Empirical Examination of an Online Version of the Self-Directed Search

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The study examined the quality and utility of online administration of the Self-Directed Search (SDS) to high school students in a career exploration workshop. An Internet-based SDS version was designed; it included automatic scoring and immediate feedback to test takers, providing a three-letter occupational code along with verbal explanation of the results. SDS was taken by participants in their homes or in school (n = 77), and compared to traditional administration of the SDS (n = 73), either self-scored or counselor scored. The mean internal consistency coefficient for the SDS was .90, and mean test-retest reliability (over a 6-week period) was .94. Mean correlation between the same SDS scales of participants who took both versions was .77. For this latter group, the Realistic, Social, and Enterprising scales were found to be higher in the online administration than in the paper-and-pencil administration, whereas the three other scales were not statistically different. Similar to the traditional version and consistent with previous research, the online version produced the configuration of a RIASEC-order hexagon. Participants who took the online version were more satisfied with it than those who took the paper-and-pencil version. These results highly support the further use of the online version of the SDS.

Keywords: Internet, online, testing, Self-Directed Search, career

Recent technological developments, along with a changing culture, have introduced new, even revolutionary means to promote career psychology. These emerging changes have created positive opportunities and prospects, as well as risks and threats for this field (Lent, 2001) and for other areas of psychology (Barak, 1999). For instance, Internet-based career resources could provide an excellent remote service to customers, on one hand, but might also create opportunities for nonprofessional imposters. Apart from this debate, however, technological innovations seem to enable career psychologists to improve their professional conduct in a number of ways, including testing and assessment (Chartrand & Walsh, 2001; Oliver & Zack, 1999; Prince, Chartrand, & Silver, 2000), supply

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and use of career information (Offer & Sampson, 1999; Robinson, Meyer, Prince, McLean, & Low, 2000), and provision of new methods of career counseling (Boer, 2001; Clark, Horan, Tompkins-Bjorkman, Kovalski, & Hackett, 2000; Kirk, 2000; Kovalsky & Horan, 1999; Sampson, 1999).

Career assessment consists of multiple sources and means, the purpose of which is to obtain vocational-relevant information on people. The Internet, as a limitless, efficient communication network, can be exploited for various needs and functions related to career assessment. For instance, interviewing over the Internet is possible and seems to be promising (Yoshino et al. 2001), as is preliminary screening questionnaires on the Internet (Coffee, Pearce, & Nishimura, 1999). To date, however, the major assessment-related application on the Internet has to do with Internet-based testing. The advantages of this procedure are many: increased standardization of test administration, elevated precision of test scoring, easy to design and modify tests, quick provision of feedback to test takers, efficient control of updated test versions and norms, effective collection of group data, and more. On the other hand, its limitations should not be undervalued: necessity for special expertise by professionals, cost of investment in the new method, special hardware and software costs, complicated issues relating to copyrights, difficulties in monitoring remote test takers, intervening effects of computer savvy or computer anxiety, and more (for a more complete review of this aspect, see Barak & English, 2002; Buchanan, 2001; Epstein & Klinkenberg, 2001; Sampson, 2000; Wall, 2000). Various career psychology experts (e.g., Tinsley, 2000), however, view Internet-aided career assessment as the method of the future, and therefore they encourage the appropriate training of career professionals.

Although using the Internet for personnel selection presents a special challenge for testing and assessment, it seems that its use for personal career counseling and career exploration, with or without face-to-face sessions, is very promising. In contrast to personnel selection—in which the motivation for cheating is obvious—test takers in personal counseling have less (or no) motivation to impersonate or cheat. Career counseling clients may thus take tests at their own convenience, be administered tests that are applicable and compatible to their personal needs and skill level, take advantage of immediate written feedback, and derive other special benefits stemming from the new method (Barak & English, 2002; Krumboltz & Vidalakis, 2000; Sampson, 1999, 2000). Various techniques and approaches are available, from having clients take the test at their homes, or anywhere else, to taking tests at a counseling agency right before or after a face-to-face session to incorporate test taking into the counseling session itself. The "Penta-A engine," consisting of accessibility, affordability, perceived anonymity, acceptability, and aloneness (Barak & Fisher, 2002), together with other Internet-unique characteristics (e.g., invisibility, easy escape, neutralizing of status), influences clients' Internet behavior in the direction of more openness and genuineness, thereby contributing to more valid test results (see also Joinson, 1998, 1999, 2001; Suler, 2001). Quite a few authors, after reviewing the growing research in

