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Assessment of Social Problem-Solving Self-Efficacy of Freshmen Engineering Students

Khalida Muntasher[1], Javeed Kittur[2], Jayanti Shinge[3], and Sanjay Kotabagi[4]
[1]School of Civil Engineering & Environmental Science, The University of Oklahoma, Norman, 73019
[2]Engineering Pathways, The University of Oklahoma, Norman, 73019
[3]School of Management Studies & Research, KLE Technological University, Hubballi, 580032
[4]Dean of Student Affairs, KLE Technological University, Hubballi, 580032
[1]khalidabegaum.h.muntahser-1@ou.edu ,[2]jkittur@ou.edu
[3]jayanti_s@kletech.ac.in, [4]sanjay_kotabagi@kletech.ac.in

***Abstract*—This paper presents an instrument designed to assess the Social Problem-Solving Self-Efficacy of freshmen engineering students. This instrument included 34 items and comprised of 5-dimensions: rational problem solving (RPO), positive problem orientation (PPO), avoidance style (AS), negative problem orientation (NPO) and impulsivity or carelessness style (ICS). This instrument was administered in the fall 2019 to freshmen engineering students at a large private southern Indian university. Exploratory factor analysis revealed 4-factors: positive approach towards problems (PAP), AS, NPO and ICS. For these 4-factors, Cronbach's alpha ranged between 0.63 to 0.87. t-test was conducted on the 4-factors to find the differences related to gender, background, and prior experience. For PAP, participants with prior experience reported higher self-efficacy than the participants without experience. For AS and NPO, participants without prior experience reported higher self-efficacy than the participants with experience. However, there were no significant difference on the four factors with respect to gender and background.**

***Keywords*—exploratory factor analysis; freshmen engineering; self-efficacy; social problem-solving; survey instrument**

I. INTRODUCTION

Problem solving is an essential skill that all engineers must possess. There have been several research studies conducted in the past that deal with problem-solving. Few examples of the main ideas of such studies are; imparting analysis skills through problem solving (Kavale, Kittur & Adi, 2016), enhancing students' learning by solving open-ended problems (Muntasher & Kittur, 2016), problem solving in engineering education and its relationship with professional engineering work (Vinson, Davis & Stevens, 2017), cognitive abilities required to solve problems in engineering education (Reid, Dunbar & Buckley, 2018), assessment of engineering problem solving (Kittur, 2018), engineering students' perceptions of problem solving (Kirn & Benson, 2018), and using technology to solve open-ended problems (Muntasher & Kittur, 2018) among others. A common aspect in all these research studies is that the focus is on assessing and/or improving the students' problem-solving abilities. Although problem-solving in general is recognized as an important part of research and has been largely discussed in the past, there is another section in the body of the literature that focuses on social problem-solving. Social problem-solving deals with solving real-world problems with an intention to make the environment a better place to live (D'Zurilla & Nezu, 1982).

II. BACKGROUND

D'Zurilla and his associates define social problem-solving as the cognitive-affective-behavioral process that people use to solve the problems that they face in the real-world situations. Social problem-solving ability comprises of two main parts: first, problem orientation and second, problem-solving skills (Chang et al., 2004). Problem orientation is defined as the metacognitive process in which an individual makes use of cognitive-emotional schemas to reflect on one's own beliefs, appraisals, problem-solving ability and feelings related to the real-word problems. On the other hand, problem-solving skills is defined as the cognitive and behavioral activities of an individual using which s/he tries to comprehend the problem and find effective solutions (Chang et al., 2004).

Research on social problem-solving was started in 1970s and it continues to be an important topic of research even now. While there exist original and revised instruments to measure the social problem-solving skills, there is lack of research evidence in the literature that measure the social problem-solving self-efficacy (SPSSE) of freshmen undergraduate engineering students in Indian context. For example, the study by Siu and Shek (2005), aimed at creating a Chinese version of the revised social problem-solving instrument and was administered to junior secondary high school students to find if the scales of the social problem-solving instrument correlated with the depressions scores (findings supported significant differences among the scales and depressions scores). In the work by Lau et al., (2018) the effect of volunteer motivation on self-efficacy, social problem-solving ability and mental health was investigated by measuring the social problem-solving ability and self-efficacy and was administered to students with degrees from health sciences, business, languages and

