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# Mediation Effect of Depression in the Relation of Suicidal Ideation and Problem Solving in Adolescents

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**Abstract:** The current study was aimed (a) to explore relations among problem solving, depression and suicidal ideation and (b) to verify a hypothesis that depression would mediate the relationship between problem solving and suicidal ideation. An adolescent sample of 378 male and female high school students participated in the present study. They self-reported their levels of problem solving, depression and suicidal ideation using three psychological instruments, Problem Solving Inventory (PSI), Beck Depression Inventory (BDI) and Scale for Suicidal Ideation (SSI). The results showed PSI was significantly and positively correlated with depression or suicidal ideation. Also, Problem Solving Confidence (PSC), one of the three subscales of PSI was positively associated with suicidal ideation or depression. Depression, as one of the strongest predictors, explained 39.3% of the variance of suicidal ideation even after controlling for problem solving. Most importantly, SEM analyses confirmed a full mediation model of depression rather than a partial model in relation of problem solving and suicidal ideation. The present findings suggest significance of and implications for intervention of suicidal behavior in adolescents. Study limitations were also discussed.

**Key words:** suicidal ideation, problem solving, depression

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*Korean Social Science Journal*, XXXIII No. 1(2006): 89-106

## I . Introduction

As our society has rapidly changed and many social problems have emerged, a great attention has been paid on suicide or self-destructive behavior. Moreover, since suicidal mortality in youths has increased sharply over time, concerns of suicidal behavior have been increased. Similarly, suicide was the third biggest reason for 15-24 years-old adolescents' death in the United States (National Center for Health Statistics, 2000). In Korea, Park, Gu, Kim and Song (1993) found that 84.6% of adolescents had ever experienced suicidal ideation at least one time and 7.9% have done almost every day. Consistently with the World Health Organization, the Korean National Statistical Office (2001) reported suicide was the third biggest reason for mortality of those in the teens or thirties and the 2nd biggest reason for those in the twenties. Therefore, suicide in adolescents has become one of the most important social issues of public health in the world as well as in some westernized societies.

While studies on socio-psychological predictors of suicide have been conducted last several decades, most studies have focused on suicide ideation or suicide attempts as an index of suicide because those who commit and succeed in suicide could not be researched. Studies of suicidal attempts would contribute to a better understanding of suicide etiology. However, given the fact that many adolescents have experienced suicidal ideation, likely leading to suicide attempts or suicide behavior, research of suicidal ideation would be important as much as that of suicidal attempts in terms of prevention of suicide.

Previous research has found that daily life stress is a key factor to increase suicidal behavior (Hirson & Ellis, 1996; Pillay & Wassenaar, 1997). Also, psychopathology (e.g., depression, drug abuse) and cognitive factors (e.g., problem solving, self-esteem,

hopelessness) have been actively dealt with for suicide research. Furthermore, beyond individual predictors, path models leading to suicide behavior have been hypothetically explored such as Diathesis Stress Theory (Shotte & Clum, 1982, 1987), Escape from Self Theory (Baumeister, 1990), or Self Control Theory (Carver & Scheier, 1981).

According to several prior investigations, problem solving as a cognitive factor was related to depression (Cheng, 2001; Park, 2004a; Spence, Scheffield & Donovan, 2002) or suicidal behavior (Chang, 1998; Reinencke, DuBois & Suchltz, 2001). Problem solving ability was defined as coping strategies to handle difficult situations or events in everyday life (D'Zurilla & Nezu, 1982). Early studies on problem solving ability had assessed objective abilities in problem solving using the Means-End Problem Solving Measure (MEPS: Platt & Spivack, 1975). However, since some people who are even good at solving problems in an objective term might underestimate their abilities, a gap between two abilities (i.e. real vs. perceived) causes a variety of problems. Perceptions or self-appraisal of their problem solving abilities are important as much as their objective and real abilities.

