

Relation of Anger and Anger Expressions in Adolescents: Focusing on the Mediating Effect of Problem Solving Ability

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청소년 분노와 분노표현유형 관계분석 연구: 문제해결능력의 매개효과를 중심으로

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Abstract Recent studies have investigated anger or anger-related problems in adolescents from various perspectives. However, understanding of anger expression types or the role of mediating variables in relation to anger and anger expressions have been disregarded. The purpose of this research was to understand the relationships between adolescents' anger, problem solving ability, and three types of anger expressions (anger-in, anger-out, anger-control) and to focus on the mediator function of problem-solving ability. Participants comprised 596 adolescents (283 males and 313 females). Anger was significantly related to all three types of anger expressions. Adolescents who showed high anger levels tended to indicate high anger-in and anger-out expressions but low anger-control expression, while controlling for age and gender. The findings also provided evidence for the mediator role of problem-solving ability on the relationship between anger and anger-control expression. From the results of this study suggestions and limitations were also discussed.

Key Words : Convergence, Anger, Problem Solving Ability, Anger Expressions Type, Mediator, Adolescents

요약 최근 청소년 분노 및 분노와 관련된 문제행동에 관한 연구들이 다양하게 진행되고 있다. 하지만 분노표현 방식에 대한 이해나 청소년 분노와 분노표현 관계에서 매개효과에 대한 연구는 거의 부재하다. 본 연구는 청소년의 분노, 문제해결능력, 분노표현유형(분노억제, 분노표출, 분노통제)과의 관계를 증명하고 이 관계에서 문제해결능력의 매개효과를 검증하고자 한다. 연구분석을 위해 총 596명(남학생 283명, 여학생 313명)의 청소년설문이 활용되었다. 연구결과 분노는 3가지 분노유형 모두와 유의미한 관계가 있음이 증명되었다. 분노가 높을수록 분노억제와 분노표출이 증가하였으나, 분노통제는 감소하는 것으로 나타났다. 분노와 분노표현유형과의 관계에서 문제해결의 매개효과 검증결과, 분노와 분노통제 관계에서만 문제해결의 매개효과가 증명되었다. 이러한 연구결과를 바탕으로 제언과 연구한계 등을 논의하였다.

주제어 : 융복합, 분노, 문제해결능력, 분노표현유형, 매개변수, 청소년

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1. Introduction

Anger is one of the basic human emotions necessary to protect ourselves from external physical and psychological harms and to defend ourselves in response to such external attacks[1]. People who feel angry generally cope with the situation by attempting to negotiate to protect ourselves or by choosing ways to solve the problems[2]. In other words, anger is the normal emotion needed to protect ourselves and to survive by solving and adapting to problems. However, anger can also cause psychological stress or psychopathic symptoms, and when accompanied by aggressive behavior, it can cause aggression or interpersonal problems with others[2].

Although anger has a positive role, the reason for experiencing anger negatively is related to anger expression. Not only expressing anger with aggressive words or actions toward others but refraining or withholding from feelings of anger and avoiding expressing those feelings can lead to negative consequences. Spielberger, Jabobs, Russell, and Crane divided anger expression types into anger-in, anger-out and anger-control expressions[3]. Anger-in and anger-out expressions are classified as a dysfunctional anger expression, whereas anger-control expression is classified as a functional anger expression. A dysfunctional anger expression, such as anger-in or anger-out expression is associated with problems such as physical illness, drug abuse, psychological problems, aggressive problem behavior, and lack of sleep[4-7]. Adolescents who have not yet established how to express anger or deal correctly with their anger might experience anger more negatively. It has been reported that the anger in adolescents is a major cause of individual problems as well as murder, suicide and accidents[8,9]. Anger in adolescents also causes social problem behaviors, including substance abuse, school maladjustment

and violent crime[9-11].

Adolescents with dysfunctional anger expression exhibit low impulse control but high anger, impulse and excitability[12]. Previous studies have shown that these adolescents have externalization problems such as misconducts and aggressive behaviors against others as well as internalization problems such as psychological problems or social isolation. Externalization problem behaviors are related to anger-out expression[13,14]. Aggressive behaviors towards others are highly likely to lead to peer harassment and violent behaviors in school[15,16], and can be a cause of cyber misconducts like cyberbullying[17,18]. In addition, repetitive offensive behaviors caused by anger expression hinder social support, causing interpersonal problems and difficulties to form social relationship[19,20]. Anger-in expression can be a cause of internalization problems such as depression, anxiety, and social atrophy[21,22]. When suppressing anger, depression mediates anger, which negatively affects the adolescent's interpersonal relationships[23]. Experiencing personal defeat and helplessness due to internalized depression fail to form an equal relationship with others[24], and self-harm behaviors are also repeated to distract attention from uncomfortable emotions[25].