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Corresponding author: Javeed Kittur, Engineering Pathways, The University of Oklahoma, Oklahoma, USA.
The University of Oklahoma, Norman 73019 (e-mail: jkittur@ou.edu).

translation, and arts among others. Yet, in another study by D'Zurilla et al., (2003), the objective was to understand the relationship between social problem-solving, self-esteem and aggression of psychology college students at northeastern university. Hence, this study will specifically add to the existing body of literature on social problem-solving self-efficacy with a focus on freshmen undergraduate engineering students based in India.

As per D'Zurilla and Nezu (1990), the social problem-solving inventory broadly includes two scales: one, problem orientation scale and second, problem-solving skills scale. The items in both these scales include positive and negative characteristics related to problem solving in general. The positive characteristics refers to facilitative or constructive features of problem solving, and the negative characteristics refer to ineffective or dysfunctional facets of problem solving. These two scales each have associated sub-dimensions. The problem orientation scale has two dimensions; positive problem orientation (PPO) and negative problem orientation (NPO). PPO is effective (or constructive) problem solving which deals with being optimistic that the problems are answerable, believing in one's ability that the problems can be solved successfully, belief that problem solving requires time and effort, and looking at problems as an opportunity and not avoid them (Chang et al., 2004). NPO on the other hand, is dysfunctional or ineffective approach towards problem solving those deals with viewing a problem as a threat to oneself (economically, socially and psychologically), having reduced confidence in one's ability in solving a problem, and having an uneasy feeling when confronted with problems (Chang et al., 2004). The problem-solving skills scale has three dimensions; rational problem solving (RPS), avoidance style (AS) and impulsivity/carelessness style (ICS). RPS is yet another type of constructive problem solving that includes rational, systematic application, and deliberation of problem-solving skills. It includes features such as defining and formulation of problem, generating alternative solutions, decision making and implementation (and verification) (Chang et al., 2004). AS is a dysfunctional approach towards problem solving which is characterized by dependency, passivity and procrastination. AS includes individuals who wait for the problem to resolve by itself, delay problem solving, transfer the responsibility of problem solving to others, and avoid solving problems. ICS is again an ineffective approach towards problem solving that deals with individuals who try to solve a problem with approaches that are impulsive, narrow, incomplete, and careless (Chang et al., 2004). More details about the associated items of five dimensions of the social problem-solving are described later in this paper.

Much of the existing work on social problem-solving focuses on the aspects related to dealing with anger management, prevention of anger, anxiety, depression, and suicidal tendencies. For example, the work by Lau et al., (2018) it was argued that volunteer motivation enhances self-efficacy and social problem-solving which further enhances improves the mental health. In the study by D'Zurilla et al., (2003), self-esteem and social problem-solving were used as predictors for aggression. In another study by Siu and Shek (2010), social problem-solving was used as a predictor for the well-being in adolescents and young adults. Work by Hamarta (2009) investigated the prediction of life satisfaction and self-esteem using the social problem-solving.

This article examined the undergraduate engineering students' self-efficacy related to social problem-solving at the freshmen level as one of the main tasks of an engineer is to solve real-life problems and help make the society a better place to live (Kirn & Benson, 2018; Kittur & Salunke, 2020). SPSSE is the confidence in the ability of an individual to solve social problems. Making individuals aware of their self-efficacy levels will help them perform better in future when faced with related activities (Bandura, 1977; Kittur, 2020; Kittur & Brunhaver, 2020). The aim of this study was to understand if there exists SPSSE differences between males and females, students with rural and urban background, and students with and without prior experience in solving social problems. In this study, the five dimensions of social problem solving were used with an aim to measure the social problem-solving self-efficacy of freshmen undergraduate engineering students at a large private university in southern India. A survey instrument to measure the SPSSE is presented, and it is hypothesized that: (1) male students will have greater SPSSE than females, (2) students with urban background will have greater SPSSE than students from rural background, and (3) students with prior experience in social problem-solving will have greater self-efficacy in RPO and PPO than students without prior experience.

