European Journal of Psychological Assessment, Vol. 11, Issue 2, pp. 98–107

A Factor Analysis of the Social Problem-Solving Inventory using Polychoric Correlations

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Keywords: interpersonal, everyday problem solving, coping.

The Social Problem-Solving Inventory (SPSI; D'Zurilla & Nezu, 1990) is a theory-driven instrument that was designed to measure two major hypothesized components of the social problem-solving process: (1) problem orientation and (2) problem-solving proper. In the present study, factor analyses using polychoric correlations were performed on the total item pool of the SPSI and its two major scales and seven subscales to examine the construct validity of the theoretical model underlying this inventory. The results indicate that the SPSI is actually measuring two different kinds of problem orientation (positive and negative) and three different problem-solving styles (a rational/systematic problem-solving style, an impulsive/careless style, and an avoidant style).

Introduction

Social problem solving (SPS) refers to the process by which a person attempts to discover or invent effective or adaptive coping responses to specific problematic situations encountered in everyday living for which no effective response is immediately apparent or available (D'Zurilla, 1986; D'Zurilla & Nezu, 1982). Much of the research on social problem-solving (i.e., real-life problem solving) and problem-solving therapy has used the prescriptive model of social problem solving developed by D'Zurilla and his associates (D'Zurilla, 1986; D'Zurilla & Goldfried, 1971; D'Zurilla & Nezu, 1982; Nezu, Nezu & Perri, 1989; D'Zurilla & Maydeu-Olivares, in press).

According to this model, social problem solving is defined as a complex, cognitive-affective-behavioral process which consists of two major components: (1) *problem orientation* and (2) *problem-solving proper*. The problem-orientation component consists of metacognitive processes (Bandura, 1989; Meichenbaum & Asarnow, 1979) that reflect the person's general awareness and appraisals of everyday problems, as well as his or her own problem-solving ability (for example, generalized cognitive appraisals, causal attributions, self-efficacy expectancies, outcome expectancies). Together with the emotions and behavioral approach-avoidance tendencies that accompany them, these generalized beliefs and expectancies can influence the specific perceptions and appraisals of new problematic situations, as well as the likelihood and efficiency of problem-solving performance in these situations. What this problem-orientation component does *not* include, however, are the specific problem-solving skills and abilities that enable a person to *maximize* his or her problem-solving effectiveness in specific problem-solving situations.

The *problem-solving proper* component of the model consists of a set of four particular goal-directed tasks that contribute to problem-solving competence: (1) problem definition and formulation, (2) generation of alternative solutions, (3) decision making, and (4) solution implementation and verification (i.e., monitoring and evaluation of solution outcomes). Each of these skilled tasks is presumed to contribute uniquely to the discovery or invention of effective "solutions" or adaptive ways of coping with particular problematic situations.

A major deficiency in the research on social problem solving has been the lack of adequate, theory-based measures of social problem-solving ability (see D'Zurilla & Maydeu-Olivares, in press; Tisdelle & St. Lawrence, 1986). D'Zurilla and Nezu (1990) attempted to correct this deficiency by developing the *Social Problem-Solving Inventory* (SPSI), which is based on the social problem-solving model described above. The SPSI consists of 70 Likert-type items rated on a 5-point scale. These 70 items are organized into the following two major scales and seven subscales:

- Problem Orientation Scale (POS)
  - Cognition Subscale (CS)
  - Emotion Subscale (ES)
  - Behavior Subscale (BS)
- Problem–Solving Skills Scale (PSSS)
  - Problem Definition and Formulation Subscale (PDFS)
  - Generation of Alternative Solutions Subscale (GASS)
  - Decision Making Subscale (DMS)
  - Solution Implementation and Verification Subscale (SIVS)

Each of the subscales has 10 items, and accordingly, POS consists of 30 items, and PSSS of 40 items. Each item is a self-statement reflecting either a positive (facilitative) or negative (inhibitive) cognitive, affective, or behavioral response to real-life problem-solving situations. One half of the items are positive, and the other half of the items are negative. The positive and negative items, as well as the items corresponding to different subscales, are distributed at random throughout the inventory.

