
Validity of Holland's Model: A Confirmatory Factor Analysis

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Abstract

Confirmatory factor analysis was used to investigate the validity of Holland's model for a sample of 155 Canadian high school students. The analysis revealed that Holland's model was quite appropriate in explaining the relationships among six personality types: Realistic, Investigative, Artistic, Social, Enterprising and Conventional across the areas of Activities, Competencies, Occupations and Self-Estimates in the Self-Directed Search.

Résumé

Conformément à l'analyse factorielle, on a examiné du modèle de Holland pour un échantillon de 155 étudiants canadiens au secondaire. L'analyse a révélé que le modèle de Holland était très approprié pour expliquer les rapports entre les six types suivants: réaliste, investigateur, artiste, sociable, innovateur et conservateur, et ce, à travers les champs d'activités, de compétences, d'occupations, et d'auto-évaluations dans la recherche autoguidée.

INTRODUCTION

At a time when vocational guidance and career counselling are rapidly becoming legitimate and essential activities of educational institutions, it is necessary to examine the theories which guide these practices. A major influence on these activities has been the work of Holland (1973, 1985a), who developed a theory of vocational personalities and work environments. He developed two instruments, namely, the Vocational Preference Inventory and the Self-Directed Search to operationalize his model. Holland's work has been so significant that even the most widely used interest inventory in the United States, the Strong Vocational Interest Inventory, now includes Holland's codes as a basis for score interpretation. The fact that the interpretation of Self-Directed Search (SDS) scores is also linked to the CCDO (Canadian Classification and Dictionary of Occupations) codes, makes it an especially attractive inventory for use with high school students in Canada. Whereas Holland's theory has stimulated a great deal of research and has provided empirical support for its main concepts, only a limited number of validity studies have been done outside the United States. Since the Canadian edition of SDS is frequently used by counsellors in Canadian schools and it has been revised (Holland, 1986), it is essential to investigate its validity.

Earlier work on the development of Holland's theory involved the use of the Vocational Preference Inventory. Research in recent years has made much greater use of the Self-Directed Search. As a measure of personal and vocational orientations, SDS not only serves as a suitable tool for research on Holland's model, but also has a special appeal for counsellors because of its practical features, including the ease of administration, scoring and interpretation. Unlike many other measures of vocational interests, the SDS is based on a theory and each of its various sections is organized according to the six types of Holland's model.

According to Holland's theory (1985a), most people can be categorized as one of six personality types: Realistic, Investigative, Artistic, Social, Enterprising and Conventional. The environments in which people typically function can also be characterized in terms of the above types. The theory further stipulates that people seek environments that will encourage the use of their skills and abilities, allow them to express their attitudes and values, and assume agreeable roles. Thus Realistic types are attracted to Realistic environments, Social types seek Social environments, and so on. It is also assumed that behaviour is determined by an interaction between personality and environment.

It appears that only three studies of the factorial structure of the SDS have been done outside the United States. In a study of 1206 professional accountants in Canada, Rachman, Amernic and Aranya (1981), factor analyzed the items in each section and the total inventory. The analyses confirmed that the SDS measured six factors, thus supporting Holland's hexagonal model. The results, however, showed that the Enterprising and Social types were combined to produce a single factor, the sixth factor being a general factor for the Occupations section. The other study involved a sample of 499 high school students enrolled in state schools in New Zealand (Tuck & Keeling, 1980). By analyzing scores on an adaptation of the SDS, the researchers hoped to identify six orthogonal factors consistent with Holland's six personality types. The factorial structure of the SDS was somewhat at variance with Holland's scheme and showed some interesting gender differences. While the Social and Enterprising scales could not be split into two distinct factors in either male or female samples, the Investigative and Realistic scales produced only a single factor for the females. The factor analysis for females confirmed only two of six types, Artistic and Conventional. Overall, Tuck and Keeling concluded that "some questions have been raised about the construct validity of the SDS, but its factorial structure, and the structural relationships among the six types, have proved to be remarkably consistent across samples and countries" (p. 113).