III. METHODS

A. Item Development

The SPSSE instrument contains a total of thirty-four items and includes five dimensions; rational problem solving, positive problem orientation, avoidance style, negative problem orientation and impulsivity/carelessness style. The description of each of these dimensions, the resources that the items are derived from, and the example items are described in Appendix A. The participants were asked to rate their confidence in their ability to perform these tasks using a 5-point, bipolar Likert-type scale. The Likert scale was anchored with texts at each level; (1) strongly disagree (2) disagree (3) neither agree nor disagree (4) agree (5) strongly agree.

B. Evidence of Content and Face Validity

To gather the evidence for content validity, the SPSSE instrument was reviewed by three experts. These experts were faculty members who have been teaching courses that deal with solving social problems. These faculty members were asked to assess the relevance, clarity, and appropriateness of the dimensions of SPSSE instrument and the associated items in each dimension. Eight students from the electrical engineering program were asked to complete the survey and provide their feedback on the item's wording and clarity. This constituted as the evidence for face validity of the instrument. The feedback received from the faculty experts and the potential student participants did not suggest any changes, and hence the

instrument was administered as proposed.

C. Data collection procedures

The target population of this study were the freshmen undergraduate engineering students from a large private university in southern India. The second author was responsible for administering the survey instrument and data collection as she had easy access to the participants. The second author with the help of the other faculty members at this university administered this survey in the class as this was the only time that all students accumulated at one place. The survey was administered during Fall 2019 in 20 sections with 35 students in each section on average. The students were invited to participate in this survey via WhatsApp as each section had a group created with all students in the group to discuss the course related aspects. The survey had two parts, first part included the 34 items of the SPSSE instrument, and the second part required responses related to demographic questions (gender and background: rural/urban). To avoid biases in the responses, the 34 items were designed to appear randomly in the survey. A follow-up reminder was sent to the participants via WhatsApp to complete the survey. No remuneration was provided to students and the participation was voluntary.

D. Data pre-processing

The participants who missed on more than 50% of the survey items were removed from the dataset. The data was scanned to understand if a participant has selected the same option as a response to all the items in the survey and such responses were also deleted. There was no missing data in the demographic data. To check the assumption of univariate normality before running the factor analysis, the kurtosis and skew of all the 34 items were examined (Seltman, 2013). The negatively worded items were reversed coded. For all the five hypothesized dimensions (RPS, PPO, AS, NPO and ICS), to ensure that all items in each dimension were correlated (significantly) to one another, inter-item correlations were checked. The suitability of the SPSSE items for factor analysis was determined using the Bartlett's test for sphericity ($p<0.05$) (McCoach, Gable & Madura, 2013). To account for the fact that the extracted factors provide a meaningful variance, Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was used (KMO>0.8) (McCoach, Gable & Madura, 2013; Kittur, 2023). SPSS statistics software was used for data pre-processing and data analysis in this study.

E. Exploratory factor analysis

To understand the structure of the SPSSE instrument used in this study and to know the items belonging or associated with each of the dimensions of SPSSE, exploratory factor analysis (EFA) was run. Inter-item correlations and variance in the inter-item correlations within each factor was checked before conducting the EFA. Principal axis factoring was used to extract factors and promax with Kaiser normalization method of rotation (kappa = 4) was used. To find the number of factors to be extracted from the data scree plots, parallel analysis and Kaiser's criterion were used (McCoach, Gable & Madura, 2013). Factors with all items with low loadings (<0.4) or at least two factors if cross loaded (>0.3) were removed from the final factor structure (Pett, Lackey & Sullivan, 2003). With the finalized structure of factors of the SPSSE, Cronbach's alpha was calculated to find the internal reliability for each dimension of the survey instrument ($\alpha>0.8$ preferred) (Cronbach, 1984). The final scores of each dimension were calculated by averaging the scores of the items belonging to the specific factor.

F. t-test analyses

To compare the social problem-solving self-efficacy of males and females, students with rural and urban background, and students with and without prior experience in solving social problems, an independent samples t-test was used. The following hypotheses were tested in this study: (1) male students will have greater SPSSE than females, (2) students with urban background will have greater SPSSE than students from rural background, and (3) students with prior experience in social problem-solving will have greater self-efficacy in RPO and PPO than students without prior experience.