The 70 items that compose the SPSI were selected from an initial item pool of 138 items based on the corrected item-total correlations between the items and their corresponding subscales and scales. The 10 items that showed the highest correlations with their own subscale and scale, whereas presenting relatively low correlations with the divergent subscales and scale were selected. Since the structure of the SPSI is primarily theory-driven, it seemed necessary to study the dimensionality of the SPSI as a whole, as well as the dimensionality of its two scales and seven subscales, which reflect the hypothesized theoretical model of the social problem-solving process. According to this model, each of the subscales of the SPSI should be unidimensional, whereas the dimensionality of the POS and PSSS scales should be three and four, respectively, while the overall inventory should be seven-dimensional.

Method

Subjects

The data used for this study was obtained by merging several samples of undergraduate students from the State University of New York at Stony Brook to whom the SPSI was administered as part of a course requirement. The first sample (N = 233) was assessed during the Fall of 1987, the second (N = 261) during the Fall of 1988, and the third (N = 107) during the Fall of 1990.

The homogeneity of the pooled sample was tested by a procedure suggested by Fritz Drasgow (personal communication, April of 1990), which is based on plotting the item means for each pair of samples. The same procedure was then applied to the corrected item-total correlations. The inspection of these plots revealed very compact and linear scatterplots, thus suggesting that the different samples could be considered as coming from the same population and, therefore, could safely be pooled.

Procedure

The dimensionality of the SPSI was investigated by performing factor analysis on the matrix of inter-item polychoric correlations. That is, the items of the SPSI were treated as polychotomous ordered variables obtained by categorizing a multivariate normal distribution, instead of as continuous variables. Testing the goodness of fit of this model involves two parts. First we need to determine whether the hypothesis of categorized multivariate normality is correct. If this hypothesis is appropriate, then the use of polychoric correlations is justified and we may proceed to test whether the restrictions imposed on the matrix of polychoric correlations are appropriate. Unfortunately, there is no test of categorized multivariate normality, only a test of underlying bivariate normality associated with each polychoric correlation. We assessed the hypothesis of categorized multivariate normality by estimating the percentage of tests that reject the hypothesis of underlying bivariate normality at a nominal rate $\alpha = .05$ corrected using the Bonferroni inequality for the total number of bivariate tests.

The goodness of fit of confirmatory factor models with polychoric correlations can be assessed by the chi-square test using weighted least squares estimation (see Muthén, 1984). However, this test is correct only when fitting a small number of items and when very large samples are available (Muthén,

* The participation of Albert Maydeu-Olivares in this research was supported by a Fulbright-La Caixa scholarship. Parts of this paper were performed by the first author as part of his doctoral dissertion at the University of Barcelona, directed by Juana Gómez Benito.

1993). Given the large number of items of the SPSI, weighted least squares (WLS) estimation is not feasible, and only unweighted least squares (ULS) confirmatory factor analyses can be performed for which no found goodness of fit test is available.

Since confirmatory factor analysis can not yield a formal test of the dimensionality of the SPSI, we used factor analysis mostly in an exploratory fashion to gain insight into the structure of the SPSI. That is, after estimating the matrix of polychoric correlations using PRELIS (Jöreskog & Sörbom, 1993 a), this was inputted into SPSS to perform unrestricted ULS factor analyses with squared multiple correlations as initial estimates of the communalities. Oblique rotations (oblimin) were used since we expected the extracted factors to be correlated.

In these analyses we assessed dimensionality by the rather conservative procedure of (1) constructing a set of plausible dimensionality hypotheses for each set of items, (2) determining which of these hypotheses was more adequate using the substantive theory of interest (in this case, social problem-solving theory), and then (3) inspecting the matrix of residuals after fitting the model.

The set of plausible dimensionality hypotheses to be subsequently assessed were obtained by constructing a confidence interval of plus/minus two factors around the dimensionality hypothesis suggested by the ratio of eigenvalue differences criterion (a.k.a. scree plot). For example, if by inspecting the magnitudes of the eigenvalues it seemed that the most appropriate dimensionality hypothesis for a set of items was two, then we examined all solutions between one and four dimensions.

Results

In only 11% of the estimated 2415 polychoric correlations in the SPSI was the hypothesis of bivariate normality rejected at $\alpha = .05/2415 = .0000207$ (this corresponds to a χ^2 of 48.55 on 15 d.f.). None of the correlations showed a Root Mean Squared Error of Approximation (RMSEA) greater than one, the maximum value suggested by Browne and Cudeck (1993). Therefore, we concluded that the model of categorized multivariate normality is appropriate for these data and that the use of polychoric correlations is justified.

