EFFORTFUL CONTROL, SOCIAL INFORMATION PROCESSING, AND THE PREVENTION OF AGGRESSION IN ELEMENTARY SCHOOLS

Alan Reid Ellis

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Social Work

Chapel Hill
2012

Approved by:

Mark W. Fraser

Shenyang Guo

Andrea M. Hussong

Kathleen A. Rounds

Paul R. Smokowski

©2012
Alan Reid Ellis
ALL RIGHTS RESERVED

ABSTRACT

ALAN R. ELLIS: Effortful Control, Social Information Processing, and the Prevention of Aggression in Elementary Schools
(Under the direction of Mark W. Fraser)

Early aggression is a problem in its own right and a risk factor for further developmental problems. Although both effortful control and social information processing (SIP) skills are negatively associated with aggression and are targeted by aggression prevention programs, little is known about the relation between them or about their joint relation with aggression. Further, effortful control is often measured poorly in aggression prevention studies. This dissertation reports findings from three studies of effortful control, SIP, and aggression. Data were collected from 691 boys and girls at 10 North Carolina schools during the third and fourth grades (2004-2006).

In Study 1, exploratory and confirmatory factor analyses were used with third grade fall data to develop an effortful control scale. In Study 2, generalized estimating equations were used to assess whether, within each grade, SIP variables (measured in winter) mediated the relation between effortful control (fall) and aggression (spring). Similarly, Study 3 assessed whether fourth-grade effortful control and SIP variables (fall and winter, respectively) mediated the effect of the Competence Support Program, a classroom management and social skills training intervention, on aggression.

Study 1 resulted in a second-order model (X^2/df=6.41, RMSEA=.089 [90% CI: .077 to .100], CFI=IFI=.957), with effortful control explaining the correlations among three factors: inhibitory control (alpha=.843), attention control problems (alpha=.876), and impulsivity (alpha=.885). In Study 2, unadjusted results showed significant indirect effects of effortful control on aggression, mediated by hostile attribution (fourth grade only), goal formulation, and response decision, but not encoding. Adjusted results showed no mediation effects. Study 3 found no effect of the Competence Support Program on mediators or on aggression.

Based on a strong theoretical framework and using appropriate statistical methods, Study 1 developed a reliable and valid teacher-reported measure of effortful control; Studies 2 and 3 provided modest support for the theory underlying many aggression prevention programs. Together, the studies resulted in recommendations for improved measurement of effortful control, SIP, and aggression; better use of longitudinal mediation models to assess the relations among them; and improved research on aggression prevention. These studies belong to a body of research that is incrementally improving the prevention of childhood aggression.

ACKNOWLEDGMENTS

I am deeply grateful to those who helped make it possible for me to complete this work. Mark Fraser, my dissertation chair and advisor, demonstrated both persistence and patience as he encouraged my progress. He was generous with his time, ideas, data, books, keen editorial advice, and even tea and snacks. As members of my dissertation committee, Shenyang Guo, Andrea Hussong, Kathleen Rounds, and Paul Smokowski offered critical feedback and probing questions as well as encouragement and compassion. The local Social and Character Development Study research team provided a wealth of knowledge and methodological expertise: Mark Fraser, Kim Dadisman, Steve Day, Shenyang Guo, Jilan Li, Dylan Robertson, Rod Rose, and Traci Wike. We also shared many humorous moments. I especially appreciate Steve's encyclopedic knowledge of the intervention and data collection procedures (and willingness to share it), Shenyang's enthusiasm and knowledge about advanced analysis methods, Jilan and Traci's companionship, and Rod's advice about imputation and propensity scoring techniques.

Outside the dissertation research process, many others have provided needed support. Without my long-time mentor, Joe Morrissey, I might never have started this doctoral program. For many years Joe has trusted my abilities, encouraged me to reach higher, and supported me in continuing to learn. Before I

met Joe, Carl Henley introduced me to research methods and made it fun; Leslie Zeldin and Amy Lovvorn believed in me enough to hire me for my first full-time research position. My current supervisor, Alan Brookhart, has given me encouragement and demonstrated flexibility and caring. Throughout my time in the doctoral program, the men of the Durham I Group sustained me and helped me to remember my true self. Kevin Ryan provided light-hearted encouragement and helpful observations. Anne Claire Broughton stayed with me in our mutually supportive co-counseling relationship. Many members of my extended family, friends, and acquaintances asked about my progress or offered words of encouragement. My friend and colleague, Stacie Dusetzina, showed understanding, encouraged me, and lent me confidence. My dog, Buddy, was always there at the end of the day.