Dysfunctional anger expressions of adolescents lead to negative experiences of anger, can cause behavioral problems, and undermine social relationships. To protect adolescents and establish social well-beings of them, it is necessary to explore intervention factors that can reduce dysfunctional anger expressions and enhance anger control. Programs to control anger for adolescents focus on anger emotions based on dysfunctional anger expressions and psychological characteristics, and include cognitive approaches, use of physical relaxation, and training of interpersonal skills[26]. Anger expressions of adolescents can also be differentiated by the ways of coping with

problem situations[27].

Taken together, the purpose of this study was to examine how anger and problem solving ability affect anger expressions in adolescents and how problem solving ability mediates between anger and anger expressions in adolescents. The research questions are as follows.

1. Do anger and problem-solving ability affect anger expressions?
2. Does the problem-solving ability mediate the relationship between anger and anger expressions?
 - 2.1 Is problem-solving ability mediated in the relationship between anger and anger-in?
 - 2.2 Is problem-solving ability mediated in the relationship between anger and anger-out?
 - 2.3 Is problem-solving ability mediated in the relationship between anger and anger control?

2. Literature Review

2.1 Relation of anger and anger expression

As mentioned earlier, anger is an emotion that is commonly experienced and has a unique function. Anger serves as a part of the defense system that protects ourselves from external threats and helps us to survive from attacks[1,2]. Anger organizes behaviors to respond to external stimuli and has a positive function of reducing anxiety by revealing conflicts[2]. Expressing stressful hostility or anger appropriately and effectively may also help to prevent cardiovascular disease such as coronary heart disease[28,29]. Inappropriate and frequent anger accompanied with high anger disposition and verbal or physical attacks, however, can undermine interpersonal relationships[30,31]. Negation and avoidance of anger itself may cause psychological problems such as anxiety and depression[32]. Comprehensive definitions of anger indicate that anger differs by a degree of experiences and a degree of expressions,

and that a degree of recognition of anger is different for each individual.

Spielberger et al. divided the disposition of anger into state anger and trait anger[33]. State anger refers to the disposition of anger at the time of measuring anger and trait anger refers to the individual's degree of difference in the tendency to experience anger. When measuring state anger and trait anger, a higher state anger means a higher disposition of anger on a daily level and a higher trait anger means more intense anger at a given stimulus. Both state anger and trait anger measure the disposition of anger experienced by an individual, but have limitations that do not fully reflect the various characteristics of anger such as physiological responses, cognitive processes, and emotional experiences[34].

Novaco defined anger as a subjective emotional state involving physiological arousal and hostile cognition[35], and Namgung emphasized how to interpret external situations and stimuli as an important variable of anger[36]. Novaco divided anger into arousal, cognitive, and behavioral domains[35]. Later, Novaco added control domain and measured anger in a total of four domains[37]. The arousal domain is divided into intensity level of anger, duration of anger, degree of physical tension and degree of excitement, and measures physical and emotional changes of an individual when experiencing anger. The cognitive domain is divided into a definition of stimulus that causes anger, a rumination as the degree of attention to anger stimulation, a hostile attitude as a respond to anger, and a doubt recognizing threats of others or situations, and measures cognitive experiences when encountering anger. In the behavioral domain, the degree of violent behaviors of the individual while experiencing anger was measured by impulsive, verbal attack, physical confrontation, and indirect expression. In the control domain, the measures were divided into

cognitive responses to control anger, conscious equanimity to calm anger, and behavioral control to govern aggressive behaviors. According to Novaco, anger has an individual's physiological, cognitive, and behavioral processes for external stimuli, and anger control means a situation where appropriate control is made in the process of recognizing physiological changes and emotional excitement, in the cognitive process of others and situations, and in the process of expressing anger[35,37]. It also has been found that cognitive factors for interpreting stimuli, evaluating emotional experiences, and establishing coping strategies are important for adolescents to control and process anger[38].