this area, have recommended the amalgamation of online testing with other assessment procedures to produce more comprehensive, valid client evaluations (cf. Buchanan, 2001). Recently, several Web sites have begun to offer professional, rather than popular, online testing services, among them Career Harmony (http://www.careerharmony.com/chweb) and Mariner7 (http://mariner7.com/m7home/home.asp).

Although the advantages of online assessment in the context of career counseling and career exploration seem clear, very little has been published on actual attempts to implement such a procedure. For example, Gati and Saka (2001) reported on the use of a Web-based tool for assessing the decision-making difficulties of university candidates. In another example, Volcani (2000) reported on adopting Internet-based apperception tests into clinical procedures. Kelly and Jugovic (2001) showed how the Keirsey Temperament Sorter II, an online personality inventory based on the Myers-Briggs Type Indicator, presented findings that supported the use of this instrument in the context of career counseling. The findings and conclusions of all these authors were consistent in regard to the positive prospects of implementing online psychological assessment devices in relevant counseling interventions.

Holland's (1997) theory and approach to career counseling is one of the most dominant and widespread (Swanson & Gore, 2000). Unlike many other approaches, Holland's model puts assessment and assessment devices in the center of its procedures and makes special use of them (Carless, 1999; Reardon & Lenz, 1999). In doing so, a career counselor facilitates better comprehension of clients' personal career theory (PCT), a concept relating to a person's collection of cognitions that act as guides in the pursuit of career choice and development. Among other instruments, and prominent in the construct of PCT and its subfactors, is the Self-Directed Search (SDS), an instrument developed by Holland (1994; Holland, Powell, & Fritzsche, 1994) that aims at assessing clients' career-related personality. Using the RIASEC typology, which is assumed to be directly related to PCT in terms of a person's achievements, life history, beliefs, and aspirations, the SDS provides a means of identifying clients' personality type and career interests. The SDS also has been widely used in the context of career exploration for adolescents as part of a career development intervention (e.g., Herring, 1998). An online version of the SDS is available by its publisher and may be taken by Web surfers in return for payment (http://www.self-directed-search.com). Other online versions, similar to the SDS and based on Holland's typology, are also available, usually free of charge (e.g., The Career Key, http://www.cgibin.ncsu.edu/cep-bin/ckbin/ck.pl).

The combination of online interactive testing and the use of the SDS in the framework of career exploration workshops for high school students is attractive, as it opens the door for elasticity (i.e., flexibility) in terms of the time and place of some of the activities included in such an intervention. Moreover, as interactive-computer and Internet-based activities have been found to appeal to users (cf. Sudweeks, McLaughlin, & Rafaeli, 1998), career exploration in school might be made

more engaging and pleasing, thus more stimulating for participants. The purpose of this research was to examine the possibility of integrating an online version of SDS in career exploration workshops administered to high school students. The examination of this procedure was conducted by referring both to the instrument's measurement quality and to criteria relating to its utility and to the users' satisfaction.

METHOD

Participants

Participants were 150 ninth-grade students who studied in a regional comprehensive middle school in an Israeli rural town. They were divided into four groups, which were administered the research instruments differently to allow testing the research hypotheses. There was an even number of boys and girls in each group, and gender was not treated as a variable. Some participants dropped out of the study because of language difficulties, or they had no interest in taking the SDS, or they did not show up for the second administration of the SDS (for which test-retest reliability was examined).