My father, Jay Ellis, my mother, Eleanor Hall Ellis, my brother, James, and my sister, Moon, have always believed in my mind, and my parents allowed me to set my own direction to a large extent; these gifts seem to have been important in getting me to this place. I am especially grateful to my wife, Genevieve Reddick, and my son, Cody Ellis, for their extreme patience, generosity, and loving support throughout this process.

Thank you all.

TABLE OF CONTENTS

LIST OF TABLES.....ix

LIST OF FIGURES x

LIST OF ABBREVIATIONS AND SYMBOLS.....xi

INTRODUCTION: EFFORTFUL CONTROL, SOCIAL INFORMATION PROCESSING, AND THE PREVENTION OF AGGRESSION IN ELEMENTARY SCHOOLS 1

Early Aggression: Prevalence, Consequences, and Risk and Protective Factors 1

Emotionality and Effortful Control..... 3

Social Information Processing..... 5

Effortful Control, Social Information Processing, and Aggression 6

Research Questions and Overview of Procedures..... 7

PAPER 1: MEASURING EFFORTFUL CONTROL IN RESEARCH ON AGGRESSION PREVENTION: EXPLORATORY FINDINGS FROM A SAMPLE OF THIRD- AND FOURTH-GRADE STUDENTS IN NORTH CAROLINA..... 10

Methods 14

Results 18

Discussion..... 24

PAPER 2: EFFORTFUL CONTROL, SOCIAL INFORMATION PROCESSING SKILLS, AND AGGRESSION AMONG CHILDREN IN ELEMENTARY SCHOOL..... 29

Introduction 29

Methods 33

Results 37

Discussion 43

PAPER 3: EFFORTFUL CONTROL AND SOCIAL INFORMATION PROCESSING SKILLS AS POTENTIAL MEDIATORS OF AN AGGRESSION PREVENTION PROGRAM FOR CHILDREN IN ELEMENTARY SCHOOL 47