Dysfunctional anger expressions have been associated with various problem behaviors. Internalization problems such as depression can be caused by anger-in and anger-out expressions and externalization problems such as violent behaviors can be caused by anger-out expression[13]. Kim et al. showed that the lower the anger control and higher anger-in expression, the greater the risk of depression[21]. It also has been found that anger-in or anger-out expression can cause psychological maladjustment such as social atrophy, depression, anxiety, misconduct, and aggression of adolescents[39].

It has been found that the anger level of adolescents has the greatest impact on anger expression types by showing a positive correlation with anger-in and anger-out, and a negative correlation with anger control[40]. It also has been shown that adolescents' level of recognizing anger was correlated with anger expression types, and that anger levels had a direct effect on anger expression types[41]. Moreover, anger thinking has been shown to have an effect on anger expression. Seo and Kwon proposed that anger occurs after giving meaning to anger-inducing events and interpreting them, and divided the thinking process into primary and secondary anger

thinking[42]. It was shown that lower factors of secondary anger thinking, such as others' rebellion/retaliation, helplessness, anger control/constructive coping, were all correlated with anger expression types. In a similar vein, primary and secondary anger thinking were found to affect anger-in and anger-out, but not anger control expression[24].

It also has been found that there were gender and age differences in adolescents' anger experiences, anger expressions, and aggressive behaviors[43-45]. The results in which anger expression predicted significantly aggression among male adolescents suggests that gender appears to be an important factor in anger expression types[43]. Wong, Konishi, and Zhao found that male students were more likely to control their outward anger as compared with female students and older students suppressed more their anger than younger ones[44]. Park et al. also found gender and age differences in Korean adolescents' anger expression. Male students tended to show higher levels of anger-out and anger-control than female students and high school students tended to show higher levels of anger-in, anger-out and anger-control than middle school students[45]. Since the purpose of this study was to investigate relation of anger and anger expression, we controlled gender and age factor that could have a significant role in adolescents' anger and anger expression.

Taken together, we can consider how anger level and anger thinking affect the anger expression types, and especially if they have a direct effect on dysfunctional anger expressions such as anger-in and anger-out expression.

2.2 Relation of problem solving ability, anger level, and anger expression

Heppner and Krauskopf described a problem as a situation that corresponds to an individual's internal or external needs, and problem solving as a purpose-oriented activity including

behavior, cognition, and definitional manipulation with the purpose of meeting those needs in that situation[46]. Heppner and Petersen developed Problem Solving Inventory (PSI) to find out not only the types of problem solving for personal problems, such as hanging out with friends, feeling depression, and choosing a job, but how confident they are in perceiving and solving problems[47].

Compared to people who solve problems effectively, those who fail to solve problems effectively show anxiety and lack of self-confidence, and do not understand their expectations of others and also show emotional problems and psychological maladjustments[48]. Our own perception of our problem-solving ability affects how we approach and deal with the problems we face in our daily lives[46]. Social problem solving for interpersonal and personal problems is a purposeful, rational and effort-based coping process in stressful situations[49]. Chow, Chiu, Wong indicated that psychological problems are related to emotional regulation and that social problem solving plays a moderating role between emotional regulation and psychological problems[50]. Social problem solving played a mediating role in adolescents' emotional control and anger[51], and a tendency to solve problems negatively played a mediating role in the relationship with self-esteem and anger[52]. Adolescents' inappropriate problem solving ability is related to aggressive behaviors [53], and training social problem solving ability has helped to reduce aggressive behaviors[54]. In a study examining the relationship of anger expression and social problem solving, problem solving ability was negatively correlated with state anger, anger-in expression, but positively correlated with anger control[55].

Our own attitude to solve problems is formed by past experiences and forms a tendency based on those experiences. That is, we positively approach a problem we have solved in the past

and focus on actions to solve the problem, but we show negative emotions and attitude to avoid problems where we have failed[56]. Following the attitude of responding according to the problem situation, the problem-solving skill phase is divided into a series of processes. The first process is to specify the problem to solve, then to list the alternative solutions. Next is to choose the most appropriate one among the alternatives by anticipating the results after the problem is solved. The last process is to evaluate the results when solving the problem.[57] According to those previous studies, it can be assumed that in order for adolescents to solve anger problems, their attitudes to anger problems are formed based on their experiences in solving anger problems, and specification for solving anger problems and selection of actions are made. In other words, the anger expression of adolescents may vary depending on the degree of self-awareness of anger problem solving ability based on past experiences.