Table 1 shows the initial and final* estimates of the eigenvalues of the polychoric correlation matrices of the SPSI subscales analyzed using ULS unrestricted factor analysis. An inspection of the final eigenvalues suggests a one-dimensional solution for PDFS, SIVS, ES and BS. However, large residuals were found after fitting a one-factor solution to the SIVS, which casts serious doubts on the adequacy of a one-factor solution for this subscale.

Multifactor solutions were obtained for the GASS, DMS, SIVS, and CS subscales. A content analysis of the items in the two-factor solutions revealed that in the GASS, DMS, SIVS, and CS subscales, the positively-worded items were loaded by one factor, whereas the negatively-worded items were loaded by the other factor. Moreover, we found that although the percentage of positively-worded items in the whole inventory is 50%, that percentage varies greatly across subscales, ranging from 10 to 100% (see Table 1). In fact, we found that the three subscales for which a one-dimensional solution appeared adequate (PDFS, ES, and BS) had respectively 100%, 10%, and 10% of their items positively worded, whereas the other subscales had between 50 and 70% of their items positively worded. Since the negatively-worded items, when recoded, show low item means, whereas the positively-worded items show high item means, it turns out that the subscales for which a two-dimensional solution seemed more appropriate have two groups of items with different item means. In contrast, those subscales that present a good one-dimensional solution either have only one group of items, or if they have two, one of them only consists of one item, which does not suffice to postulate a second factor.

Table 1. Initial and final estimates of the eigenvalues obtained from factor analysis of the subscales of the SPSI.

	PDFS	GASS	DMS	SIVS	CS	ES	BS
Initial estimates							
	4.92	4.32	3.88	3.55	3.86	6.14	5.69
	.83	1.61	1.63	1.42	1.64	.73	.73
	.74	.83	.81	1.16	.84	.61	.71
	.66	.73	.78	.82	.73	.57	.62
Final estimates							
	4.41	3.87	3.15	2.99	3.35	5.25	5.20
	.45	1.07	1.14	.88	1.15	.45	.30
	.26	.32	.29	.62	.34	.25	.20
% pos	100	70	50	50	40	10	10

Notes. $N = 601$; only the first four initial eigenvalues and the first three final eigenvalues are presented here; % pos = percentage of positively worded items in the subscale; each subscale consists of 10 items; SPSI = Social Problem-Solving Inventory; PDFS = Problem Definition and Formulation Subscale; GASS = Generation of Alternative Solutions Subscale; DMS = Decision Making Subscale; SIVS = Solution Implementation and Verification Subscale; CS = Cognition Subscale; ES = Emotion Subscale; BS= Behavior Subscale.

* These are the eigenvalues of the reduced correlation matrix (see SPSS, 1991).

There is a well-known psychometric controversy about whether the distribution of item means (also called *item difficulties* in ability testing) affects the dimensionality of an item pool as measured by factor analytic procedures. Specifically, when there are several groups of items with different item means, factor-analytic procedures might yield factors that correspond to the clustering of items based on their means. Some authors have argued that those factors are "mathematical artifacts" and not substantive factors (for a classical review of this issue, see Rorer, 1965). McDonald (1985) has successfully argued that it is the violation of the linearity assumption between the observed variables and the factors, and not the differences in item means, that creates those "mathematical artifacts". This violation of the linearity assumption is avoided by the use of polychoric correlations. Thus, *it is not a methodological artifact* that the positively and negatively worded items of the SPSI form separate clusters of items.

Instead, a careful content analysis of the items suggests that the negatively- and positively-worded items actually measure different constructs. Thus, 10 of the 11 negatively worded items in the 40-item Problem-Solving Skills Scale form a cluster that could be conceived as measuring "impulsivity/carelessness," or an impulsive/careless problem-solving style, instead of simply representing the *lack of* effective problem-solving skills. The positive items of the PSSS scale, on the other hand, reflect a rational, deliberate, systematic, and efficient application of effective or adaptive problem-solving skills and techniques (i.e., problem definition and formulation, generation of alternative solutions, decision making, and solution implementation and verification), that is, a rational problem solving style.

