asian, and 9.5% Black).

Experimental Design

Chosen for this study was a 2 x 3 (Group treatment x Learning ability level) randomized block design with one treatment variable (the use of DISCOVER or SIGI PLUS) and one blocking variable (high, middle, and low learning ability).

Six dependent variables were used for this study. Five of them—career maturity, career salience, accuracy of self-knowledge, certainty of vocational preference, and satisfaction of vocational preference—were examined by means of a multivariate analysis of variance procedure. The sixth, vocational exploratory behavior, was analyzed by means of the chi-square test.

Instruments

Degree of Reading Power Test. Designed by the College Entrance Examination Board in 1986, the Degrees of Reading Power Test (DRP) measures reading ability. The subjects for the present study had taken this test in grade 10.

The internal-consistency of reliability coefficients using the Kuder-Richardson formula ranged from .94 to .97. Test-retest reliability coefficients of the same or an alternate form ranged from .86 to .91. Construct validity was supported by test results consistent with the students' ability.

Career Development Inventory. The School Form of the Career Development Inventory (CDI), developed by Super, Thompson, Lindemen, Jordaan, and Myers (1979), was used to assess the dependent variable, level of career maturity. The CDI consists of five basic scales: (a) Career Planning (CP), (b) Career Exploration (CE), (c) Decision-Making (DM), (d) World-of-Work Information (WW), and (e) Knowledge of Preferred Occupational Group (PO). Three additional scores are obtained by combining scores from these scales: (a) Career Development-Attitudes (CP and CE scores), (b) Career Development-knowledge and Skills (DM and WW scores), and (c) Career Orientation Total (CP, CE, DM, and WW scores).

The alpha coefficients of internal consistency for the five scales ranged from .64 to .89, with the validity studies of the CDI indicating differences on gender, grade, and program. Further, the factor structure of the CDI supported its construct validity.

Salience Inventory. Career salience, the importance of work to an individual, was assessed by Super and Nevill's Salience Inventory (SI). This inventory includes 170 items divided into three parts: (a) Participation, (b) Commitment, and (c) Value
Expectations. A 4-point scale was used in all three subscales. For the present study, only the Working portion of this inventory was used.

The reliabilities of the three scales are quite high, with alpha coefficients ranging from .80 to .90. In addition, intercorrelations among the scales supported the construct of the inventory and concurrent validities (Super & Nevill, 1986).

Vocational Survey Form. The Vocational Survey Form was used to assess the degree of subject's certainty and satisfaction of vocational preference. Two Likert-type items based on a 5-point scale constitute the questionnaire. The higher the scores are received, the higher are the subject's degrees of certainty about or satisfaction with his or her chosen occupations.

Self-Directed Search. In order to evaluate the accuracy of self-knowledge, vocational interests of the SIGI PLUS group were measured by the Self-Directed Search (SDS) developed by Holland (1985). This instrument measures six interest fields: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C).

Internal consistency reliabilities for the various sections ranged from .67 to .94 for college freshmen. The SDS manual reported moderate predictive validity over 1- and 3-year intervals for the Activity scale, as well as correlation with this and the other scales of the instrument. The Occupations scale differentiated among students and adults with interest or actual employment in different occupations, and correlated with several interest and personality variables. Correlations with the Kuder Preference and the Strong Vocational Interest Blank were as expected (Holland, 1985).

Interest Questionnaire. The Interest Questionnaire provided a basis for evaluating the accuracy of self-knowledge with regard to the subject's interests. Entitled "Estimating your Interests," this questionnaire was modified from Pilato's Interest Questionnaire (Pilato, 1968), in which the subject was asked to rank his or her interests according to Holland's six interest fields. Rank "1" indicates the most preferred field; rank "6" indicates the least preferred.

The code assigned to the first two preferred fields represents the subject's self-estimation of interests. To evaluate the accuracy of self-knowledge regarding interests, for the SIGI PLUS group the self-estimate code was compared with the first two letters of the subject's actual SDS test summary code; for the DISCOVER group the self-estimate code was compared with the Holland summary code of the on-line UNIACT Interest Inventory.

Learning Ability Questionnaire. To provide a basis for assessing the accuracy of self-knowledge of learning ability, the questionnaire, "Estimating Your Learning Ability" (Pilato, 1968), was administered. First the estimated quartile was compared with
the actual quartile from the DRP test. This comparison provided an assessment of the accuracy of self-knowledge regarding learning ability.