Considering this issue, Heppenr and Petersen (1982) created the Problem Solving Inventory (PSI) to assess a perception and self-appraisal of problem solving abilities. This inventory consisted of 3 subscales, such as Problem Solving Confidence (PSC), Approach-Avoidance Style (AAS), and Personal Control (PC). PSC represents a degree of confidence in problem solving ability; AAS is defined as a personal style to solve problems such as approach vs. avoidance; PC represents a degree of control in personal emotion and behavior in a process of solving problems. PSI with cognitive, behavioral, and emotional components is related to psychological adjustments (Dixon, Heppner & Anderson, 1991; Dixon, Heppner, Burnett & Lips, 1993). Yang and Clum (1996) hypothesized a theoretical model in which suicidal ideation was influ-

enced by negative life events and furthermore, the relation could be mediated by cognitive factors (i.e. problem solving). Recently, Chang (2002) found that social problems solving partially mediated a relation between suicidal ideation and daily stress. On the basis of the Diathesis Stress model, Park (2004b) examined an effect of problem solving in the relation of negative daily stress and suicidal ideation in adolescents. According to her finding, adolescents who had negative daily stress and perceived their problem solving ineffective were more likely to experience suicidal ideation than those who had stress but didn't perceive it ineffective or those who didn't have stress but perceived it ineffective.

In sum, prior studies showed that cognitive factors, in particular problem solving, play a key role in the prediction of suicidal ideation, suicidal attempts, or especially suicide. As effects of problem solving are well known, researchers who were interested in prevention or intervention have considered problems solving as a key factor. However, as a limitation of previous studies, effect of problem solving has been examined without consideration of depression in spite of one of the strongest predictors.

A long history of studies has shown that suicidal ideation or suicidal attempts was associated with depression. Recently, Cho et al. (2002) conducted a study of suicidal ideation and attempts with 2,203 middle or high school students. The results showed that depressed adolescents attempted suicide three times as frequently as those who were not depressed. In a community sample of abused adolescents, Kaplan et al. (1999) found that depression was the strongest predictor of suicidal ideation and its likelihood among family cohesion, perceived academic performance, disruptive disorder, anxiety disorder and so on. People who were not adequately equipped with problem solving skills or did not develop coping abilities tend to feel depressed or hopeless, leading to suicidal behavior (Rotheram-Borus, Trautman, Dopkins & Shrout, 1990; Yang & Clum; 1994). In a recent meta-analysis study con-

ducted by Speckens and Hawton (2005), most of these studies, which compared adolescent patients with suicide attempts versus either nonsuicidal psychiatric or normal controls, found evidence for problem-solving deficits in the attempters; however, few of the differences remain after controlling for depression and/or hopelessness. They speculate a hypothesis that deficiencies in problem-solving skills lead to depression when adolescents are faced by adversity and hence to suicidal behavior. Based on these results, a possible mediation effect of depression merits exploration in relation of cognitive variables (i.e. problem solving) and suicidal behavior.

As reviewed before, problem solving was associated with or significantly predicted both depression and suicidal ideation. In line with the Diathesis-Stress theory, some individuals were born with vulnerability, contributing to the development of depression or suicidal ideation. Previous research has not taken into a consideration of depression in relation between problem solving and suicidal behavior. More importantly, although problem solving, depression and suicidal behavior are hypothesized to relate to each other, possible relationships or paths of influences have been rarely examined so far. Therefore, purposes of the present study were (a) to re-verify effects of problem solving and depression on suicidal ideation and (b) to explore possible relationships between them. Furthermore, we will explore paths where depression mediated the relation of problem solving to suicidal ideation. We would suggest implications for preventive trials of suicidal attempts or suicide commitment, more serious types of suicidal behavior.

## **II . Methods**

### **1. Participants**

Four hundred and nine students in high schools participated in

the current study. Their schools were located in Seoul. Among them, 31 students were excluded from data analysis because their responses were not reliable or because of multiple missing variables. As a result, 378 students (Female=207, Male=171) were included for further analyses. They were comprised of 168 (44.4%) in Grade 1 or 210 (55.6%) in Grade 2 of high school. Their average age was 16.75 years old ( $SD = 1.10$  years).

## 2. Measures

**Problem Solving Inventory.** Problem Solving Inventory (PSI) created by Heppner and Petersen (1982) was used to assess perceptions of their problem solving behaviors and attitudes toward problem solving. This inventory was translated by the authors of the current study. PSI consisted of 32 items and three sub-scales such as Problem Solving Confidence (PSC), Approach-Avoidance Style (AAS) and Personal Control (PC). Each item was responded on a 6-point rating scale, with low scores representing perceptions of problem solving as effective whereas high scores representing ones as ineffective. When a test-retest was administered 2 weeks in an interval, test-retest coefficients were .83-.89. Reliability coefficients as Cronbach alpha ranged from .72 to .90. In the current study, reliability coefficients were .80 for the entire scale, .79 for PSC, .75 for AAS, and .65 for PC.

**Beck Depression Inventory.** Beck Depression Inventory-Korean (BDI-K) was used to assess a degree of how students feel depressed. BDI-K consisted of 21 items. Each item was responded on a 4-point rating scale from 0 to 3. Cronbach alpha coefficients were .98 in Lee and Song's study (1991) and .90 in the current study.