Similarly, five of the six positively-worded items of the 30-item Problem Orientation Scale might be tapping a positive, problem-solving cognitive "set," which is partially independent from the negative or inhibitive orientation dimension measured by the remaining 24 negatively-worded items. Thus, based on our factor analyses of the subscales of the SPSI, we hypothesized that its items could be reconceptualized as measuring four components: (1) rational problem solving style, (2) impulsivity/carelessness style (an impulsive and careless problem-solving style), (3) positive problem orientation (a facilitative problem-solving cognitive "set"), and (4) negative problem orientation (inhibitive cognitions, emotions, and avoidance behavior).

Based on these analyses, and the subsequent content analyses of the items, we decided to eliminate four items from further analyses at this point. Three of these items belong to the SIVS and the fourth item is from the ES. Substantively, two of the SIVS items were eliminated because they seem to be reflecting the person's self-appraisal of the *outcome* of his or her problem-solving attempts instead of assessing the *process* of problem solving (i.e., solution verification skills). The SIVS was originally intended to measure process skills and not outcome expectancies. The third SIVS item was eliminated because it seemed to be measuring a different dimension that was not clear. The ES item was the only positively-worded item ("I am generally able to remain 'cool, calm, and collected' when I am solving problems") that clustered with items measuring negative emotions. Since it was not clear if this item is actually

Table 2. Initial and final estimates of the eigenvalues obtained from factor analysis of the scales of the SPSI.

PSSS		POS		SPSI	
Initial	Final	Initial	Final	Initial	Final
13.51	13.03	13.09	12.68	19.34	18.94
(13.04)	(12.57)	(12.58)	(12.19)	(18.27)	(17.85)
3.66	3.11	2.23	1.79	10.18	9.78
(3.56)	(3.00)	(2.24)	(1.78)	(9.94)	(9.51)
1.53	1.01	2.06	1.65	3.70	3.23
(1.38)	(.90)	(1.80)	(1.37)	(3.01)	(2.52)
1.23	.71	1.18	.73	2.05	1.69
(1.16)	(.65)	(1.08)	(.64)	(1.89)	(1.50)
1.18	.68			1.60	1.19
(1.10)	(.62)			(1.48)	(1.07)
1.11	.57			1.44	1.01
(1.01)	(.48)			(1.31)	(.87)
				1.35	.90
				(1.29)	(.83)
				1.28	.83
				(1.19)	(.75)
				1.11	.68
				(1.08)	(.59)
				1.04	.64
				(1.08)	(.59)
				1.04	.59
				(1.00)	(.55)

Notes. $N = 601$; these eigenvalues were obtained by ULS factor analysis with squared multiple correlations as initial communality estimates and polychoric correlations; only the eigenvalues greater then one in the initial estimation are presented here; PSSS = Problem-Solving Skills Scale (40 items); POS= Problem Orientation Scale (30 items); SPSI= Social Problem Solving Inventory (70 items); the values within parentheses correspond to the eigenvalues obtained when the total number of items is reduced from 70 to 66, with 37 items in the PSSS and 29 items in the POS.

measuring positive emotions or simply the *absence* of negative emotions, we decided to eliminate it from further analyses.

Table 2 presents the initial and final estimates of the eigenvalues obtained in the ULS unrestricted factor analysis of the overall SPSI and its two scales, the Problem Orientation Scale and the Problem-Solving Skills Scale.

Using the ratio of eigenvalue differences criterion, the most plausible dimensionality hypotheses seemed to be two factors for the Problem-Solving Skills Scale, three factors for the Problem Orientation Scale, and four factors for the overall inventory. Consequently, we examined dimensionality solutions from one to four factors for the Problem-Solving Skills Scale, one to five factors for the Problem Orientation Scale, and two to six factors for the overall inventory.

A content analysis of the items that were loaded by the two factors in the reduced (37 items) Problem-Solving Skills Scale indicated that they match exactly, using an oblique rotation, our hypothesized distinction between rational problem solving and impulsivity/carelessness style. These two factors accounted for 41.7% of the variance of the Problem-Solving Skills Scale. The correlation between the factors was –.38.