Methods 54

Results 62

Discussion 69

DISCUSSION 73

Strengths and Limitations 74

Implications for Practice 76

Recommendations for Future Research 77

Conclusion 82

APPENDIX 1: ITEMS ELIMINATED DURING EXPLORATORY FACTOR ANALYSIS 83

APPENDIX 2: DETAILED “MAKING CHOICES” OUTCOME AND MEDIATION FINDINGS 84

REFERENCES 101

LIST OF TABLES

Table

1.1 School and Student Characteristics 19

1.2 Regression and Correlation Coefficients of Final Exploratory Factor Model with Promax Rotation 21

1.3 Confirmatory Factor Analysis Results 23

1.4 Predictive Validity of the Effortful Control Measure 24

2.1 Means, Standard Deviations, and Correlations among Variables in Mediation Models 39

2.2 Unadjusted Results of Mediation Models for the Full Sample 41

2.3 Adjusted Results of Mediation Models for the Full Sample 42

3.1 "Making Choices" Outcome and Mediation Findings 52

3.2 Baseline Characteristics Before and After Propensity Score Matching 64

3.3 Means, Standard Deviations, and Correlations among Variables in Mediation Models, Within Matched Sample 65

3.4 Adjusted Results of Mediation Models for the Matched Sample 67

3.5 Grade 3 Intervention Exposure in Hours for Full Sample and Propensity-Score-Matched Sample 68

A2.1 Detailed "Making Choices" Outcome and Mediation Findings 84

LIST OF FIGURES

Figure

1.1 Models Tested in Confirmatory Factor Analysis 22

2.1 Mediation Model with Effortful Control Predicting Aggression 36

3.1 Mediation Model with Program Participation Predicting Aggression... 60

LIST OF ABBREVIATIONS AND SYMBOLS

ACS	Attentional Control Scale
AIC	Aikake Information Criterion
AS	Aggression Scale
BASC	Behavior Assessment System for Children
BASC-T	Behavior Assessment System for Children - Teacher
CBCL-TRF	Child Behavior Checklist - Teacher Report Form
CCC	Carolina Child Checklist
CCC-TF	Carolina Child Checklist - Teacher Form
χ^2	Chi-square
CFA	confirmatory factor analysis
CFI	comparative fit index
CSP	Competence Support Program
EATQ-R	Early Adolescent Temperament Questionnaire - Revised
ECS	Effortful Control Scale
EFA	exploratory factor analysis
ER	emotion regulation
ES	effect size
F1	Factor 1
F2	Factor 2
F3	Factor 3
FPG	federal poverty guideline

FRL	free or reduced-price lunch
GEE	generalized estimating equation
HLM	hierarchical linear model
ICST	Interpersonal Competence Scale - Teacher
IEP	individualized education program
IFI	incremental fit index
MC	Making Choices
MCP	Making Choices Plus
NBAA	normative beliefs about aggression
ns	not significant
OFM	optimal full matching
RMSEA	root mean squared error of approximation
RQ	research question
SACD	Social and Character Development
SCS-T	Social Competence Scale - Teacher
SD	standard deviation
SEM	structural equation modeling
SIP	social information processing
TEA-Ch	Test of Everyday Attention for Children
TOCA-R	Teacher Observation of Classroom Adaptation - Revised

Introduction

Effortful Control, Social Information Processing, and the Prevention of Aggression in Elementary Schools

This dissertation contains three papers, each addressing a specific research question in the context of aggression prevention in U.S. elementary schools. This introductory chapter briefly defines the key constructs involved (aggression, effortful control, and social information processing), states the three research questions, provides an overview of the research procedures, and outlines the structure of the dissertation.

Early Aggression: Prevalence, Consequences, and Risk and Protective Factors

Few studies have reported, and no U.S. national study has estimated, the prevalence of specific aggression-related behaviors in early or middle childhood. The available evidence allows rough estimates. Among preschool children, about 7% to 25% of preschoolers display problem behavior (Egger & Angold, 2006). In elementary and middle school, about 10% to 15% of children exhibit chronic aggression (Hemphill et al., 2009; Schaeffer et al., 2006). In high school, nearly a third (32%) of students engage in physical fights each year, and the prevalence

approaches 40% in males, Black students, and Hispanic students (Centers for Disease Control and Prevention, 2010).

Early aggression places children at risk for later crime, violence, and substance use (Belfer, 2008; Lochman & Wells, 2002; Zucker, Heitzeg, & Nigg, 2011). For victims, aggression can cause fear, injury, or death (Dinkes, Kemp, & Baum, 2009). For both victims and perpetrators, aggression carries academic, mental health, and economic costs (Caspi, 2000; Rappaport & Thomas, 2004; Rutherford et al., 2007; Smokowski & Kopasz, 2005).

Research has found that risk and protective factors for aggression exist on multiple levels. For example, environmental risk factors include exposure to violence and association with violent peers (Hemphill et al., 2009; Rappaport & Thomas, 2004; Singer et al., 1999; Sprague & Walker, 2000; Thomas, Bierman, & Conduct Problems Prevention Research Group, 2006). Family risk factors include family conflict; discipline that is physically harsh, inconsistent, or permissive; and parental alcohol dependence, especially if it involves both parents or is comorbid with depression or antisocial personality disorder (Dodge & Pettit, 2003; Hemphill et al., 2009; Hussong et al., 2007; Rappaport & Thomas, 2004; Sameroff, Peck, & Eccles, 2004; Sprague & Walker, 2000). Individual risk factors include genetic predisposition, hormone imbalance, and maladaptive social information processing skills (Dodge & Pettit, 2003; Fraser, 1996; Rappaport & Thomas, 2004). Knowledge and skill in managing emotions appear to be important protective factors (Eisenberg, Fabes, Carlo, & Karbon, 2002; Hemphill et al., 2009). Aggressive behavior likely results from complex mechanisms, including many interactions among the risk and

protective factors. Children have relatively stable developmental trajectories with regard to aggression (Caspi et al., 1995; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Moffitt, 1993; Oldehinkel et al., 2007; Petras et al., 2004; Rothbart et al., 2000; Schaeffer et al., 2006), but these trajectories appear malleable (Petras et al., 2004; Roisman, Aguilar, & Egeland, 2004; Stouthamer-Loeber, Wei, Loeber, & Masten, 2004).