Instruments

SDS, paper-and-pencil version (Holland, Fritzsche, & Powell, 1994). The SDS is a broadly used, extensively investigated measure of career interests as reflected by the personality types of its respondents. The inventory includes four sections (Activities, Competencies, Occupations, and Self-Ratings); each contains items that represent six personality types: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). The total score for each type (in a range from 0 to 50) reflects the degree to which a respondent resembles the respective prototype personality. A final code, usually made up of the three highest types and ordered by magnitude, is commonly the practical career assessment output of the SDS as related to the respondent's recommended career paths. The reliability and validity of the SDS have been studied continuously and thoroughly and generally have been very highly supported. The SDS was translated into Hebrew and adapted for use in the Israeli culture. Numerous studies have provided findings that support the reliability and validity of the Hebrew version, with measurements similar to the original ones (Meir, Hadas, & Noyfeld, 1997; Meir & Hasson, 1982; Meir, Keinan, & Segal, 1986; Meir & Segal-Halevi, 2001; Meir & Tzadok, 2000).

SDS, online version. The online version of the SDS was constructed on an independent Web site, which was published on the Internet, enabling partici-

pants to access it from anywhere at anytime. The site was built in a combination of several formats, including HTML, cgi-pearl, and Java scripts. The online questionnaire actually duplicated the paper-and-pencil version but included the following special features: (a) Instructions were partially modified to fit the electronic version and guide respondents on how to mark their responses online and so on; (b) items were followed by yes/no (1 to 7 for the Self-Ratings sections) buttons that respondents had to click instead of marking boxes; (c) on completion, respondents clicked a "send" button. A built-in procedure in the software made sending the questionnaire impossible unless all items were marked. After a respondent's filled-out questionnaire had been sent, server-based software calculated the scores for all scales (types) and came up with the code. Then, after a few seconds, the respondent received a personal message on the computer screen. The message contained a standard explanation of the nature of the results, the respondent's three-letter code, and an explanation of this code. The explanation referred to the dominant type and its combination with the two other types in relation to the respondent's personality characteristics and interests, as well as recommended career directions.

Satisfaction Questionnaire. This questionnaire was constructed for the purpose of the present study. The Satisfaction Questionnaire had two identical versions: paper-and-pencil and online. The two versions were administered according to the mode by which the respondents took the SDS. The questionnaire had 17 Likert-type items, each response ranging from 1 (*very little*) to 5 (*very much*). For example, "To what degree have you found this format of the SDS interesting?" "To what extent are you satisfied with the way the results of the SDS were provided to you?" "To what degree has the SDS provided new information to you in regard to your vocational interests?" Several items were reversed to reduce effects of response set. Furthermore, respondents were given the opportunity to write personal comments in an open space at the end of the Satisfaction Questionnaire. The total score ranged from 17 (*very little satisfaction*) to 85 (*very high satisfaction*).

Procedure

The SDS and the current study were introduced in the framework of a career exploration workshop for high school students. In addition to the SDS, students took several other tests, mainly pertaining to their abilities, and participated in career-related class discussions. Participants of the study were randomly assigned to four groups: (a) were administered the paper-and-pencil version of the SDS in classrooms, received personal face-to-face feedback by a counselor approximately 1 week later, and took the online version of the SDS 6 weeks later ($n = 31$); (b) were administered the paper-and-pencil version of the SDS in classrooms, scored it by themselves according detailed instructions and, accordingly, found the

meaning of their personal profiles in a booklet prepared for them, and 6 weeks later took the online version of the SDS (n = 42); (c) took the online version of the SDS twice, 6 weeks apart, both times in the school's computer lab (n = 46); (d) took the online version of the SDS using their home computers at a time of their own choosing (n = 31). The last four digits of participants' phone numbers identified those who took the SDS twice.

Standard personal computers, mostly Pentium II or III with 15-inch color monitors, were used to take the SDS online. Internet connection speed varied from 56k to Asymmetric Digital Subscriber Line, but this variability did not seem to affect significantly the results of the research. All students who took the online version of the SDS underwent basic training in Internet browsing prior to the study.