In the reduced (29 items) Problem Orientation Scale, the two-factor solution clustered the items in: (1) negative problem orientation (the negative items in the CS and the ES) and (2) positive problem orientation (the positive items in the CS and the BS). The three-factor solution yielded the following clusters: (1) the positive problem orientation items, (2) the negative items from the ES and the CS, and (3) the negative items from the BS. Within this three-factor framework, problem orientation is to be reconceptualized as involving only cognitive and emotional components (there are no behavioral items in the clusters of items corresponding to the first and second factors). Also, we reconceptualized the negative behavior items as reflecting an avoidant type of problem-solving style (i. e., putting off solving problems for as long as possible, waiting for problems to resolve themselves, asking others to help solve one's problems), rather than a type of problem orientation. The correlations between the negative problem orientation factor and the positive problem orientation and avoidance style factors were –.36 and .63, respectively, whereas the correlation between the positive problem orientation factor and the avoidance style factor was –.37. The percentage of variance accounted for by the two factor solution is 45.8%, and by the three factor solution is 49.6%. Thus, it is not clear from this analysis alone whether a two or three factor solution is more adequate for the POS scale of the SPSI.

We therefore used the factor analysis of the overall SPSI item pool to explore whether for this data an empirically derived hypothesis might be more adequate than the original hypothesis, which consisted of two scales and seven subscales. We considered two empirically derived hypotheses: (1) a four-factor structure consisting of problem-solving skills, impulsivity/carelessness style, positive problem orientation, and negative problem orientation, or (2) a five-factor structure consisting of problem-solving skills, impulsivity/carelessness style, positive problem orientation, negative problem orientation, and avoidance style.

When analyzing the overall item pool of the SPSI (minus the four items that were deleted previously), the two-factor solution clustered the items exactly into positive and negatively worded items. The three-factor solution clustered the items exactly into (1) problem solving skills and positive problem orientation, (2) negative problem orientation and avoidance style, and (3) impulsivity/carelessness style. The four factor solution clustered the items in: (1) problem solving skills and positive problem orientation, (2) negative problem orientation, (3) avoidance style, and (4) impulsivity/carelessness style. Finally, the five-factor solution clustered the items in: (1) problem solving skills, (2) positive problem orientation, (3) negative problem orientation, (4) avoidance style, and (5) impulsivity/carelessness style. The percentage of variance accounted for by the one to five-factor solutions is, respectively, 27%, 41.1%, 45%, 47.3%, and 48.8%. The six-factor solution did not seem appropriate since the magnitude of the sixth final eigenvalue was small (.87), and the inspection of the residuals after fitting a 5-dimensional model did not reveal any pattern that suggested the existence of a sixth factor.

In order to determine whether a four or five dimensionsional solution was most appropriate for the remaining 66 items of the SPSI we estimated (1) the canonical correlations for each pair of clusters of items using polychoric correlations, and (2) the disattenuated correlations between the sums of the item scores within each cluster. The latter correlations were computed estimating the reliability of the constructs by coefficient alpha.

The canonical correlations between pairs of item sets indicates what would be the largest possible inter-set correlation if we weight each item to maximize the correlation. Since we performed these analysis using polychoric correlations among the items, each of the obtained inter-cluster canonical correlations can be considered as an upper bound for the inter-cluster correlation obtainable by performing confirmatory factor analysis on that pair of clusters of items. The dissatenuated correlations provide us with estimates of the inter-cluster correlations if each of the constructs measured by those clusters were measured without error (with perfect reliability).

The results of these worst case analyses are presented in Table 3. As the results show, none of the indices approached one (the largest entry in Table 3 is .82). This clearly indicates that we do not need *less* than five dimensions to account for the inter-item covariation of the SPSI. Therefore, we concluded that a five-factor solution is a better representation for the SPSI than the four-factor solution.

Table 3. Corrected for attenuation correlations and canonical correlations among the five components of the SPSI using polychoric correlations.

	PPO	NPO	RPS	ICS	AS
PPO	—	–.54	.74	–.32	–.56
NPO	–.58	—	–.15	.58	.78
RPS	.76	–.60	—	–.43	–.27
ICS	–.46	.74	–.60	—	.68
AS	–.61	.82	–.58	.69	—

Notes. $N = 601$; the corrected for attenuation correlations are above the diagonal; the canonical correlations are below the diagonal; SPSI = Social Problem-Solving Inventory; PPO = Positive Problem Orientation; NPO = Negative Problem Orientation; RPS = Rational Problem Solving; ICS = Impulsivity/Carelessness Style; AS = Avoidance Style.