The research questions stated below focus on reactive aggression: physical violence committed by one person against another in response to perceived threat or harm (Dodge, 1980). Proactive aggression, aimed at gaining a specific reward (Dodge, 1980), has different underlying social cognitive mechanisms (Fontaine, 2006). Similarly, social aggression and relational aggression differ from physical aggression and deserve separate attention, including their own body of theory (Heilbron & Prinstein, 2008).

Emotionality and Effortful Control

Often (but not always), reactive aggression involves poorly controlled anger (Fontaine, 2006). Therefore, the experience and management of emotion are relevant to the study of reactive aggression. Emotionality, an aspect of individual temperament, encompasses an individual's typical experience of emotion, including the threshold a stimulus must reach in order to generate a positive or negative emotional response (i.e., reactivity) and the usual latency (i.e., rise time), intensity, and duration of the response (adapted from Eisenberg & Fabes, 1992). Within individuals, emotionality can vary among emotions (e.g., anger, sadness, joy, fear).

Effortful control refers to the conscious management of this emotional experience and of associated behaviors. More formally, *effortful control* is the use of cognitive, behavioral, and/or physiological processes to modulate affective and physiological experiences of negative or positive emotion (e.g., its valence, intensity, or time course) and/or to direct concomitant behaviors (e.g., facial or vocal expressions, aggression, or modification of the social context in such a way as to affect emotional experiences) (Bridges, Denham, & Ganiban, 2004; Cole, Martin, & Dennis, 2004; Eisenberg & Spinrad, 2004).

Effortful control has three skill-related dimensions: attention control, inhibitory control, and activation control (Eisenberg & Spinrad, 2004; Eisenberg et al., 2005). Attention control is the ability to focus on a specific task and to shift attention between tasks (e.g., in order to work toward a goal without distraction or to transition smoothly between social interactions). Inhibitory control refers to the ability to suppress a behavior (e.g., to delay action or prevent an inappropriate outburst) despite a personal preference to do otherwise. Similarly, activation control is the ability to initiate a behavior (e.g., for a child to comply with instructions from an adult caregiver) despite a personal preference not to.

Effortful control is thought to emerge as early as the second six months of life, to increase greatly as children develop during the preschool years (Olson et al., 2005; Spinrad et al., 2007), and to be more stable and increase more slowly during later childhood and early adolescence (Olson et al., 2005; Valiente et al., 2003). However, despite the relative stability of effortful control, the requisite skills likely can be learned (Derryberry & Reed, 2002; Ellis, Rothbart, & Posner, 2004; Kochanska et

al., 2000; Muris & Ollendick, 2005). For example, in a longitudinal study of 106 very young children (9 to 33 months), Kochanska and colleagues (2000) found that effortful control developed with maturation and was influenced by environmental factors such as parental responsiveness. In elementary school children, some studies of universal social skills training programs have found beneficial effects on effortful control ("emotion regulation") (Fraser et al., 2004, 2009) or inhibitory control (Riggs et al., 2006).

Social Information Processing

Whereas effortful control refers to the management of emotional experience, social information processing (SIP) refers to the cognitive processing of social experiences. According to Crick and Dodge's SIP model (Crick & Dodge, 1994; Dodge, 1980, 1986), people process social information in a continuous six-step cycle: the (1) encoding and (2) interpretation of social cues, (3) goal clarification, (4) response generation, (5) response decision, and (6) behavioral enactment. Encoding refers to the translation of sensory information into a usable form. Interpretation includes attributions of cause and intent, as well as the evaluation of goal attainment, past performance, meaning for self, and meaning for others. Goal clarification involves maintaining, revising, or replacing goals related to specific social interactions. Response generation means identifying possible responses to the situation, possibly using scripts. Response selection depends on the specific social context, perceived self-efficacy for enacting the behavior, and the capacity to represent the situation mentally and predict outcomes. Enactment means carrying

out the selected response. Each step involves the storage of information in, or retrieval of information from, the social database. This processing occurs quickly and is often unconscious, except in novel or complex situations (Dodge, 1986). Successful application of SIP skills leads to behavior that is perceived by others as competent.