It is hard to find researches directly dealing with problem solving ability and anger in Korea, but the effect of problem solving ability can be inferred from studies related to other psychological characteristics. Song and Lim found that the lower the self-confidence of problem solving, the higher the depression and the higher the avoidance-centered coping style, and that the avoidance-centered coping style was positively correlated with depression[56]. Park found that the problem solving ability of adolescents had a mediating effect on the relationship between negative emotions and suicide thinking caused by child abuse experiences such as neglect, parental violence and sexual violence[58]. In addition, self-perception of problem solving was shown as a moderating variable in the relationship between negative living stress and depression. Depression caused by negative living stress was found to be lower with higher positive

self-perception of problem solving.[59]

Ihm presented a model of the relationship between anger experiences and anger thinking in adolescents, and thinking plays a role between anger-induced stimuli and anger experiences and between anger experiences and anger expression[41]. It has been emphasized that these thinking process can affect anger experiences and anger expression, and cognitive problem solving ability to interpret and deal with problems is one of important factors in controlling anger. Moon and Eisler argued that cognitive problem solving ability, social skills to form relationships with others and express themselves, and empathy to understand others' situations and feelings are elements of anger control, and that the person who controls the expression of anger does not express the anger impulsively, but in the right way at the right time[60].

In sum, it can be predicted that the anger experiences of adolescents influence the attitudes of approaching anger problem solving and the behaviors chosen for problem solving, and that anger expression of adolescents can be formed based on those experiences. Thus, we predicted the possible effect of problem solving ability of adolescents on the relationship between anger levels and anger expression, and examined a mediating effect of problem solving ability because the problem solving ability reflects the individual's cognitive process formed based on experiences.

3. Method

3.1 The study model

The proposed study aimed to analyze the following. First, the study attempted to investigate relationships between anger, problem solving ability, and three types of anger expressions (anger-in, anger-out, and anger-control) while

controlling for age and gender. In addition, the study attempted to investigate a mediating effect of problem solving on the relationships between anger and three types of anger expressions among adolescents. For this purpose, we followed Baron and Kenny[61]'s three step procedures as shown below in Fig. 1. First, independent variable predicts the dependent variable, second, independent variable predicts the mediator, and third, independent variable and mediator predict the dependent variable. In order to test the mediating effect, all three steps should be statistically significant.

3.2 Participants

Participants were students from two high schools and two middle schools in Chungbuk province. The study was conducted between May to July, 2017 and approved by the IRB of Dankook University.

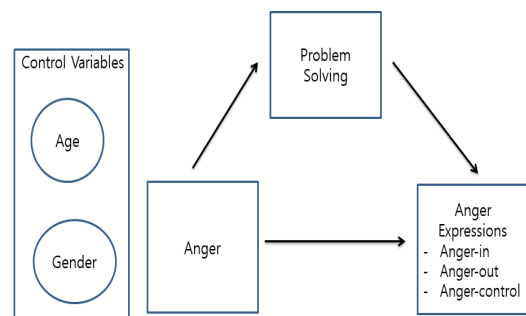


Fig. 1. The study model

A total of 680 students were consented for the study. Of those students, 84 students provided improper consents or did not complete the survey. Therefore, a total of 596 survey was analyzed for the study.

3.3 Measurements

3.3.1 Novaco Anger Scale

The original Novaco consisted of 90 items to measure a person's disposition for anger[35]. The

study used a modified version of Novaco Anger Scale[36]. The scale is a self-reported questionnaire with cognitive, arousal, and behavioral dimensions that constitute 48 items. Each dimension consists of 16 items. The scale used a three-point Likert type, ranging from 1 (almost never) to 3 (almost always). A sample item is, "Once something makes me angry, I keep thinking about it." Overall scale was used to test participants' disposition for anger. Higher score indicates higher disposition for anger. Overall reliability of the 48-item scale is Cronbach's $\alpha=0.93$.

3.3.2 Personal Problem-Solving Inventory

The Personal Problem Solving Inventory is a 35-item Likert-type scale designed to measure problem solving ability and problem-solving style[47]. The scale contains three dimensions: problem solving confidence, approach-avoidance style, and personal control. We used a translated and modified Korean version in this study[62]. The responses to the items ranged from 1(strongly agree) to 6(strongly disagree). A sample item is, "When I make plans to solve a problem, I am almost certain that I can make them work." Higher score indicates the clearer perceptions of problem solving. Overall 35-item scale was used to investigate the problem solving ability. The reliability of the scale is Cronbach's $\alpha=0.91$.