Vocational Exploration Behavior Checklist. The Vocational Exploration Behavior checklist (VEBC) was originally developed by Krumboltz and Schroeder (1965) and later modified by Zener and Schnuelle (1972). This inventory was employed in the present study because it includes a wide range of vocational information-seeking behaviors.

Experimental Treatment

DISCOVER (1990-1991 Version). DISCOVER for high school students consists of seven modules. Module 1, Beginning the Career Journey, includes a Career Journey Inventory. After completing the inventory, the student should understand his or her personal level of career development. Module 2, Learning about the World of Work, describes the World-of-Work Map to the students, providing an opportunity for the exploration of occupations or programs according to the student's World-of-Work regions. Module 3, Learning about Yourself, instructs the student to complete inventories which may result in greater understanding of his or her interests, abilities, values, and experiences.

Based on all of these, Module 4, Finding Occupations, assists in pinpointing occupations that merit serious exploration. Module 5, Learning about Occupations, helps the student to explore occupational information and then to narrow preferences to about 10 occupations. Module 6, Making Educational Choices, aids in selecting a path of future occupations. This module also provides educational information related to the student's most preferred occupations. Module 7, Planning Next Steps, helps the student locate information regarding college or military programs and includes sources of financial aid. In addition, this module provides a variety of job-seeking skills (American College Testing Program, 1990).

SIGI PLUS (1990-91 Version). Eight sections comprise SIGI PLUS. Section 1, Self-Assessment, helps the student explore his or her values, interests, and abilities. In section 2, Search, the student creates a list of desired occupations, chooses a college major, and views a list of related occupations. Section 3, Information, provides information concerning the student's preferred occupations. From section 4, Skills, the student learns about skills required in the revealed occupations and rates himself or herself on those skills.

Section 5, Preparing, acquaints the student with paths for preparation in the chosen occupation. Section 6, Coping, helps the student obtain suggestions to prepare in greater detail for the career. From section 7, Deciding, the student is assisted in arriving at a decision from several perspectives. And section 8,
Next Steps, guides the student in focusing on a succession of short-term goals in order to reach his or her career objectives (Educational Testing Service, 1990).

Procedure
In the Spring of 1990, approval was obtained from the New York City Board of Education to conduct this study, followed by agreement from the Principal of a high school which was the site of the study. At the start of the Fall 1990 semester, permission was received from the Chairperson of the high school's Business Education Department, as well as from individual teachers, for the experimenter to select the subjects from nine business classes and one physics class.

Each of the 10 classes was contacted, and an announcement made of the availability for the computer-assisted career guidance systems. Ninety-six students volunteered to use the programs; none had previous experience with the two computer-assisted systems. Subjects under 18 years of age, before participating in the study, were required to obtain parental approval.

Earlier, the test results of all subjects on the Degrees of Reading Power Test (DRP) had been obtained from school records. All 96 subjects were divided into three learning ability levels according to their percentile ranks on the DRP test (low = 6-37, middle = 38-60, high = 61-93). By use of a random numbers table, the subjects were randomly assigned to two experimental groups within their learning ability levels. The two groups were then assigned the treatments at random by the flip of a coin.

The two programs were installed on microcomputers and connected with a printer. Arrangements were made for each student to use the programs according to individual schedules, with the treatments carried out between early October and late November 1990. The subjects were required to use the whole program sequentially and record the modules or sections they employed during each period. They were also instructed to inform the experimenter after completing the entire program.

Immediately on completion of the programs by all subjects, the posttests were conducted, with instructions and administration procedures standardized. The instruments were administered in the following sequence: Career Development Inventory, Salience Inventory, Vocational Survey Form, Interest Questionnaire, and learning Ability Questionnaire. In addition, after finishing the Learning Ability Questionnaire, the SIGI PLUS group took the Self-Directed Search.

Four weeks after subjects completed the programs, a follow-up survey, the Vocational Exploration Behavior Checklist, was administered. During the Posttest period, to secure that all the data were complete, the answer sheets were checked closely by the
experimenter.

Scoring

Accuracy of Self-Knowledge: Interest. Accuracy of self-knowledge of interest was scored according to the degree of agreement between the subject's Holland summary code on the Self-Directed Search (or on-line UNIACT Interest Inventory) and his or her self-estimation on the Interest Questionnaire. In the comparisons, only the first two letters of Holland's summary code on the SDS or UNIACT were used.