SIP theory suggests that children increase their SIP knowledge and skills through maturation and social experience (Dodge, 1986; Dolgin, 1986; Crick & Dodge, 1994; Gifford-Smith & Rabiner, 2004; Richard & Dodge, 1982; Rubin & Krasnor, 1986). This may include increases in the speed and complexity of SIP, but paradoxically, this enhanced capacity may be accompanied by increased rigidity of the adaptive and maladaptive patterns that have already been learned (Crick & Dodge, 1994). These components of SIP theory imply that SIP skills are malleable characteristics and that interventions to address skill deficits should take place as early as possible. Further, it may make sense to tailor such interventions to match children's cognitive development.

Effortful Control, Social Information Processing, and Aggression

Deficits in SIP skills and hostile biases in social knowledge are associated with aggression (Burks et al., 1999; Camodeca & Goossens, 2005; Dodge, 1980; Dodge & Pettit, 2003; Gifford-Smith & Rabiner, 2004; Lochman & Wells, 2002; Richard & Dodge, 1982; Schwartz et al., 1998; Sprague & Walker, 2000). Similarly, deficits in effortful control are associated with externalizing problems (Caspi et al., 1995; Dearing et al., 2002; Eisenberg, 2001; Eisenberg et al., 2004, 2005; Lengua,

2002; Muris & Ollendick, 2005; Oldehinkel et al., 2004, 2007; Rydell, Berlin, and Bohlin, 2003; Valiente et al., 2003), even in children as young as 18-45 months (Olson et al., 2005; Spinrad et al., 2007). Because both effortful control problems and SIP deficits are likely risk factors for aggression, aggression prevention programs often target effortful control and SIP skills.

According to theory, emotion and SIP influence each other reciprocally during social situations, and emotional arousal (possibly due to poor effortful control skills) can interfere with children's capacity for SIP (Crick & Dodge, 1994; Dodge, 1991; Eisenberg & Fabes, 1992; Izard, 1991; Lemerise & Arsenio, 2000). However, effortful control and SIP skills usually have been studied separately; therefore, little is known about the relation between them or about their joint relation with aggression. Further, in studies of aggression prevention, effortful control generally has not been measured well.

Research Questions and Overview of Procedures

The purpose of this dissertation was to learn about effortful control and its relations with SIP skills and aggression, and to assess whether the Competence Support Program reduced aggression by improving effortful control and SIP skills. The study data came from the North Carolina site of the Social and Character Development Study, a multi-site project that evaluated seven interventions designed to prevent aggression and promote positive social behavior (Social and Character Development Research Consortium, 2010). In North Carolina, 14 schools from three rural districts participated. Half of the schools participated in the Competence

Support Program, which included the Making Choices classroom intervention (Fraser, Nash, Galinsky, & Darwin, 2000; Nash, Fraser, Galinsky, & Kupper, 2003). The first of two study cohorts represented five intervention schools and five comparison schools. The study sample included 691 boys and girls in this cohort who were present in regular third grade classrooms (versus self-contained special education classrooms) in the fall of 2004. The sample excluded children who entered the study after baseline. Although data were collected during the fifth grade, only third- and fourth-grade data from the 691 students were used to address the three research questions:

RQ1. What degree of validity and reliability can be achieved by constructing a comprehensive effortful control measure with existing teacher-reported data?

RQ2. Do SIP skills mediate the effect of effortful control on aggression?

RQ3. Do effortful control and SIP skills mediate the effect of the Competence Support Program on aggression level at the end of fourth grade?

A separate paper describes each of the three studies. A brief overview follows: For RQ1, a single imputed dataset was created using the expectation-maximization method, an initial pool of 16 items was selected from a composite teacher-rated instrument, and exploratory and confirmatory factor analyses were conducted to develop a measure of effortful control. For the remaining research questions, the new measure of effortful control was included in multiply imputed datasets. To address RQ2, within-grade mediation models were examined for the third and fourth grade, with effortful control measured in the fall, SIP skills in the winter, and aggression in the spring. For RQ3, propensity score matching was used

to balance the intervention and comparison groups on pre-intervention characteristics; the mediation models were tested using fourth grade data, again with effortful control measured in the fall, SIP skills in the winter, and aggression in the spring.