The foregoing studies provided partial support for the structural validity of the SDS. Exploratory factor analytic techniques have been used in the above studies which do not require the specification of a model to be

tested. As Holland's model of six personality types is grounded in theory, it would be more appropriate to specify and test the structural model. Following this approach, Khan and Alvi (in press) tested the validity of the model for a sample of 243 males and 133 females in Pakistan. The model fitted the data for the males but only partially for the females.

The purpose of the present study was to investigate the structure of the revised Canadian edition of the SDS by specifying the model according to Holland's typology, to evaluate the fit of the prespecified model to the data, and to examine the validity of the concept of calculus (Holland, 1985a).

METHODOLOGY

Sample

The sample of this study included grade 12 students from six schools in a large school board in Ontario. The six schools were mid to large size schools located in a suburban community near Toronto. One hundred and fifty-five students (65 males and 95 females) participated in the study. These students regularly participated in career counselling activities including field trips, cooperative work-study programs, career days, and regular guidance classes. The students ranged in age from 17 to 19 years and came from homes with average to above average socioeconomic status.

Instrument

The SDS booklet consists of four sections: (i) Activities, (ii) Competencies, (iii) Occupations, and (iv) Self-Estimates. First published in 1971, the instrument underwent changes in 1977 (Holland, 1977) and 1985 (Holland, 1986). There are six scales in each section of the booklet according to the following types: Realistic, Investigative, Artistic, Social, Enterprising and Conventional, based on a total number of 228 items.

Each section of the booklet is divided into six areas, according to the types suggested by Holland, resulting in thirty subscores and six overall summary scores. The three highest summary scores become the three-letter summary code for each person. Thus, for example, an ASI summary code means that the most dominant orientation of the individual is Artistic, followed by Social and Investigative. A CRE code, on the other hand, signifies that the individual is Conventional, Realistic and Enterprising in that order.

Holland (1985a) reports internal consistency (KR 20) reliabilities ranging from .67 to .94 for a sample of college men and women. Test-retest reliabilities of the six summary scales for high school students over a period of three to four weeks range from .31 to .87 for boys and .44 to

TABLE 1

Unweighted Least Squares Estimates for the Total Sample (n = 155)

Categories/Scales	Latent Variables						R ²
	1	2	3	4	5	6	
Activities							
Realistic	.84						.702
Investigative		.80					.633
Artistic			.81				.656
Social				.70			.493
Enterprising					.58		.339
Conventional						.57	.325
Competencies							
Realistic	.82						.672
Investigative		.73					.538
Artistic			.89				.788
Social				.76			.574
Enterprising					.75		.564
Conventional						.60	.579
Occupations							
Realistic	.80						.632
Investigative		.72					.513
Artistic			.74				.551
Social				.65			.417
Enterprising					.69		.473
Conventional						.60	.363
Self Estimates-1							
Realistic	.85						.721
Investigative		.90					.807
Artistic			.73				.538
Social				.66			.442
Enterprising					.78		.614
Conventional						.65	.427
Self Estimates-2							
Realistic	.47						.221
Investigative		.43					.181
Artistic			.58				.337
Social				.76			.572
Enterprising					.73		.526
Conventional						.73	.535

Total Coefficient of Determination for Observed Variables = .994
 Goodness of Fit Index = .909
 Adjusted Goodness of Fit Index = .892
 Root Mean Square Residual = .092

TABLE 2

Intercorrelations Among the Factors

	R	I	A	S	E	C
Realistic (R)	1.00	.42	.18	-.39	.06	-.14
Investigative (I)		1.00	.24	-.07	.06	-.06
Artistic (A)			1.00	.39	.26	-.16
Social (S)				1.00	.46	-.01
Enterprising (E)					1.00	.48
Conventional (C)						1.00

.78 for girls. Such reliability coefficients range from .60 to .84 for college students over a seven- to ten-month period.

Data Analysis

The data were analyzed using LISREL (Jöreskog & Sörbom, 1986). LISREL analyzes linear structural relationships among observed variables using various estimating techniques. As Holland has proposed a specific structure, it was of greater interest to test the validity of the structure than to subject the correlation matrix to principal components analysis. Since almost all previous studies on the SDS have used exploratory factor analysis to examine the structure of the SDS, the present study represents a departure from previous practice. A table listing the related factor loadings and eigenvalues is available from the authors.