Four criteria were chosen to evaluate the degree of agreement. The subject received a score of 4 if the first two letters of his or her summary code on the SDS or UNIACT were the same, and in the same order, as his or her estimated interests. If only the first letter in each code were the same, a score of 3 was gained. If the first two letters of each code were the same but in different order, the subject received a score of 2. If only one letter of each code was the same but in different order, then the subject gained a score of 1.

Accuracy of Self-knowledge: learning Ability. Accuracy of self-knowledge of learning ability was scored in terms of the degree of agreement between the subject's quartile on the Degree of Reading Power Test and his or her self-estimation by quartile on the Learning Ability Questionnaire. Perfect agreement was scored 4; a difference of one quartile between test and self-estimation was scored 3; a difference of two quartiles was scored 2; and a difference of three quartiles was scored 1.

Results

Relationship of Group Treatment and learning Ability to Career Development

The first research question is whether there are any significant interaction effects between group treatment and learning ability level on the following dependent measures: The subjects' career maturity, career salience, certainty of vocational preference, satisfaction of vocational preference, and accuracy of self-knowledge. Responses were measured by the Career Development Inventory, the Salience Inventory, the Vocational Survey Form, the Interest Questionnaire, and the Learning Ability Questionnaire. A 2 x 3 (Treatment x Learning ability level) MANOVA using the Pillai criterion was performed in order to answer this question. Low-to-high intercorrelations (.01 to .74) between the 12 dependent measures supported the use of MANOVA techniques for the analysis.

The multivariate interaction yielded an F(24, 160) value of 1.06, p > .05, ns. Because the multivariate result of interaction was not statistically significant, examination of the
univariate statistics of interaction was unnecessary (Norusis, 1985). Thus, there is no evidence that the effects of the two programs, DISCOVER and SIGI PLUS, depend on subjects' learning ability.

The second research question is whether there are any significant differential effects of treatment on the dependent variables. The multivariate F value reveals no significant main effect of group treatment, $F(12, 79) = .85, P > .05$. That is, the best linear combination of the 12 subscales does not differentiate between the two treatment groups.

Inspection of the means and standard deviations by group treatment in Table 1 shows the following: (a) For the Career Development Inventory, the subjects' mean scores on the five subscales (Career Planning, Career Exploration, Career Decision-making, World-of-Work Information, and Knowledge of Preferred Occupation) in both groups were close to their respective averages when compared to the national norms. (b) For the Salience Inventory, students' mean scores on the subscales of Participation (What you actually do or have done recently), Commitment (How you feel about it), and Value Expectations (Which values you seek or hope to find in the working role) in both groups, divided by number of items, were about "3," signifying "Often" or "Quite a lot." (c) For the degree of certainty of preferred occupation, students' mean scores in both groups were about "4," signifying that after the treatments they were certain about their preferred occupation. (d) For the degree of satisfaction of preferred occupation, students' mean scores in both groups were about "4," indicating they were satisfied with their preferred occupation. (e) For the degree of accuracy of self-knowledge of interest, the mean scores of both groups were above the average. (f) For the degree of accuracy of self-knowledge of ability, the mean scores of both groups were about "3," indicating less than perfect agreement.

The multivariate F value shows a significant main effect of learning ability, $F(24, 160) = 1.99, p < .01$. Although the major interest of this study is in the differences between the two treatments, the significance of the learning ability main effect indicates the appropriateness of the randomized block design used here (Timm, 1975).

The follow-up survey regarding vocational exploratory behavior was analyzed by use of the chi-square test. Two scores yielded from the Vocational Exploration Behavior Checklist are the frequency of the information-seeking behavior and the variety of the information-seeking behavior. The chi-square value in Table 2 indicates there was no significant difference between the two group treatments on the frequency distributions of information-seeking behavior, $X^2(4, N = 96) = 3.21, p > .05$. 
Based on the data in Table 3, no significant difference appeared between the two group treatments on the varieties of information-seeking behavior, $X^2(5, N = 96) = 6.76, p > .05$. Therefore, there is no significant difference between the DISCOVER and SIGI PLUS groups on the vocational exploratory behavior measure. In sum, then, the results show that no significant differential effects were found between the two treatments on students' career development measures.

### Relationship of Group Treatment and Computer Use Time to Career Development

The third research question is whether computer use time influences the effects of the two computer-assisted career systems on the dependent measures. The subjects' computer use time was first divided into three categories: less than 2 hr, 2-3 hr, and more than 3 hr. Then, a 2 x 3 (Treatment x Computer use time) MANOVA using the Pillai criterion was employed to answer this question. The results show that of all the main effects of computer use time and treatment and the interaction of treatment and computer use time, none were statistically significant: $F(24, 160) = 1.33, p > .05$; $F(12, 79) = .82, p > .05$; and $F(24, 160) = .64, p > .05$. These results reveal that the best linear combination of the 12 subscales of career development measures does not differentiate among the three categories of computer use time.