IV. RESULTS

A. Participants

The data was collected during the last week of the semester to ensure that the students have completed all the required learning units in the social innovation course. A total of approximately 700 students had been approached to complete this survey and 269 participants responded. The approximate response rate was 38%. After cleaning the data, the final sample of the participants responses was 240. The demographic information of the participants has been presented in Table 1. The responses by male and female students in this survey were approximately the same. However, most of the participants who responded to the survey belonged to the urban background (69%) and most of the participants in this sample have reported to have solved social problems in the past (63%). The descriptive statistics of each of the five dimensions of the survey instrument has been shown in Appendix B.

TABLE 1
DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Category	*n*	%
Total	240	100
Gender		
Male	135	56
Female	105	44
Background		
Rural	75	31
Urban	165	69
I have solved social problems in the past		
Yes	89	37
No	151	63

B. Exploratory factor analysis

The absolute values of skewness and kurtosis for all the items of the SPSSE instrument were less than 3.0 and this considered to be an acceptable limit as reported in (Seltman, 2013). The suitability of the items of the SPSSE scale for factor analysis was verified by Bartlett's test for sphericity ($p<0.001$). The extraction of factors for accounting meaningful variance if factor analysis was to be conducted was approved by the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) (KMO=0.881) (McCoach, Gable & Madura, 2013). The number of factors suggested from the data using Kaiser's criterion, scree plot and parallel analysis were four, three and four respectively. The number of factors suggested by the three methods are not same as number of hypothesized factors (five:

RPS, PPO, AS, NPO and ICS); however, the authors went ahead with the suggestion by Kaiser's criterion and parallel analysis as the number of factors suggested by these two methods are closer to the number of hypothesized factors. Varimax rotation was used as the correlations of the factors were less than 0.33 (McCoach, Gable & Madura, 2013).

There were no items with factor loadings less than 0.4 on all the four factors; however, a few items cross-loaded on more than one factor and such factors were removed from the analysis (Pett, Lackey & Sullivan, 2003). For example, the item from the AS scale "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" cross-loaded on two factors. Other examples, "I hate to solve problems in life", "I feel afraid when I have problem to solve", "I find it difficult to come up with different possible solutions when attempting to solve a problem", "I think that I am too impulsive (or thoughtless) when it comes to making decisions", "After coming up with different alternative solutions to solve a problem, I do not evaluate all alternatives carefully" and "After carrying out a solution to a problem, I do not take time to evaluate all results carefully". With this, the first factor of the four-factor structure had fifteen items in total, these items included all the items of the dimensions RPS and PPO. Combining the two dimensions RPO and PPO makes sense such that a person having an ability to understand and assess the social problem will also be able to provide a rationale to solve that particular social problem. The first factor henceforth will be called positive approach towards problems (PAP) The second factor had five items all belonging to the AS dimension. The third factor also had five items and all these five items were related to the NPO dimension. The fourth and the final factor had two items belonging to the ICS dimension. Generally, a factor is included in the analysis with at least three items; however, in this study, the fourth factor 'Impulsivity/Carelessness style' was retained even though it contained only two items. This factor was included just to present the factor structure of four factors resulted from the EFA.

The factor loadings of the final structure of the SPSSE instrument are shown in Appendix C. The range of factor loadings for the first was 0.48 to 0.65, second factor from 0.48 to 0.75, third factor from 0.61 to 0.71 and fourth factor from 0.49 to 0.64. The reliability coefficient of internal consistency (Cronbach's α) for the four factors ranged from 0.63 to 0.87.

C. t-test analyses

The descriptive statistics of the final four factors has been shown in Appendix D. This section discusses the results of the independent samples t-test. There was no significant effect for gender in the positive approach to problems factor of the SPSSE, $t(238)=-1.9$, $p=0.058$, despite females reported ($M=4.16$, $SD=0.38$) higher scores than males ($M=4.05$, $SD=0.51$). Also, there was no significant effect for student background in the positive approach to problems factor of the SPSSE, $t(238)=-0.92$, $p=0.357$, despite students from urban background reported ($M=4.12$, $SD=0.44$) higher scores than rural background students ($M=4.06$, $SD=0.51$). The 89 students who had solved social problems in the past ($M=4.21$, $SD=0.55$) compared to the 151 students with no prior experience ($M=4.03$, $SD=0.39$) reported higher self-efficacy in positive approach to problems factor of the SPSSE, $t(238)=3.02$, $p=0.006$. This produced a medium sized effect ($d=0.4$) and the post-hoc power analysis for this medium sized effect ($d=0.4$), produced an output power of 84.64%.