**Scale for Suicidal Ideation.** Scale for Suicidal Ideation (SSI) created by Beck, Kovacs and Weissman (1979) was a diagnostic

instrument which a clinician assesses a degree of suicidal ideation in an interview format. This instrument comprises 19 items and each item is rated on a 4-point rating scale (0-3). We used a self-report instrument transformed by Shin, Park, Oh, and Kim (1990). Cronbach  $\alpha$  was .81 in the previous study and .91 in the current study.

### 3. Data Analysis

Correlation analysis was utilized to explore associations between suicidal ideation, problem solving, and depression. A hierarchical regression analysis was also used to decide a degree of how problem solving and depression predict suicidal ideation. Furthermore, Structure Equation Modeling analyses with Maximum Likelihood estimator used to validate hypothetical mediation models of depression in relation to problem solving and suicidal ideation. Criteria indices of model fitness were Goodness of Fit Index (GFI), Adjusted Good of Fit Index (AGFI), Root Mean Square Error of Approximation: (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI), or Incremental Fit of Index (IFI).

## III. Results

### Correlations between Suicidal Ideation, Problem Solving and Depression

Table 1 shows associations between suicidal ideation, problem solving and depression

Problem Solving was significantly and positively related to Suicidal Ideation. Among three sub-scales of PSI, Problem Solving Competence only was positively related to suicidal ideation. Depression was positively associated with Suicidal Ideation. In addition, PSI was positively related to depression. Three subscales of PSI were positively associated with depression.

**Table 1.** Correlations between Suicidal Ideation, Problem Solving, and Depression

	1	2	3	4	5	6
1. Suicidal Ideation						
2. PSI total	.15**					
3. PSC	.18**	.83***				
4. AAS	.07	.81***	.50***			
5. PC	.10	.48***	.30***	.05		
6. Depression	.65***	.26***	.28***	.10*	.22***	
Mean	6.03	103.52	34.32	49.83	19.38	11.46
SD	6.71	13.70	6.20	7.87	4.41	9.54

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

- PSC: Problem Solving Confidence
- AAS: Approach-Avoidance Style
- PC: Personal Control

### Hierarchical Regression Analysis

A hierarchical regression analysis result showed that both problem solving and depression significantly predicted suicidal ideation. In Step 1, Problem solving explained 2.3% in the variance of Suicidal Ideation ( $\beta = .152$ ,  $p < .01$ ). In Step 2, depression explained additional 40.2% in the variance of Suicidal Ideation. Notably, problems solving became non-significant when depression entered in the model. This result supported a mediation effect of depression in relation of problem solving and suicidal ideation.

A Sobel test was conducted to formally examine the significance of the indirect effect of depression on the relationship between problem solving and suicidal ideation. A Sobel test result indicated mediation effect of depression was significant ( $z = 4.86$ ,  $p < .001$ ).

**Table 2.** Hierarchical Regression Result Predicting Suicidal Ideation from Problem Solving and Depression.

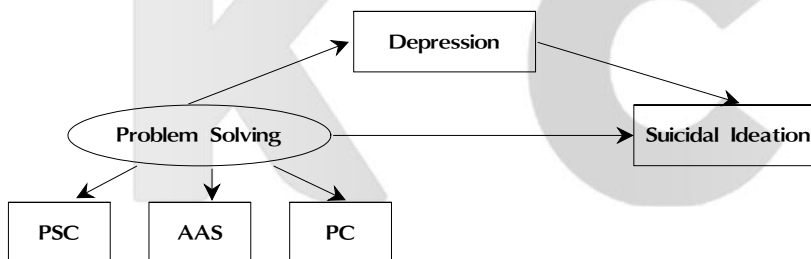
	Predictor	B	$\beta$	t
Step 1	PSI total	.074	.152	2.97**
$R^2 = .023^{**}$ ,				
Step 2	PSI total	.008	.017	.41
	Depression	.461	.656	16.19***
$R^2 = .425^{***}$ , $\Delta R^2 = .402^{***}$				

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

### Structure Equation Modeling Analysis

Structure Equation Modeling analyses were used to test a mediation effect of depression in the relation of problem solving and suicidal ideation. Based on prior research, a hypothetical model was drawn as shown in Figure 1.