3.3.3 The adolescent's STAXI-K

State-trait Anger Expression Inventory(STAXI) was originally developed by Spieberger[63]. We used a modified Korean version, developed by Lee and Cho in this study[64]. STAXI-K is a self-reported 44-item Likert-type scale ranging from 1(never) to 4(always). Although the scale contains two dimensions: state-trait anger (ten items each) and anger expressions(anger-in, anger-out, and anger-control, eight items each), we only used anger expressions(anger-in, anger-out, and anger-control. Thus, the 24-item

scale was used to investigate the anger expressions in this study. Anger-in illustrates suppressing or holding in anger feelings. A sample item of Anger-in is, "I keep things in." Anger-out illustrates expression of angry feeling toward other people or objects. A sample item of Anger-out is, "I argue with others." Anger-control explains controlling angry feelings so that it prevents expression of anger toward others or objects. A sample item of Anger-control is, "I control my temper." Overall reliability of the scale was Cronbach's $\alpha=0.75$ (anger-in=0.63, anger-out=0.73, anger-control=0.87).

3.3.4 Demographic Information

The questionnaire included questions regarding gender, age, school grade, and household income. These variables provide specific characteristics of the sample. Since age and gender differences have been found in adolescents' anger and anger expression[43-45], age and gender variables were controlled for hypothesis testing.

4. Results

4.1 Descriptive Analysis

Descriptive statistics for the research variables are presented in Table 1. A total of 596 adolescents was analyzed for the study. There were 283(47.5%) male and 313(52.5%) female participants with an average age of 15.09(SD=1.55). The anger average score was 1.61(between "almost never" and "sometimes"). The problem solving average score was 3.84(between "slightly agree" and "slightly disagree"). Among three types of anger expressions, the average of anger-in was 1.91(between "slightly" and "mostly"). The average of anger-out was 1.72(between "slightly" and "mostly"). The average of anger-control was

higher than other anger expressions ($M=2.42$, between “mostly” and “always”).

Table 1. Descriptive Findings of Variables

Variables	Sub scales	Frequency	Mean(SD)
Gender	Male	283(47.5%)	
	Female	313(52.5%)	
Age			15.09(1.55)
Anger			1.61(0.30)
Problem Solving			3.84(0.55)
Anger Expressions	Anger-in		1.91(0.46)
	Anger out		1.72(0.45)
	Anger control		2.42(0.61)

4.2 Bivariate Analyses

For further analyses, gender was transformed to Dummy variable(male=1, female=0). Anger-in was significantly correlated with anger ($r=0.51$, $p<.001$) and problem solving ($r=-0.18$, $p<.001$) (see Table 2). The participants who indicated high anger-in expression also showed high anger or low problem solving. Anger-out was significantly correlated with anger ($r=0.58$, $p<.001$) and anger-in($r=0.34$, $p<.001$). The participants who indicated high anger-out expression showed high anger or high anger-in expression. Anger-control was significantly correlated with gender($r=0.13$, $p=0.01$), anger($r=-0.24$, $p<.001$), problem solving($r=0.37$, $p<.001$), anger-in($r=0.23$, $p<.001$), and anger-out($r=-0.24$, $p<.001$). The participants who indicated high anger control showed male, high problem solving ability, high anger-in expression. Moreover, the participants who indicated high anger control showed low anger or low anger-out expression.

4.3 Predicting anger-in, anger-out, and anger-control

4.3.1 Predicting anger-in

Hierarchical multiple regression was used to test whether the independent variables of anger and problem solving would predict the outcome of anger-in, when age and gender were controlled.

Table 2. Pearson's Correlation Coefficient on Research Variables

	gender	age	anger	problem solving	anger in	anger out	anger control
gender	1	-.03	-.06	.12**	.00	.11**	.13**
age		1	.01	.08	-.04	-.07	-.01
anger			1	-.23**	.51**	.58**	-.24**
problem solving				1	-.18**	-.07	.37**
anger in					1	.34**	.23**
anger out						1	-.24**
anger control							1

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

As shown in Table 3, two demographic variables explained only 0.1% of the variance in anger-in, $F=0.42$, $p=0.66$. At step 2, when anger and problem solving were entered, the model explained an additional 26% of the variance, $F=53.17$, $p<.001$. However, only anger remained a strong predictor of anger-in expression($\beta=0.50$, $p<.001$). Participants with higher disposition to anger showed that they reported higher anger-in expression. Problem solving was not a statistically significant predictor of anger-in expression.