### Discussion

Use of either of the two computer-assisted career guidance systems, DISCOVER and SIGI PLUS, produces similar effects on high school students' career development, regardless of students' different learning ability levels. When previous studies on the comparative effects of computer-assisted career guidance systems are examined, it becomes evident that they cannot be compared equivalently. Because these studies used differing independent and/or dependent variables and employed a variety of methodological approaches, meaningful conclusions cannot be easily reached. Nevertheless, most of the studies have revealed no statistically significant differences among their treatments on the vocation-related behaviors. The present study, having arrived at similar results, is consistent in its conclusions with
these previous studies (e.g., Brownfield, 1987; Harris-Bowlsbey, Rayman, & Bryson, 1976; Garis & Niles, 1990; Glaize, 1983; Nocella, 1985; Peterson, Ryan-Jones, Sampson, Reardon, & Shahnasarian, 1987; Rayman, Bryson, & Harris-bowlsbey, 1978; Shahnasarian, 1986).

However, one rather surprising difference was found. All the mean scores of the five subscales on the Career Development Inventory (Career Planning, Career Exploration, Career Decision-Making, World-of-Work Information, and Knowledge of Preferred Occupation) were approximately at the average level. In spite of any reasonable expectation to the contrary, it seems that the impact of the two computer-assisted career guidance systems was not powerful enough to cause significant change in the students' career maturity.

A possible explanation for this outcome is that the duration of the treatment period was too short to affect the subjects' career maturity in any significant proportion. One might also speculate that the stand-alone approach used with the computer-assisted career guidance system proves less than adequate for all students (Johnston, Buescher, & Heppner, 1988).

No significant positive relationship was found between computer use time and career development measures. Earlier studies, however, did show positive relationships between computer use time and such variables as planning orientation, choice of resources of exploration, and congruence of college and personality. Thus, the conclusion of the present study is inconsistent with those previous ones such as Bauer's (1989) and the study of Myers, Lindeman, Thompson, and Patrick (1975).

Because of their similar thrust, a comparison must be made of the Myers et al. and the present one. Differences between the two may be attributable to several factors. First, Myers et al. used as subjects students from the mainstream ethnic/racial group; in contrast, in the present study all the subjects were drawn from minority groups. Because English is not the first language for most of these subjects, it is highly probable that some of them, such as the Asian students, would need more time to comprehend and use the program than native English-speaking students. In such cases, the minority students' career development measures would be confounded by their language ability. Thus, the amount of time used would not be reflected by increased scores on the dependent measures.

Second, in the Myers et al. study, the interval between the pretest and the posttest spanned an entire school year, but in the present study the interval between treatments and posttest was only 2 months. In addition, the range of use time in the Myers et al. study was higher than the range of use time in this study. Thus, it may be concluded from such a discrepancy that the use time in the present study was not extensive enough to
effect a significant change. Finally, the sample sizes of the
two studies were extremely different. Myers et al. used a large
sample size (N = 792), but the sample size of this study totalled
only 96.

In summary, the results of this study would indicate that
both systems tested, DISCOVER and SIGI PLUS, are appropriate for
counselors to utilize in assisting students with many aspects of
their career development. Furthermore, both systems can be used
for students of different learning ability levels because the
effects of the systems will be virtually the same.

Considering the normally demanding schedules of most high
school students, a particularly effective method of enabling them
to use the computer-assisted systems is to arrange implementation
as part of the students' curriculum within related courses or
guidance activity classes. If schools possess computers with
networking capabilities, all students in a given class would then
have the opportunity to use the network version of the career
guidance system, completely under the counselor's supervision.

Further, limitations of the present study must be noted and
considered in future research. Future research might include
studies utilizing subjects with demographic characteristics
different from those in the present study. In order to enhance
understanding of the effects of computer-assisted career guidance
systems, further study should also utilize a nontreatment control
group to compare the effects of different systems between
treatment groups and a nontreatment group.

In addition, the influence of personal internal attributes,
such as decision-making style, motivation, and decidedness,
should be accounted for or even emphasized in future studies.
Such studies would yield valuable additional information and
provide evidences of applicability of the systems to a wider
range and variety of clients than previously assumed.

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