**Figure 1.** A Partial Mediation Model of Depression in the Relation of Problem Solving and Suicidal Ideation



AMOS result showed that this model did not fit, even though several indices were relatively good. Given the fact that  $X^2$  test is over-sensitive to sample size,  $X^2/df$  as a complementary index was used but it was still not good enough to accept. Since it should be lower than 2 (strictly) or 3 (leniently),  $X^2/df$  value of this model was not acceptable.

A full mediation model of depression as an alternative model was tested as seen in Figure 2. AMOS result showed that this model fit well. As usual, GFI, AGFI, NFI, and IFI are judged as good if they are .90 or higher. Although RMSEA are considered as good if it is .05 or less, RMSEA less than .08 are fairly good. Compared to the previous model, the full mediation model of depression is better and more acceptable.

**Table 3.** Comparisons of two mediation models: Goodness fit statistics

	$X^2$	$X^2/df$	GFI	AGFI	CFI	NFI	IFI	RMSEA
Model 1	$X^2=14.835,$ $dfs=4, p=.00$	3.70	.98	.94	.97	.96	.97	.08
Model 2	$X^2=14.842,$ $dfs=5, p=.00$	2.96	.99	.95	.98	.96	.98	.07

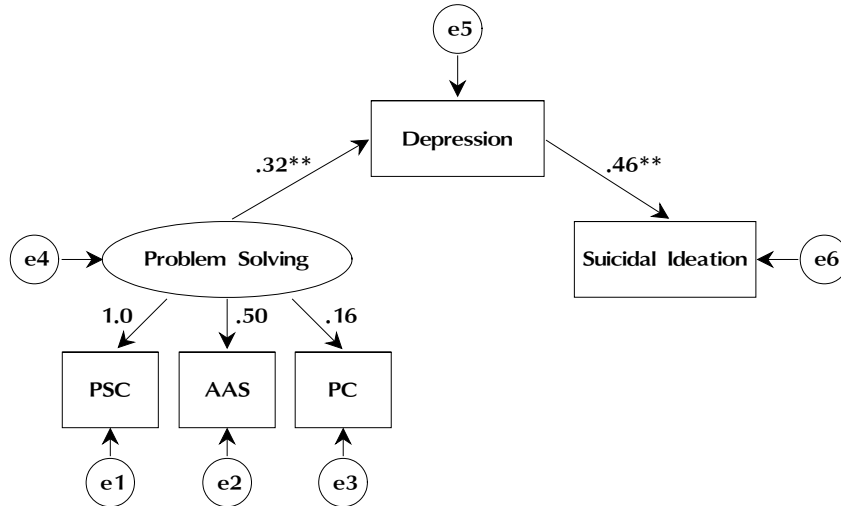
Model 1: Partial mediation model;

Model 2: Full mediation model

Alternatively, because Model 2 was nested within the Model 1, chi-square differences tests could be conducted to select a better model (Browne & Cudeck, 1993). A non-significant change in model chi-square ( $\Delta X^2 = .007, \Delta df = 1$ ) emerged, when deleting the path of direct effect of problem solving on suicidal ideation. According to parsimony principle, we concluded that Model 1 was better than Model 2.

As seen in Figure 2, the path coefficient from problem solving to depression was .32 ( $p < .01$ ) and that from depression to suicidal ideation was .46 ( $p < .001$ ). According to these results, we concluded that depression fully mediated the relation between problem solving and suicidal ideation.

**Figure 2.** full mediation model of depression in the relation of problem solving and suicidal ideation



#### IV. Discussion

Adolescence is a transition period of identity formation in development and youths in this period are also highly sensitive to a variety of changes at home as well as at school. As well known, adolescents have suffered from a variety of difficulties such as psychological maladjustment and behavioral problems. Currently, suicide in adolescents has emerged as one of the most serious social problems. Incredibly many studies on suicide have been conducted past decades and most studies have targeted adults. A few studies were done with adolescents, with highlighting youth participants of the current study. Consistent with previous studies, problem solving and depression significantly predicted suicidal ideation and notably examined potential paths which three variables influenced on each other. We evaluated a hypothesis that de-

pression would mediate the relation between problem solving and suicidal ideation.

Suicidal Ideation was positively correlated with Problem Solving Confidence, one of three subscales of PSI as well as depression. The more ineffective and unconfident problems solving was perceived, the severer depression was and more frequently suicidal ideation occurred. Both problem solving and depression predicted suicidal ideation. Moreover, the problem solving confidence was the significant predictor of suicidal ideation. In particular, depression was the strongest predictor of suicidal ideation since it explained 40.2% of the variance of suicidal ideation after controlling for problem solving. Regression results suggest that depression would mediate the relation between problem solving and suicidal ideation since problem solving which was significant in Step 1 became non-significant when depression entered in Step 2. A Sobel test revealed that the mediation effect of depression was significant.