Table 3. Predicting anger-in

Model	Variables	B	β	F	F/Inc	R ²	R ² /Inc
1				.421	.66	.001	.001
	Age	-.005	-.005				
	Gender	-.01	-.04			.17	.04
2				53.17	<.001	.26	.26
	Anger	.76	.50***				
	Problem Solving	-.05	-.06				

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

4.3.2 Predicting anger-out

As shown in Table 4, two demographic variables explained 2% of the variance in anger-out, $F=5.11$, $p=.006$. Younger adolescents tended to show higher anger-out expression than older adolescents. At step two, when anger and

problem solving were entered, the model explained an additional 26% of the variance, $F=83.19$, $p<.001$. However, only anger level remained a strong predictor of anger-in expression ($\beta=0.60$, $p<.001$). Participants with higher disposition to anger reported that they expressed more anger-out expression. Similar to the outcome of anger-in, problem solving was not a statistically significant predictor of anger-out expression.

Table 4. Predicting anger-out

Model	Variables	<i>B</i>	β	<i>F</i>	<i>F</i> _{inc}	<i>R</i> ²	<i>R</i> ² _{inc}
1				5.11	.006	.02	.02
	Age	-.10	-.11**				
	Gender	-.01	-.04				
2				83.19	<.001	.36	.34
	Anger	.90	.60***				
	Problem Solving	.05	.06				

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

4.3.3 Predicting anger-control

As shown in Table 5, two demographic variables explained 2% of the variance in anger-control, $F=5.59$, $p=.004$. Younger adolescents tended to show higher anger-control expression than their counterparts. At step two, when anger level and problem solving were entered, the model explained an additional 15% of the variance, $F=30.58$, $p<.001$. Unlike to previous results, anger ($\beta=-.16$, $p<.001$) and problem solving ($\beta=0.33$, $p<.001$) showed statistically significant relationships to anger-control expression. Participants with lower disposition to anger and higher problem solving ability reported that they expressed more anger-control expression. Problem solving was found a significant predictor of anger-control expression, unlike to anger-in and anger-out outcomes. Therefore, the mediating effect of problem solving to the relationship between anger and anger control was further analyzed.

Table 5. Predicting anger-control

Model	Variables	<i>B</i>	β	<i>F</i>	<i>F</i> _{inc}	<i>R</i> ²	<i>R</i> ² _{inc}
1				5.59	.004	.02	.02
	Age	-.17	-.14**				
	Gender	-.00	-.01				
2				30.58	<.001	.17	.15
	Anger	-.33	-.16***				
	Problem Solving	.36	.33***				

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

4.3.4 Testing a mediating effect of problem solving ability

To determine whether the association between anger and anger-control would be mediated by problem solving, a mediation analysis was performed. As shown in Table 5, anger and problem solving were found to be strong predictors of anger-control. Moreover, anger was also a strong predictor of problem solving ($\beta=-0.23$, $p<.001$), shown in Table 5.

Table 6. Analyzing a mediating effect

Baron & Kenny Steps	IVs	DVs	<i>B</i>	β	<i>F</i>
1	Anger	Anger-Control	-.48	-.23***	15.54***
2	Anger	Problem solving	-.41	-.23***	15.02***
3	Anger	Anger-Control	-.33	-.16***	30.57***
	Problem solving		.36	.33***	

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

IVs: Independent Variables, DVs: Dependent Variables

As mentioned before, Baron & Kenny's three step analyses were followed to test mediation. As shown in Table 6, first, anger was a strong predictor of anger-control ($\beta=-0.23$, $p<.001$), while controlling for age and gender. Second, anger was also shown a strong association with problem solving ($\beta=-0.23$, $p<.001$). Third, anger ($\beta=-.16$, $p<.001$) and problem solving ($\beta=0.33$, $p<.001$) were strong predictors of anger-control. Outcomes of all three analyses were statistically

significant. The mediating effect of problem solving on the association between anger and anger control is shown below in Fig. 2. In addition to Baron & Kenny steps to test a mediating effect, Sobel test was performed to assess if a mediation effect is significant. The result of Sobel test was $Z=-3.05$, $p=.002$, explaining that a mediating effect of problem solving was statistically significant.