This introductory chapter has described the theoretical foundation for the three studies and explained how they relate to each other. Each of the three papers was designed to stand alone as a research article, reporting findings associated with a specific research question. Necessarily, the introductory and methods sections of the papers share some content with each other and with the current chapter. In the concluding chapter, the findings from the three studies are summarized and discussed together, in the context of the overall theoretical framework.

Paper 1

Measuring Effortful Control in Research on Aggression Prevention: Exploratory Findings from a Sample of Third- and Fourth-grade Students in North Carolina

Sustained, rewarding social interaction requires skillful management of emotional responses. This management occurs through a process called *effortful control*, which has three components: attention control, activation control, and inhibitory control. Attention control is the ability to shift attention between tasks and to focus on a specific task (e.g., in order to transition smoothly between social interactions). Activation control and inhibitory control refer to the ability to initiate or suppress a behavior, respectively, despite a personal preference to do otherwise (e.g., the ability of a child to take action or delay action based on instructions from an adult caregiver) (Eisenberg et al., 2005; Eisenberg & Spinrad, 2004; Rothbart & Bates, 1998, cited in Eisenberg & Spinrad, 2004).

Several neuropsychological measures have been developed to measure aspects of effortful control (e.g., Derryberry & Reed, 2002; Kochanska, Murray, & Harlan, 2000; Manly et al., 2001; Schachar & Logan, 1990). A few paper-and-pencil instruments have been used to measure effortful control in children, including the self-report and parent versions of the Early Adolescent Temperament Questionnaire

– Revised (EATQ-R; Capaldi & Rothbart, 1992; Ellis, 2002; Ellis & Rothbart, 2001), which measures all three components; the self-report Effortful Control Scale (ECS; Lonigan & Phillips, 2001), which measures impulsivity and “persistence” (attention focusing); and the self-report Attentional Control Scale (ACS; Derryberry & Reed, 2002).

Effortful control has been defined inconsistently (Muris & Ollendick, 2005), and evidence of the reliability and validity of the various measures is still emerging. For example, Verstraeten, Vasey, Claes, and Bijttebier (2010) validated the factor structure of the ACS, ECS, and EATQ-R and found that the EATQ-R (parent report) and ACS were negatively associated with internalizing and externalizing problems as expected. However, they also found that some EATQ-R subscales had insufficient internal consistency reliability and that the paper-and-pencil measures were only weakly correlated with scores on the Test of Everyday Attention for Children (TEA-Ch), a neuropsychological battery (possibly due to ceiling effects in the TEA-Ch). In another study, mother-reported EATQ-R effortful control was correlated as expected (r=-.31) with scores on a test of emotional interference with cognition, but was uncorrelated with scores on an attention test (Ellis, Rothbart, & Posner, 2004). The ACS has been administered to children (Verstraeten et al., 2010), but it was developed in adult studies (Derryberry & Reed, 2002) and may not be ideal for younger respondents. Despite these shortcomings, however, existing effortful control questionnaires appear to reflect similar or overlapping constructs (Verstraeten et al., 2010).