There was no significant effect for gender in the avoidance style factor of the SPSSE, $t(238)=0.55$, $p=0.579$, as the males reported ($M=2.57$, $SD=0.79$) similar scores as females ($M=2.52$, $SD=0.81$). Also, there was no significant effect for student background in the avoidance style factor of the SPSSE, $t(238)=-0.34$, $p=0.734$, as students from rural background reported ($M=2.52$, $SD=0.79$) similar scores as urban background students ($M=2.56$, $SD=0.81$). The 151 students without prior experience in solving social problems ($M=2.66$, $SD=0.81$) compared to the 89 students with prior experience ($M=2.36$, $SD=0.75$) reported higher self-efficacy in avoidance style factor of the SPSSE, $t(238)=-2.91$, $p=0.004$. This produced a medium sized effect ($d=0.39$) and the post-hoc power analysis for this medium sized effect ($d=0.39$), produced an output power of 82.81%.

There was no significant effect for gender in the negative problem orientation factor of the SPSSE, $t(238)=0.63$, $p=0.531$, as the males reported ($M=2.63$, $SD=0.89$) similar scores as females ($M=2.56$, $SD=0.85$). Also, there was no significant effect for student background in the negative problem orientation factor of the SPSSE, $t(238)=-0.044$, $p=0.965$, as students from rural background reported ($M=2.59$, $SD=0.84$) similar scores as urban background students ($M=2.6$, $SD=0.89$). The 151 students without prior experience in solving social problems ($M=2.69$, $SD=0.84$) compared to the 89 students with prior experience ($M=2.43$, $SD=0.91$) reported higher self-efficacy in negative problem orientation factor of the SPSSE, $t(238)=-2.29$, $p=0.023$. This produced a small to medium sized effect ($d=0.3$) and the post-hoc power analysis for this small to medium sized effect ($d=0.3$), produced an output power of 60.87%.

There was no significant effect for gender in the impulsivity/carelessness style factor of the SPSSE, $t(238)=0.73$, $p=0.467$, as the males reported ($M=3.13$, $SD=0.97$) similar scores as females ($M=3.04$, $SD=0.87$). There was no significant effect for student background in the impulsivity/carelessness style factor of the SPSSE, $t(238)=1.05$, $p=0.297$, as students from rural background reported ($M=3.18$, $SD=0.94$) similar scores as urban background students ($M=3.05$, $SD=0.92$). Also, there was no significant effect for experience in the impulsivity/carelessness style factor of the SPSSE, $t(238)=-0.4$, $p=0.688$, as students with prior experience in solving social problems reported ($M=3.06$, $SD=0.96$) similar scores as students without prior experience ($M=3.11$, $SD=0.9$).

V. Discussion and Implications

The SPSSE instrument was proposed with five dimensions (rational problem solving, positive problem orientation, avoidance style, negative problem orientation and impulsivity/carelessness style). This study essentially aims at filling the gap in the literature by including the student population from the undergraduate engineering program and more so freshmen engineering students. Face and content validity were checked for all the items on the five dimensions,

and EFA was conducted on 240 SPSSE responses. From EFA, a total of 27 items with four-factor structure was obtained as against the hypothesized five-factor structure. An independent samples t-test was conducted on the sample to find if there exist significant differences related to gender, background and prior experience on each of the four factors obtained from EFA.

For the factor positive approach towards problems students with prior experience in solving social problems reported higher self-efficacy than the students without prior experience. However, there was no significant difference in the self-efficacy scores for the positive approach towards problem dimension related to gender and student background. Similarly, for the avoidance style and negative problem orientation factors the self-efficacy scores for predictors gender and background were not statistically significant. However, for the avoidance style and negative problem orientation factors the participants without prior experience in solving social problems reported higher self-efficacy scores than participants without prior experience. There was no statistically significant difference for the predictors gender, background, and experience for the impulsivity/carelessness style dimension.