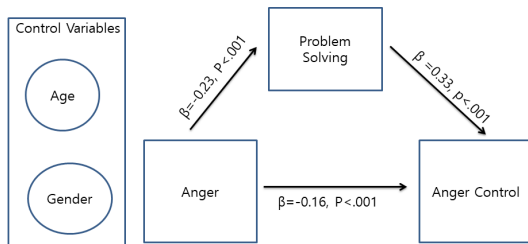


Fig. 2. Mediating effect of problem solving on the relationship between anger level and anger control

5. Discussion

Anger in adolescents is a major cause of psychological problems, social problem behaviors such as alcohol abuse, violent crimes, and so on[9,11]. Adolescents who experience anger negatively, in general, show dysfunctional anger expressions, anger-in and anger-out expression. Adolescents using dysfunctional anger expressions often show externalization such as violent behaviors and internalization problems such as depression[65]. It has been found that dysfunctional expressions are positively correlated with anger level, whereas anger control is negatively correlated with it[40]. Moreover, adolescents' inappropriate problem solving ability is related to aggressive behaviors[53], and social problem solving has been found to be related with anger expressions[55]. Thus, the purpose of this study was to examine the relationship of anger, problem solving ability, and anger expression in adolescents.

In this study, we investigated relationships between anger level and problem solving ability predicting three types of anger expressions (anger-in, anger-out, and anger-control), respectively while controlling gender and age. In addition, the mediating effect of problem solving ability in the relation between anger level and anger expressions was examined. We found that anger level was strongly associated with all three types of anger expression. Adolescents with high level of anger showed higher anger-in and anger-out expression, respectively, but lower anger control expression. Our results are consistent with previous findings[40,41], in which adolescents with high level of anger often use anger-in or anger-out expression, whereas those with low level of anger often use anger control expression. Adolescents' level of anger was found to be significantly related with problem solving ability, that is the higher the anger level, the lower the problem solving ability. Similar to the results of study[55] on relationship between social problem solving ability and anger expression, problem solving ability was negatively correlated with anger-in expression and positively correlated with anger control, but not with anger-out expression. When using anger level and problem solving ability as predictors for each anger expression, anger level significantly predicted all three anger expressions, while problem solving ability predicted only anger control expression. Thus, we found that problem solving ability mediates the relationship between anger level and anger control, in which anger level has a direct effect on anger control expression and an indirect effect of anger level mediated by problem solving ability on anger control is also shown.

We cannot say definitively that anger deteriorates cognitive thought, but Rydell et al. have shown that high levels of physiological arousal along with anger reduced individuals' ability to go through knowledge processing,

impairing the reappraisal processes that evaluate anger and decide to show aggression in part[66]. In a similar vein, we suggest that adolescents with high levels of anger might show impaired cognitive processes for problem solving, and thus lower problem solving ability yields lower anger control but does not affect on anger-in or anger-out expression that does not necessarily require cognitive process. The finding of a mediating role of problem solving ability implies that training to enhance problem solving ability might help adolescents using anger control expression, but not those using anger-in or anger-out expression. Interventions for adolescents to reduce anger and related problems must be implemented considering adolescents' attributes.

It is, however, important to note that this study has some limitations. Although a causal direction of anger level to anger control expression through problem solving ability shown in this study is supported by previous findings, a cross-sectional study is still be limited to clarify a causal effect. To compensate this limitation, a longitudinal or experimental study would be necessary in future. Second, we conducted this study using a convenience sampling method, which students from two middle schools and two high schools in one province of Korea were sampled. It is, thus, hard to generalize our findings and more diverse students from other provinces should be needed for generalization. Lastly, it is necessary to investigate other factors that can be mediated in a relationship between anger level and dysfunctional anger expressions because problem solving ability was found to be a cause of functional anger expression.

In conclusion, this study found that a relationship between anger level and anger expressions and that between anger level and problem solving ability are significant. Moreover, since problem solving ability had a mediating

role in a relationship between anger level and anger control expression, it may be possible to gain insight into factors that enhance functional anger expression, resulting reduce anger-related problems in adolescents. This study, therefore, might aid to develop intervention programs to reduce adolescents' anger level and improve appropriate anger expression.

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