In line with the regression analysis, a SEM analysis with AMOS was conducted to test a mediation model of depression in the relation of problem solving and suicidal ideation. The first hypothetical model, a partial mediation model of depression did not fit in terms of  $X^2/df$  index as an alternative of  $X^2$ . In the model, significant was the path where problem solving impacted depression and then depression influenced on suicidal ideation, however non-significant was the path that problem solving directly impacted suicidal ideation. On the basis of this finding, a full mediation model of depression as an alternative was speculated. The full mediation model did fit better in regard to goodness of fit statistics. Therefore, we concluded that depression fully mediated the relation of problem solving and suicidal ideation. The results showed perceptions of their problem solving as ineffective cause depressed feelings and then such feelings are more likely to ruminate about suicide.

In a sample of college students, Lerner and Clum (1990) conducted a study to compare the effectiveness of two interventions: problem solving or support. They found that both interventions were equally effective in reduction of suicidal ideation. However a 3-month follow-up showed that participants in the problem solving intervention kept decreases in depression, hopelessness, and loneliness. They suggested that depression, hopelessness, or loneliness should be considered as risk factors of suicidal behavior. Consistent with our findings, Reinencke, DuBois, and Schultz (2001) found that both depression and hopelessness fully mediated the relation of social problem solving and suicidal ideation in a sample of adolescent inpatients. Problem Orientation, one of Social Problem Solving Inventory-Revised (SPSI-R) subscales, was related to depression and suicidal ideation. According to Nezu and Perri (1989), PSC and PC of PSI were similar to Problem Orientation of SPSI-R in nature. Not surprisingly, PSC was significantly related to depression and suicidal ideation. These findings confirmed a possibility that those who were unconfident enough in their problem solving tend to be depressed and furthermore more likely to consider suicide. According to Baumeister's theory (1990) where suicidal impulses were defined as escape from self, those who experienced a gap between expected situation and real situation tend to perceive themselves as blameworthy or evaluate themselves negatively. In a process of internalization, they have experienced excessive awareness of themselves, resulting in negative emotions (i.e. depression). They want to get free from concerns about themselves and try to escape from status of cognitive deconstruction. As such efforts fail, they choose a suicide attempt, looking for a stronger method. Baumeister's explanation supports our findings.

Although it is a well-known strong predictor of suicidal ideation, depression has been less focused on a role it played in relation of problem solving. The current study explored the relation-

ships among three variables and more importantly confirmed a full mediation effect of depression using the SEM analysis. The full mediation model shows that a path from problem solving to depression was advanced to the other from depression to suicidal ideation. In order to prevent suicidal behavior such as suicidal ideation, it is essential to inhibit development of depression and provide depressed people with an adequate therapeutic intervention. Previous studies as well as the present research found that problem solving was related to depression. Adolescents who don't feel confidence in their problem solving are more likely to feel depression, leading to development of suicidal ideation. It is crucial to improve problem solving ability and furthermore important to modify their perceptions about problem solving.

A cognitive-behavioral therapy contributes to development of positive beliefs and confidence in their problem solving. Since it was developed on the basis of Beck's cognitive theory, BDI used in the current study included many items reflecting a cognitive component of depression. A therapeutic intervention focusing on the cognitive component would be helpful to prevent depression. Adolescents who are more vulnerable to depressive tendencies in nature of development should be taken a great care of when they appeal to feelings of depression even to a mild degree.

In spite of crucial findings, the current study has several limitations as follows. First, since our data were gathered at one time point (i.e. a cross-sectional research design), relationships among three variables should be cautiously understood even though the mediation effect of depression was significant. Future studies would obtain greater benefits from a set of prospective longitudinal data wherecausal relations can be more clearly explained. Second, gender differences were not considered in the current study. Given the facts that females are more likely to be depressed than males and that depression is a strong predictor of suicidal ideation in female adolescents whereas alcohol depend-

ence, not depression, significantly predict that of male adolescents, future studies should examine gender differences in the confirmed model and confirm observed relationships separately for males and females. Besides problem solving and depression, potential variables that impact suicidal ideation were not controlled, such as past experiences of suicidal attempts, severity in depression symptoms, interpersonal difficulties, or academic performance. Future research should be expanded into more complex and sophisticated models, including several potential predictors of suicidal ideation.

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