A growing body of evidence supports the conclusion that effortful control is

negatively associated with externalizing problems (Caspi et al., 1995; Dearing, Hubbard, Ramsden, et al., 2002; Eisenberg, 2001; Eisenberg et al., 2004, 2005; Ellis et al., 2004; Lengua, 2002; Oldehinkel et al., 2004, 2007; Rydell, Berlin, & Bohlin, 2003; Valiente et al., 2003; Verstraeten et al., 2010), even in children as young as 18-45 months (Olson et al., 2005; Spinrad et al., 2007). One key longitudinal study in this area measured the characteristics and behavior of the April 1972-March 1973 birth cohort in Dunedin, New Zealand (N=1,037) (Caspi et al., 1995). This population study collected parent, teacher, and observer ratings about boys and girls every 2 years up to age 21, and it assessed the relations between specific dimensions of temperament and multiple types of behavior problems. Controlling for other temperamental characteristics, Lack of Control at ages 3-5 predicted externalizing problems for both boys and girls at ages 9-11 (effect sizes .37 and .35 for boys and girls respectively) and ages 13-15 (effect size .23 for both boys and girls). Specifically, when behavioral observations at ages 3 and 5 reflected "inability to modulate impulsive expression, impersistence in problem solving, as well as sensitivity to challenge that is expressed in affectively charged negative reactions" (Caspi et al., 1995, p. 59), children were likely to have higher parent and teacher scores on antisocial behavior (e.g., fighting, stealing, disobedience) at ages 9-11 and higher parent scores on conduct disorder (e.g., teasing, disobedience, bullying, quarreling) at ages 13-15. Even though the methods could be improved upon (e.g., using now-standard measures of temperament, missing value imputation, and more sophisticated statistical models), the Dunedin Study made an important connection between early behaviors that are closely related to effortful control and later

externalizing problems.

Although individuals develop effortful control abilities and distinctive styles of effortful control early in life (Caspi et al., 1995; Eisenberg et al., 2000; Ferdinand & Verhulst, 1995; Keenan et al., 1998; Kochanska, Murray, & Harlan, 2000; Olson et al., 2005; Rappaport & Thomas, 2004; Rothbart, Ahadi, & Evans, 2000; Spinrad et al., 2007), effortful control improves with maturation and experience (Rothbart et al., 2000) and likely can be learned (Derryberry & Reed, 2002; Ellis et al., 2004; Kochanska et al., 2000; Muris & Ollendick, 2005). Many aggression prevention programs for elementary school children rely on this belief (e.g., Bacon, 2003; Bruene-Butler et al., 1997; Fitzgerald & Edstrom, 2006; Fraser, Nash, Galinsky, & Darwin, 2000; Frey, Hirchstein, & Guzzo, 2000; Greenberg, Kusché, & Mihalic, 1998; Nash, Fraser, Galinsky, & Kupper, 2003). Despite diverse theoretical underpinnings and a variety of intended outcomes, these programs share an assumption that social problem-solving requires emotional skills and that these skills decrease the likelihood of aggression. Accordingly, one goal of such programs is to improve children's ability to manage their responses to emotion.

In outcome evaluations, effortful control tends to be measured broadly (e.g., with a general social competence scale), narrowly (e.g., with a single measure of impulsivity, frustration tolerance, inhibitory control, or temper outbursts), or not at all. The purpose of the current study was to develop an effortful control measure in order to evaluate the effects of a universal aggression prevention program for elementary school children.

Methods

The Social and Character Development (SACD) Study, a multi-site project, evaluated seven programs designed to prevent aggression and promote positive social behavior. In North Carolina, 14 schools from three rural districts participated in the SACD Study; seven of these schools took part in the Competence Support Program, which included the Making Choices intervention (Fraser, Nash, Galinsky, & Darwin, 2000; Nash, Fraser, Galinsky, & Kupper, 2003). The current study involved baseline (third grade fall) data from boys and girls (N=691) in the first of two North Carolina study cohorts. These participants represented five of the intervention schools and five of the comparison schools. To be eligible, students had to be present in regular classrooms (as opposed to self-contained special education classrooms) when the project began in 2004.

At multiple occasions during the SACD Study, teachers completed a composite instrument to rate children's behavior over the past 30 days, using a 4-point Likert scale ranging from "never" to "almost always." Sixteen items on the composite instrument had content that appeared to fit the theoretical dimensions of effortful control. (Table 1.2 lists the 10 items retained in the final exploratory factor analysis model. The eliminated items appear in Appendix 1.) After selection of this initial item pool, consultation of the documentation revealed that the items originated from the Social Competence Scale (SCS-T, 8 items; Corrigan, 2003), the IOWA Conners Rating Scale (4 items; Waschbusch & Willoughby, 2008), and the SNAP-IV scale (4 items; Swanson et al., 2001). (Originally the IOWA Conners and SNAP-IV used a 4-point scale from "not at all" to "very much," and the SCS-T used a 5-point

scale from “not at all” to “[describes this child] very well.” The SACD Study used a uniform 4-point scale instead.)