Finally, we assessed the dimensionality of each of the clusters of items corresponding to the five-dimensional solution. This amounts to assessing whether *more* than five dimensions were needed for the SPSI. If each cluster could be considered unidimensional, that would strongly support the hypothesis that five constructs are *necessary and sufficient* to account for the inter-item covariation of the SPSI, since no *less* nor *more* than five dimensions would be needed.

In addition, by examining the dimensionality of the problem-solving skills set of items we were also testing whether the four subsets of items that were designed to measure four different problem-solving skills (problem definition and formulation, generation of alternative solutions, etc.) could be empirically distinguished. Similarly, by examining the dimensionality of the negative problem orientation set of items we were testing whether the cognitive and emotional aspects of this component were empirically distinct.

Table 4. Exploratory factor analyses of the five components of the SPSI.

	PPO	NPO	RPS	ICS	AS
	2.77	8.43	12.05	4.36	4.85
	.73	.97	1.31	1.01	.69
	.60	.88	1.07	.80	.57
	.49	.69	.97	.69	.53
final =	2.77	7.95	11.55	3.79	4.44
% var=	44.40	49.70	42.80	38.00	55.50
n =	5	16	27	10	8

Notes. $N = 601$; SPSI = Social Problem-Solving Inventory; PPO = Positive Problem Orientation; NPO = Negative Problem Orientation; RPS = Rational Problem-Solving; ICS = Impulsivity/Carelessness Style; AS = Avoidance Style; the factor analyses were performed by unweighted least squares factor analysis with squared multiple correlations as initial communality estimates and polychoric correlations; only the first four initial eigenvalues and the first final eigenvalue are presented here; the second final eigenvalues for PSS and ICS are .81 and .51 respectively; n = number of items in the subscale;
final = magnitude of the final first eigenvalue; % var = proportion of variance accounted for by the final first eigenvalue.

In Table 4, we present the distribution of the initial and final eigenvalues obtained by fitting a one-dimensional model to these five clusters of items. For all five sets of items, the ratio of eigenvalue differences criterion suggests that there is one major factor that accounts for most of the variance. Additional evidence supporting the goodness of fit of the one factor model to each of these sets of items is obtained by inspecting the number of residual correlations obtained after fitting the model larger than some arbitrary value, say .10. Only 7 out of 351 residual correlations (less than 2%) were larger than this arbitrary value in the rational problem solving set of items, and none in the other sets of items.

These results provide strong support to the hypothesis that the four skills which make up the problem-solving skills component are empirically indistinguishable, as are the cognitive and emotional aspects of negative problem orientation. The empirical distinctiveness among the subsets of items corresponding to the four problem-solving skills, as well as the cognitive and emotional aspects of negative problem orientation, were also assessed by examining the disattenuated correlations among these subsets of items. The disattenuated correlations among the problem-solving skills subsets ranged from .89 to .98, while the disattenuated correlation between the negative problem orientation subsets

Table 5. Matrix of non-zero loadings of the five-factor model for the Social Problem-Solving inventory obtained using unweighted least squares confirmatory factor analysis.

Item #	*SPSI scale*	*PPO*	*NPO*	*RPS*	*ICS*	*AS*
10	CS	0.66				
12	CS	0.59				
37	CS	0.65				
51	CS	0.66				
26	BS	0.73				
1	CS		0.50			
6	CS		0.70			
18	CS		0.75			
59	CS		0.56			
63	CS		0.73			
67	CS		0.51			
4	ES		0.72			
9	ES		0.67			
17	ES		0.71			
24	ES		0.72			
43	ES		0.79			
47	ES		0.77			
48	ES		0.77			
54	ES		0.75			
68	ES		0.81			
3	BS		0.70			
2	PDFS			0.62		
13	PDFS			0.55		
16	PDFS			0.68		
20	PDFS			0.58		
38	PDFS			0.80		
39	PDFS			0.66		
41	PDFS			0.58		
44	PDFS			0.60		
58	PDFS			0.63		
66	PDFS			0.78		
8	GASS			0.63		
27	GASS			0.52		
29	GASS			0.76		
34	GASS			0.77		
52	GASS			0.70		
62	GASS			0.70		
65	GASS			0.84		
25	DMS			0.56		
32	DMS			0.65		
53	DMS			0.78		
57	DMS			0.51		
61	DMS			0.62		
33	SIVS			0.66		
35	SIVS			0.62		
36	SIVS			0.45		
46	SIVS			0.72		
49	SIVS			0.62		
11	GASS				0.44	
28	GASS				0.44	
30	GASS				0.75	
60	DMS				0.59	
70	DMS				0.61	
5	DMS				0.63	
7	DMS				0.50	
45	DMS				0.65	
22	SIVS				0.68	
69	SIVS				0.64	
15	BS					0.51
21	BS					0.69
23	BS					0.68
31	BS					0.80
40	BS					0.78
42	BS					0.87
56	BS					0.80
64	BS					0.74