RESULTS

Reliability

Internal consistency of the online SDS scales. The questionnaires of the 77 participants who took the online version of the SDS and the 73 who took the paper-and-pencil version were used to compute Cronbach alpha internal consistency coefficients of the SDS scales and their subscales. Of those who took the online version twice, only the first administration of the questionnaire was used in this analysis. The results are presented in Table 1. As can be seen, alpha coefficients of the online and the paper-and-pencil versions are very similar, yielding a mean alpha coefficient of .90 for both versions. Furthermore, the internal consistency coefficients of both the online version and the paper-and-pencil version are all higher than .85; that is, they are in the satisfactory range for vocational assessment. It should also be noted that the findings reported in Table 1 resemble the internal consistency coefficients reported by Holland, Powell, et al. (1994).

Test-retest reliability of the online SDS scales. The stability of the scores of the online version of the SDS was examined by using the questionnaires of the participants who completed this questionnaire twice, 6 weeks apart. Table 2 reports these results. All scales' reliability coefficients are very high, average .94, and certainly support the use of the online version of the SDS. It should be noted that the coefficients reported in Table 2 are generally higher than the test-retest correlations reported by Holland, Powell, et al. (1994) for a similar age group and a similar time interval between test administrations. In testing the differences in the personal scores of the six scales between the two administrations of the questionnaire, it was found that none of the scores changed significantly.

Correspondence between paper-and-pencil and online versions of the SDS scales. To examine the correspondence between the paper-and-pencil SDS

Table 1
Cronbach Alpha Coefficients for Self-Directed Search (SDS) Scales and Subscales by Mode of Administration

	SDS Subscale							
	Activities		Competencies		Occupations		Total	
SDS Scale	Online	P&P	Online	P&P	Online	P&P	Online	P&P
Realistic	72	69	66	76	82	72	88	86
Investigative	72	75	69	68	90	83	89	88
Artistic	73	80	81	83	90	87	90	93
Social	77	77	80	78	86	88	87	92
Enterprising	77	73	80	78	88	81	92	87
Conventional	84	80	83	74	89	84	92	89

Note. Decimals omitted. P&P = paper and pencil. Online n = 77; P&P n = 73.

Table 2
Test-Retest Reliability Coefficients of the Online Version of the Self-Directed Search (SDS) by Scale

	SDS Subscale			
SDS Scale	Activities	Competencies	Occupations	Total
Realistic	74	82	89	93
Investigative	84	93	86	95
Artistic	86	92	91	96
Social	87	75	90	94
Enterprising	89	76	85	90
Conventional	83	62	97	95

Note. Decimals omitted. n = 15.

results and the online SDS results for the participants who completed the two versions, correlations were conducted between corresponding scales, as were comparisons of the profiles that emerged. Table 3 shows the Pearson correlations between the two versions for each SDS scale and subscale. As can be observed in the table, most correlations are high; the total SDS type scales are close to the internal consistency coefficients reported in Table 1. It should be noted, however, that the results received by participants after the first SDS administration (paper-and-pencil version) might have affected their responses on the second administration (online version), whether by increasing or decreasing their scores in any given scale. However, the nature of the findings is very supportive of the personal results obtained by the two SDS versions.

Table 3
Correlations Between Paper-and-Pencil and Online Versions of Self-Directed Search (SDS) Scales and Subscales

	SDS Subscale			
SDS Scale	Activities	Competencies	Occupations	Total
Realistic	66	70	69	84
Investigative	76	50	77	79
Artistic	35	74	72	80
Social	23	74	48	67
Enterprising	74	55	47	77
Conventional	60	55	41	68

Note. Decimals omitted. $n = 73$.

In addition to the correlational analysis, comparisons were made of the magnitude of the means of the SDS. Table 4 presents the results of these comparisons. As may be seen, the means of all SDS type scales are higher in the online-version administration than in the paper-and-pencil-version administration. The *t* tests for dependent samples revealed that only three of these differences were statistically significant: Realistic, Social, and Enterprising. As a whole, however, the elevated profile of the Internet-based questionnaire is clear when compared to the standard questionnaire (random probability of occurrence of $0.5^6 = 0.0156$).