The results from EFA make sense as the two dimensions rational problem solving, and positive problem orientation were merged and were defined as a new factor positive approach towards problems. This suggests that the two dimensions may not be separated completely and the same is reported in the literature (Siu & Shek, 2005). The average scores of the factor positive approach towards problems is higher than the other three factors (avoidance style, negative problem orientation and impulsivity/carelessness style) and this finding is reported in the literature as favorable outcome of problem-solving (Chang et al., 2004; Hamarta, 2009).

The results of the independent samples t-test helped further understand the hypotheses proposed in this study. First, the hypothesis that male participants will have greater self-efficacy on the dimensions of social problem-solving than females was proved to be false for all the four final factors. This is not surprising as some of the available literature on self-efficacy documents that males tend to generally report higher self-efficacy than females (Chou, 2001; Cassidy, & Eachus, 2002) and at the same time there are studies that show no statistical differences in self-efficacy between gender (Smith & Betz, 2000; Kittur, 2020). In a related study (D'Zurilla, et al., 1998), the gender effect was observed on positive and negative problem orientation, males scored higher on positive problem orientation than females, and females scored higher on negative problem orientation than males.

Second, the hypothesis, students with urban background will have greater self-efficacy on all the dimensions of the social problem-solving than students from rural background was also proved false. This hypothesis was essentially made on the basis that students living the urban areas are exposed to different social problems and the solutions to those social problems relatively more than the exposure the students get with the rural background. Referring to Table 1, even though the sample included 69% of the students belonging to urban background, there was no statistically significant difference seen in the background predictor. The authors believe more research is needed in this direction to understand the influence of student background on SPSSE.

Third, the hypothesis, students with prior experience in social problem-solving will have greater self-efficacy in RPO and PPO dimensions of the social problem-solving than students without prior experience was proved. As the final factor structure required to combine RPO and PPO, this gave rise to a new factor positive approach towards problems (PAP). The finding that students with prior experience reported higher self-efficacy for the factor PAP makes sense, as students with higher experience in solving social problems will be dealt with situations which requires them to come up with rationales for solving problems (with positive orientation towards problem solving). The finding that students without prior experience reported higher self-efficacy for the avoidance style and negative problem orientation dimension seems reasonable because such students (with no prior experience) are likely to avoid problems considering that they may not be easy to solve and hence develop negative orientation towards it. Students with prior experience who reported higher self-efficacy are likely to believe that the social problems are solvable (Hamarta, 2009) and hence the role of an engineering university then becomes important in providing social problem-solving experiences to students. These experiences will help students to look at problems as opportunity to learn and solve them rather than perceiving problems as threats and avoiding them. The factor ICS was not statistically significant on any of the predictors (gender, background, and experience).

VI. Future Work

This paper presented the instrument to measure the social problem-solving self-efficacy (SPSSE) of freshmen engineering students and this study comes with some limitations and scope for future research. The sample considered in this study was from a specific university and hence was not representative of the larger population. A potential direction for future work would be to expand the sample to collect more data, to determine if the factor structure will have any change with respect to the number of items in each factor as there were only two items in the ICS factor in this study and the final factor structure included four factors as against the five hypothesized factors. Another possible path for future research would be to include sophomore, junior and senior students in the sample in addition to freshmen engineering students, to understand how SPSSE varies across the class standings and to confirm the structure of the instrument by conducting confirmatory factor analysis (Flora & Flake, 2017; Orcan, 2018; Crede & Harms, 2019). Understanding the SPSSE at different class standings will help inform the engineering universities to accordingly provide social problem-solving experiences to students at different levels in their programs. To investigate deeper the findings obtained in this study, qualitative studies could be designed and implemented as the next step (Kittur, Coley & Kellam, 2020; Walther, et al., 2017).