Notes. $N = 601$; Five dimensional model of the SPSI: PPO = Positive Problem Orientation; NPO = Negative Problem Orientation; RPS = Rational Problem Solving; ICS = Impulsivity/Carelessness Style; AS = Avoidance Style. SPSI scales: PDFS = Problem Definition and Formulation Subscale; GASS = Generation of Alternative Solutions Subscale; DMS = Decision Making Subscale; SIVS = Solution Implementation and Verification Subscale; CS = Cognition Subscale; ES = Emotion Subscale; BS = Behavior Subscale.

Table 6. Inter-factor correlations in the five-factor confirmatory model for the SPSI using polychoric correlations.

	PPO	NPO	RPS	ICS	AS
PPO	1.00				
NPO	–.53	1.00			
RPS	.74	–.17	1.00		
ICS	–.37	.64	–.46	1.00	
AS	–.58	.81	–.31	.74	1.00

Notes. $N = 601$; PPO = Positive Problem Orientation; NPO = Negative Problem Orientation; RPS = Rational Problem Solving; ICS = Impulsivity/Carelessness Style; AS = Avoidance Style.

was .97. These results provide further support for our conclusions that both problem-solving skills and negative problem orientation should be regarded as unidimensional constructs in this sample.

At a reviewer's request, a ULS confirmatory factor analysis on the matrix of polychoric correlations for the final model was estimated using LISREL (Jöreskog & Sörbom, 1993 b). In this analysis, since no chi-square test is available, goodness of fit was assessed by other goodness of fit indices, such as the Root Mean Squared Residual (RMSR; Jöreskog & Sörbom, 1993 b), the Goodness-of-Fit Index (GFI; Jöreskog & Sörbom, 1993 b), and the Relative Noncentrality Index (RNI; McDonald & Marsh, 1990; see also Bentler, 1990). In Table 5 we present the matrix of factor loadings obtained by fitting by ULS the five dimensional model to the matrix of polychoric correlations. The model yielded a minimum of the discrepancy function $F_{ULS} = 8.94$ on 2069 d. f., and the following goodness of fit indices, RMSR = .064, GFI = .96, RNI = .97, which indicate that the five factor model provides a good fit to these data.

In Table 6 we present the matrix of inter-factor correlations. The highest correlation in this table is between negative problem solving and avoidant style (.81), which indicates that this constructs share more than 65% of the variance, whereas the lowest correlation is between negative problem solving and rational problem solving (–.17), which indicates that these constructs share less than 3% of the variance. The correlations shown in this table are positive or negative because two of the factors can be thought of as constructive or facilitative dimensions (positive problem orientation and rational problem solving), whereas the remaining three can be thought of as dysfunctional dimensions (negative problem orientation, impulsivity/carelessness style, and avoidance style).

Discussion and Conclusions

The SPSI was originally designed to measure the two major components of the social problem-solving model described by D'Zurilla and his associates: (1) problem orientation and (2) problem-solving skills (D'Zurilla, 1986; D'Zurilla & Nezu, 1982, 1990). The Problem Orientation Scale was hypothesized to tap a positive, problem-solving "set" (i. e., facilitative cognitions, emotions, and approach behavior), while the Problem-Solving Skills Scale was hypothesized to reflect the rational, systematic application of effective problem-solving skills and techniques (i. e., problem definition and formulation, generation of alternative solutions, etc.). The present results support the distinction postulated repeatedly by D'Zurilla and Nezu between problem orientation and problem solving styles, although suggests distinguishing between two partially independent problem orientation dimensions (positive and negative problem orientation), and three partially independent problem solving styles (rational problem solving, impulsivity/carelessness style, and avoidance style). Below are some examples of SPSI items corresponding to each of these dimensions:

Positive Problem Orientation

#26. I usually confront my problems "head on" instead of trying to avoid them.