In addition to the foregoing analyses, a tally was made of the number of participants who were administered the two SDS versions and came up with a similar occupational code as it emerged from the two versions. It was found that 59 (80.8%) of the participants had the same first-letter type, 38 (52.1%) had the same first two-letter code, and 31 (42.5%) had identical three-letter personality codes in both modes of administration. Taking into account the fact that the position of a letter or a personality-type code might change with the difference of a single point on any SDS scale, these frequencies are quite impressive.

Content validity. Examination of the validity of any measure of interests or of personality characteristics is a very complicated mission. Validating the online version of the SDS as such might take a very long time and require numerous criterion variables and samples. However, as the online version has been found to be sufficiently reliable and highly correlated with the paper-and-pencil version, it would be fair to examine—at least at an early stage—some aspect relating to validity. Thus, the internal structure of the online version of the SDS was examined to test Holland's (1997) hexagonal model of the structure of the six personality types, which many have replicated (Ones & Brown, 2001). The intercorrelations among the SDS scales of the 77 participants who were administered the online version were entered into the Alternating Least Squares Scaling proce-

Table 4
Means and Standard Deviations of Self-Directed Search (SDS) Scales by Mode of Administration

SDS Scale	Mode		
	Paper and Pencil	Online	*t*
Realistic			
M	21.82	23.29	–2.35*
SD	9.22	10.06	
Investigative			
M	21.37	21.95	–0.84
SD	8.89	9.07	
Artistic			
M	25.15	26.62	–1.68
SD	11.91	11.82	
Social			
M	29.34	31.51	–2.29*
SD	9.99	9.81	
Enterprising			
M	24.47	27.63	–3.91**
SD	9.04	10.63	
Conventional			
M	22.89	24.05	–1.20
SD	9.42	11.04	

Note. $n = 73$.
*$p < .05$. **$p < .01$.

dure of the SPSS, and a two-dimensional structure was found sufficient (stress = 0.01; RSQ = 0.99). A hexagon- shaped structure emerged. The types were indeed found to deploy in a circular arrangement in the RIASEC order as predicted by the model and consistent with numerous previous investigations. In a separate configural analysis for the 73 participants who took the traditional SDS version, incidentally, an almost identical hexagonal RIASEC structure was found.

Participants' satisfaction. The participants who took the SDS in different modes were compared by means of the Satisfaction Questionnaire. Four different group modes were compared: participants who took the paper-and-pencil version of the SDS and used self-scoring ($n = 42$); participants who took the paper-and-pencil version of the SDS, which was later scored by the counselor ($n = 31$); participants who took the online version of the SDS in the school's computer lab ($n = 46$); and participants who took the online version of the SDS at home ($n = 31$). One-way analysis of variance revealed significant differences among the

groups, $F(3, 146) = 8.21$; $p < .01$. Post hoc comparisons found that the paper-and-pencil version (either self-scored or counselor scored) of the SDS was less preferred than the online version, whether taken at school or at home. As a whole, a comparison between the two groups of participants who took the online version ($M = 64.59$, $SD = 6.70$) and the two groups that took the paper-and-pencil version ($M = 57.67$, $SD = 9.45$) showed that the former were more satisfied, $t(148) = 6.46$, $p < .01$.

DISCUSSION

The current study investigated several parameters involved in the use of an online version of SDS in the framework of career exploration workshops conducted for high school students. This examination was necessary to establish fundamental grounds for this application in the context of actual use with clients, in contrast to online tests, which might be considered just for fun and amusement. Two basic requirements of the online version—psychometric value and user satisfaction—were examined, in comparison to the standard paper-and-pencil version. In addition to these data, informal reports and responses by test takers and counselors were collected.