Appendix

APPENDIX A. OVERVIEW OF THE SPSSE INSTRUMENT

Dimensions (# of Items)	Definition of dimension	Primary Inspiration for Items	Example Items
RPS – Rational problem solving (10)	Deals with the assessment of the degree of rational, thoughtful, and organized approach of problem solving	D'Zurilla, & Nezu, 1982; Siu & Shek, 2005; Wakeling, 2007	• I use a systematic method for comparing alternative solutions to a problem • When working on a problem, I try to get the facts about the problem
PRO – Positive problem orientation (5)	Assesses an individual's orientation towards problem solving using the optimism, willingness, and appraisal of problems as metrics	Maydeu-Olivares & D'Zurilla, 1995; Siu & Shek, 2009	• 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 • I believe I can solve a problem if I try hard enough
AS – Avoidance style (6)	Assesses the patterns of avoiding problem solving which could be through inaction, postponement and/or dependency	D'Zurilla, & Nezu, 1986; Siu & Shek, 2009	• I think that I spend more time avoiding my problems than solving them • I avoid thinking about problems
NPO – Negative problem orientation (8)	Assesses an individual's orientation towards problem solving using pessimism, perceiving problems as threats, and feeling of frustration and anxiety when confronted with problems	Chang, D'Zurilla, & Sanna, 2004; Siu & Shek, 2005	• I am usually nervous and unsure when making important decisions when solving a problem • I feel afraid when I have problem to solve
ICS – Impulsivity / carelessness style (5)	Assesses an individual's pattern of problem-solving in which the attempts made to solve problems are impulsive, hurried, careless, incomplete, and narrow	D'zurilla, Chang, & Sanna, 2003; Wakeling 2007	• When working on a problem, I go with first good idea that comes to mind • When working on a problem, I go with my "gut feeling" without thinking about consequences

APPENDIX B. DESCRIPTIVE STATISTICS OF ITEMS OF HYPOTHESIZED DIMENSIONS OF SPSSE

Item	Category	Mean (SD)
	Rational Problem Solving	
1	I use a systematic method for comparing alternative solutions to a problem	4.0 (0.9)
2	When working on a problem, I try to get the facts about the problem	4.2 (0.7)
3	When I am finding a solution to the problem, I keep in mind the goal	4.2 (0.8)
4	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	4.2 (0.7)
5	When working on a problem, I try to examine the factors contributing to the problem	4.1 (0.7)
6	When I am attempting to find a solution to a problem, I try to approach the problem from as many different angles as possible	4.1 (0.9)
7	When analyzing the options to solve a problem, I can predict positive and negative effects of options	4.0 (0.8)
8	When solving a problem, I consider both immediate and long-term consequences	3.9 (0.9)
9	When I am trying to find solution to a problem, I think of as many solutions as possible	4.2 (0.7)
10	When working on a problem, I try to think of creative or original solutions	4.2 (0.7)
	Positive Problem Orientation	
11	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	4.1 (0.8)
12	I believe I can solve a problem if I try hard enough	4.2 (0.7)
13	Whenever I have a problem, I believe it can be solved	4.2 (0.7)
14	If I encounter difficulties when working on a problem, I try to deal with these difficulties as soon as possible	3.9 (0.8)
15	If the first attempt fails when solving a problem, I continue working to find the desired solution	4.1 (0.7)
	Avoidance Style	
16	I think that I spend more time avoiding my problems than solving them	2.9 (1.2)
17	I avoid thinking about problems	2.5 (1.1)
18	I delay trying to solve problems as long as possible	2.5 (1.1)
19	I delay solving problems until it's too late	2.3 (1.0)
20	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	2.7 (1.1)
21	I wait to see if a problem will resolve itself	2.6 (1.1)
	Negative Problem Orientation	
22	I hate to solve problems in life	2.0 (0.9)
23	I am usually nervous and unsure when making important decisions when solving a problem	2.8 (1.1)
24	I feel afraid when I have problem to solve	2.4 (1.1)
25	When I encounter a difficult problem, it makes me upset	2.6 (1.1)
26	When my first efforts to solve a problem fail, I tend to get discouraged and depressed	2.4 (1.2)
27	When I am attempting to solve a problem, I doubt if I can solve difficult problem on my own	2.7 (1.1)
28	When I am attempting to solve a problem, I spend time worrying about problems instead of solving them	2.5 (1.1)
29	I find it difficult to come up with different possible solutions when attempting to solve a problem	2.6 (1.1)
	Impulsivity/Carelessness Style	
30	I think that I am too impulsive (or thoughtless) when it comes to making decisions	2.4 (1.0)
31	When working on a problem, I go with first good idea that comes to mind	3.4 (1.1)
32	When working on a problem, I go with my "gut feeling" without thinking about consequences	2.8 (1.1)
33	After coming up with different alternative solutions to solve a problem, I do not evaluate all alternatives carefully	3.4 (1.0)
34	After carrying out a solution to a problem, I do not take time to evaluate all results carefully	3.4 (1.1)