In order to perform confirmatory factor analysis, a pattern matrix reflecting the model to be fitted is provided. This pattern matrix contains 1s and 0s, indicating free and fixed parameters. In the present case, the unweighted least square technique was used to fit the model, given as a pattern matrix, to the data. In addition, the correlations among the factors were regarded as free and to be estimated. The fit was evaluated in terms of various indices of the goodness of fit provided as part of the analysis.

RESULTS

Table 1 includes the unweighted least squares estimates for the 30 scales scores. The model fits the data adequately. Holland's six types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional have loadings on corresponding factors across the areas of Activities, Competencies, Occupations, and Self-Estimates. Except for Self Estimates-2, all Realistic scores have loadings in the range of .80s on a "Realistic" factor. Similarly, the loadings of .43 in Self-Estimates-2 is somewhat smaller compared to the loadings of the Investigative scale across the other areas; the loadings range from .72 to .90. The pattern is the same for the Artistic factor. The loadings in Self-Estimates-2 for the remaining three factors, namely, Social, Enterprising, and Conventional improve substantially being .76, .73 and .73 respectively. Except for Enterprising and Conventional under Activities, the rest of the scales have sufficiently large loadings on the corresponding factors: Social, Enterprising and Conventional.

The last column in the table includes squared multiple correlations for the observed variables. This index is interpreted as a reliability of the observed variable for the measurement of the latent variable (factor). These correlations range from .181 (Investigative under Self-Estimates-2) to .807 (Investigative under Self-Estimates-1). The total coefficient of determination, .994, is an index of the reliability of the observed variables jointly as a measure of the latent variables jointly.

The two goodness of fit indices (adjusted for degrees of freedom and unadjusted) are measures of the relative amount of variances and covariances jointly accounted for by the model. For a good fit of the model to the data, these should be close to 1. In the present case, they are .892 (adjusted) and .909 (unadjusted). Another measure of the goodness of fit is the root mean square residual. This is a measure of the average of the residual variances and covariances after the model has been fitted. For a good fit, this index should be close to zero. In the present case, the root mean square residual is .092.

Factor intercorrelations are given in Table 2. Overall, the intercorrelations indicate that SDS measures six distinct dimensions. Generally, SDS types which are closer to each other on the hexagonal model tend to have higher intercorrelations than types which are farther apart. Intercorrelations for types adjacent to each other range from .24 (Investigative-Artistic) to .48 (Enterprising-Conventional). The magnitude of the intercorrelations for adjacent and non-adjacent types provide evidence of the validity of the concept of calculus.

DISCUSSION

The purpose of this study was to investigate the validity of Holland's model represented by the most recent Canadian edition of the Self-

Directed Search. Holland's model fitted the data for the 155 grade 12 students. Various indices of the fit of the model to the data indicated that Holland's model as operationalized by the Self-Directed Search adequately explained the relationships among each personality type across the areas of activities, competencies, occupations, and self-estimates.

Some positive evidence was obtained in this study for the concept of calculus (Holland, 1985a) which states that "the relationships within and between types or environments can be ordered according to a hexagonal model in which the distances between the types or environments are inversely proportional to the theoretical relationships between them." (p.5). The intercorrelations among the types were generally similar to those reported by Holland (1985b) pointing to the validity of the hexagonal model.

When compared with the factor analyses of SDS in other countries such as New Zealand (Tuck & Keeling, 1980) and Pakistan (Khan & Alvi, in press), the findings of this study reveal a clearer structure of vocational orientations, consistent with Holland's theory. This of course may be in part due to the closer affinity of the American culture with the Canadian than with the New Zealand and Pakistani cultures.

It would have been interesting to analyze the data separately for females and males to determine if the fit would have been similarly adequate as it was for the combined sample. However, due to the small size of the sample, this was not possible in the present study. It is recommended that future research examine this issue by analyzing data separately for females and males. A logical extension of this will be studying the validity of Holland's model for subpopulations such as college students, professional groups, and blue-collar workers.

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