The results of the study clearly showed that the online version of the SDS successfully survived the empirical examinations. The findings revealed much support for the online version in terms of its reliability of measurement and content validity, as well as the degree of satisfaction expressed by its users, in comparison with participants who took the paper-and-pencil version. In addition, it became clear through informal interviews conducted with both test takers and counselors, and through freely written comments in the Satisfaction Questionnaire, that the online version produced much enthusiasm among both students and counselors. The students who took the online version—either in school or in their homes—were very thankful for the automatic scoring system, the relative flexibility in time and place of testing, and the immediate feedback. The counselors, in addition to these advantages, mentioned savings in labor time, enhanced accuracy in scoring a large number of questionnaires, the automatic detection of questionnaires wrongly or not fully filled out, and the automatic logging system that saved students' scores in preestablished data sheets. These impressions reflected the commonly accepted advantages of online-testing procedures (Barak & English, 2002; Epstein, & Klinkenberg, 2001; Sampson, 2000).

One particular finding worth further attention was the elevated SDS profile of the online version. Although only three of the six means of individual scales were found to be significantly different from the corresponding means of the paper-and-pencil version, the whole online profile was higher than the traditional test-based profile. The data from our study cannot reveal the reason for this trend, but the effect of online behavior in general, which is characterized by reduced inhibitions, may account for it. Another suggested explanation, however, is that

responding to online questionnaires elicits less commitment. Further research is required to look into this important issue, which has direct implications for the validity of online assessment.

An additional and advanced phase of the procedure that can be used in collaboration with online assessment but that was not applied in the current project is the linking of individual results (i.e., SDS personal profile) to online occupational information databases. In this way, career exploration could be much enriched by associating personal assessment, on one hand, with the world of work, on the other, in terms of possible occupational opportunities and relevant education and training. Rich, reliable occupational information resources available on the Internet (e.g., O*Net, at http://online.onetcenter.org) can easily be used for this career exploration experience (McDaniel & Snell, 1999). As argued by Robinson et al. (2000) and Sampson (1999), online assessment of interests can integrate with more complex, Internet-based career information guides to enable the obvious and necessary link between personal assessment and actual career-related information. A client will not then be left with test results alone but will have immediate access to possible direct implementations.

Despite the overall positive results, we have detected several problems and difficulties that should be addressed. First, computers and communication networks typically do not operate without failures. Test takers encountered various problems, from an abrupt cutoff while undertaking the assessment procedure (related to ISP service, local power failure, personal computer hardware or software problem, or server problem) to lack of browser compatibility. Second, several of the participants experienced difficulty in understanding the test instructions or specific SDS items because of language limitations. In the context of online testing, this difficulty is more complicated to solve than in a face-to-face situation (when an examiner is present). Third, especially in a school environment, the segregation of students into groups of those who took the SDS through its online version and those who took it through the traditional paper-and-pencil version leads to feelings of personal inconvenience. Although school computer labs were open to all students, some felt deprived by not having the opportunity to take the SDS in their homes. This last point is related to the more general problem of digital divide (e.g., Norris, 2001); computer and Internet self-efficacy (Eastin & LaRose, 2000) might pose a significant barrier to the implementation of online assessment.

In addition, several ethical concerns should be pointed out. Although the SDS results were used in the current project for the purpose of career exploration, one should bear in mind the problem of test security in relation to the unfair use of test results. It is widely known that security, privacy, and confidentiality are common problems on the Internet; they present special problems for test takers who expose personal and highly private information. Although many professional firms take measures to protect test takers, this problem remains a severe limitation of online assessment. Another difficulty relates to the lack of close human contact in the online environment, which might discourage some test takers and

even prevent people from engaging in online assessment. This is especially relevant when test results are disappointing or ambiguous, or they have negatively perceived personal implications (Barak & English, 2002; Wall, 2000).

Nevertheless, the rapid emergence of Internet-related activities in the education system, as well as its entrance into many homes, should minimize some of these concerns. In addition, technological breakthroughs in hardware and software, as well as newly developed communication protocols and standards, also address some of the problems mentioned. Professionals, however, must realize that despite the great advantages made possible by new technologies that could promote highly advanced counseling-related interventions, they are dealing with human clients, for whom a personal touch might mean much more than any sophisticated device. Based on our research and other accumulated experiences, we advocate the implementation of online assessment, at least in the context of career exploration. We believe, however, that a counselor's personal involvement is necessary to foster a client's career development.

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