#51. When I have a problem, I usually try to see it as a challenge, or opportunity to benefit in some positive way from having the problem.

Negative Problem Orientation

#43. When I am attempting to solve a problem, I often get so upset that I cannot think clearly

#68. When my first efforts to solve a problem fail, I tend to get discouraged and depressed

Rational Problem Solving

#65. When I am attempting to find a solution to a problem, I try to approach the problem from as many different angles as possible.

#66. When I am having trouble understanding a problem, I usually try to get more specific and concrete information about the problem to help clarify it.

Impulsivity/Carelessness Style

#22. After carrying out a solution to a problem, I do not usually take the time to evaluate all the results carefully.

#30. I think that I am too impulsive when it comes to making decisions.

Avoidance Style

#42. I think that I spend more time avoiding my problems than solving them.

#56. When I am faced with a difficult problem, I usually try to avoid the problem or I go to someone else for help in solving it.

Several important conclusions can be extracted from these results:

First, positive problem orientation and negative problem orientation are *not* polar opposites on a single problem-orientation dimension. Instead, they are best conceived as two different but related dimensions. This finding parallels similar findings for related or overlapping constructs, such as optimism and pessimism (Chang, D'Zurilla, & Maydeu-Olivares, 1994; Marshall, Wortman, Kusulas, Hervig & Vickers, 1992).

Second, the items that were originally generated to assess *deficits* in problem-solving skills reflect, instead, a distinct construct, i. e., an impulsive/careless problem-solving style, which is opposed to a rational or adaptive problem-solving style.

Third, the original avoidance behavior correlates of problem orientation are best conceived as measuring a different dimension, i. e., an avoidant problem-solving style. Consequently, negative problem orientation now consists of cognitive and emotional aspects only. Moreover, these cognitive and emotional aspects are not empirically distinguishable.

Fourth, the specific skilled tasks that D'Zurilla and his associates have hypothesized to form the problem-solving skills part of the social problem-solving process (problem definition and formulation, generation of alternative solutions, etc.) are best conceived as a single general construct, such as a "rational, systematic problem-solving style," or more simply, "rational problem solving."

More empirical research is needed to improve our measurement of positive problem orientation, avoidance style, and impulsivity/carelessness style, since the items that measure these components were obtained as by-products and may not represent all domains of their corresponding theoretical constructs. It is possible, for example, that the most adaptive problem orientation might include certain facilitative emotional states (e. g., exhilaration, excitement, joy) in addition to its cognitive aspects. However, the SPSI as currently constructed does not include any positive emotion items (the one borderline positive emotion item in the original inventory was deleted earlier).

More research is also needed to determine whether the originally hypothesized problem-solving skills components (problem definition and formulation, generation of alternative solutions, etc.) can be empirically differentiated in other subject populations; that is, whether there are subjects with lower levels in some skills but not all of them. The results presented above suggest that individuals tend to report good or poor social problem-solving skills *in general*. However, caution is needed when interpreting these results since they are based only on college student subjects. More research is needed with other subject populations, including samples drawn from clinical populations, before any definitive conclusions can be made on this issue.

Based on the results presented in this paper D'Zurilla, Nezu, and Maydeu-Olivares (1994) have developed a revised version of the Social Problem Solving Inventory consisting of five scales which presents very promising psychometric properties. For instance, each of its scales (positive problem orientation, negative problem orientation, rational problem solving, impulsivity/carelessness, and avoidance style) can be fitted by unidimensional item response models (see Maydeu-Olivares, 1991).

Using this revised SPSI, several studies have investigated the relationships between this five dimensional model of social problem solving and psychological distress in various populations (D'Zurilla & Maydeu-Olivares, in press; Sadowski, Moore & Kelley, 1994), psychological well-being (D'Zurilla & Maydeu-Olivares, in press), and coping (Chang & D'Zurilla, 1994; D'Zurilla & Chang, in press).

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