APPENDIX C. FINAL FACTOR LOADINGS OF THE SPSSE ITEM STRUCTURE

#	Category	F1	F2	F3	F4
	Positive Approach towards Problems (Cronbach's α =0.87)				

1	I use a systematic method for comparing alternative solutions to a problem	0.48				
2	When working on a problem, I try to get the facts about the problem	0.56				
3	When I am finding a solution to the problem, I keep in mind the goal	0.56				
4	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	0.61				
5	When working on a problem, I try to examine the factors contributing to the problem	0.55				
6	When I am attempting to find a solution to a problem, I try to approach the problem from as many different angles as possible	0.65				
7	When analyzing the options to solve a problem, I can predict positive and negative effects of options	0.55				
8	When solving a problem, I consider both immediate and long-term consequences	0.48				
9	When I am trying to find solution to a problem, I think of as many solutions as possible	0.53				
10	When working on a problem, I try to think of creative or original solutions	0.53				
11	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	0.62				
12	I believe I can solve a problem if I try hard enough	0.56				
13	Whenever I have a problem, I believe it can be solved	0.61				
14	If I encounter difficulties when working on a problem, I try to deal with these difficulties as soon as possible	0.49				
15	If the first attempt fails when solving a problem, I continue working to find the desired solution	0.49				
	Avoidance Style (Cronbach's α =0.80)					
16	I think that I spend more time avoiding my problems than solving them		0.48			
17	I avoid thinking about problems		0.61			
18	I delay trying to solve problems as long as possible		0.71			
19	I delay solving problems until it's too late		0.75			
20	I wait to see if a problem will resolve itself		0.53			
	Negative Problem Orientation (Cronbach's α =0.85)					
21	I am usually nervous and unsure when making important decisions when solving a problem			0.61		
22	When I encounter a difficult problem, it makes me upset			0.68		
23	When my first efforts to solve a problem fail, I tend to get discouraged and depressed			0.64		
24	When I am attempting to solve a problem, I doubt if I can solve difficult problem on my own			0.72		
25	When I am attempting to solve a problem, I spend time worrying about problems instead of solving them			0.71		
	Impulsivity/Carelessness Style (Cronbach's α =0.63)					
26	When working on a problem, I go with first good idea that comes to mind				0.64	
27	When working on a problem, I go with my "gut feeling" without thinking about consequences				0.49	

Note. F1 = positive approach towards problems, F2 = avoidance style, F3 = negative problem orientation, and F4 = impulsivity/carelessness style.

APPENDIX D. DESCRIPTIVE STATISTICS OF THE FINAL FOUR FACTORS

	Gender		**Background**		**Experience**	
	Male (*n*=135)	**Female** (*n*=105)	**Rural** (*n*=75)	**Urban** (*n*=165)	**Yes** (*n*=89)	**No** (*n* =151)
Factor	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
PAP	4.05(0.51)	4.16(0.38)	4.06(0.51)	4.12(0.44)	4.21(0.55)	4.03(0.39)
AS	2.57(0.79)	2.52(0.81)	2.52(0.79)	2.56(0.81)	2.36(0.75)	2.66(0.81)
NPO	2.63(0.89)	2.56(0.85)	2.59(0.84)	2.60(0.89)	2.43(0.91)	2.69(0.84)
ICS	3.13(0.97)	3.04(0.87)	3.18(0.94)	3.05(0.92)	3.06(0.96)	3.11(0.90)

Note. PAP = Positive approach towards problems (RPO+PPO), AS = Avoidance style, NPO = Negative problem orientation, and ICS = Impulsivity or carelessness style.

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