Data were missing for 13.5% (93/691) of the children and 11.0% (1,221/11,056) of the items. Because complete case analysis often yields biased results (Allison, 2002), SAS PROC MI (SAS Institute Inc., 2008) was used to impute missing values. In addition to the potential scale items, the imputation model included a set of auxiliary variables selected to provide maximal information about the analysis variables. Although the expectation-maximization method does not account for the uncertainty associated with imputing missing values, when assumptions are met it does result in unbiased means and variances (Allison, 2002). It also yields a single analysis dataset, allowing a factor analysis with interpretable results. Variable transformations were used as necessary to meet the assumption of multivariate normality. Pre-imputation collinearity checks were conducted, and post-imputation diagnostics were used to confirm that means and variances converged after the first few iterations.

Basic descriptive statistics (means, standard deviations, and medians) were used to characterize the sample. Exploratory factor analysis (EFA) was conducted in SAS PROC FACTOR (SAS Institute Inc., 2008) using principal axis factoring, with squared multiple correlations as prior communality estimates. Factor retention depended on assessment of the scree plot and the number of eigenvalues greater than 1. The dimensions of effortful control are closely related and effortful control functions may depend on each other, suggesting an oblique rotation; however, both orthogonal and oblique (promax) rotations were assessed. In order for an individual

item to be retained, it was required to have a main loading of at least 0.60, the cutoff recommended by Marsh and Hau (1999, cited in Norris & Lecavalier, 2010), and cross-loadings below 0.30. The final model was determined through an iterative process. At each step, the item with the lowest main loading and/or highest cross-loading was deleted before re-running the EFA.

Model fit was assessed with confirmatory factor analysis (CFA), using SAS PROC CALIS (SAS Institute Inc., 2008). Because the EFA and CFA used data from the same sample, both should be considered exploratory. Three CFA models were tested: (1) a three-factor model (the final model from the EFA), (2) a one-factor model created by constraining the inter-factor correlations in the three-factor model to equal 1, and (3) a second-order model created by introducing a latent, unmeasured effortful control factor that explained the inter-factor correlations in the three-factor model.

For CFA, good fit is indicated by χ^2/df no larger than 2 to 5, root mean squared error of approximation (RMSEA)<=0.05, comparative fit index>=0.95, and incremental fit index>=0.95 (Cabrera-Nguyen, 2010; Kline, 2005). RMSEA between 0.05 and 0.10 indicates marginal fit (Kline, 2005). The χ^2/df ratio has the least clear fit criteria and is somewhat dependent on sample size (Kline, 2005).

The predictive validity of the effortful control score was evaluated by examining associations with female sex (expected to be positive), aggression (negative), conduct problems (negative), and internalizing behavior (negative), all measured in the fall of third grade. Predictive validity assessment also included change over time within the third grade (expected to be positive) and associations

with four social information processing (SIP) scores in the winter and spring of third grade: encoding (positive), hostile attribution (negative), goal formulation (positive), and response decision (positive). The expected relations with SIP variables were based on theory indicating that emotional arousal (possibly due to poor effortful control skills) can interfere with the capacity of children to process social information (Crick & Dodge, 1994; Dodge, 1991; Eisenberg & Fabes, 1992; Izard, 1991; Lemerise & Arsenio, 2000).

Measures for the predictive validity assessment included the aggression and conduct problems subscales of the Behavior Assessment System for Children (BASC; Thorpe, Kamphaus, & Reynolds, 2003), the aggression subscale of the Interpersonal Competence Scale (ICST; Cairns, Leung, Gest, & Cairns, 1995), and the Skill Level Activity (SLA; Nash, Fraser, Galinsky, & Kupper, 2003), which measures SIP variables. The Skill Level Activity is child-rated; the other instruments are teacher-rated. Fraser and colleagues (2005, 2009) reported the following reliability statistics from similar samples: BASC aggression, alpha=.95, test-retest r=.91; ICST aggression, alpha=.78; SLA encoding, kappa=.96 (for coding), alpha=.79 (among vignettes); SLA hostile attribution, alpha=.52; SLA prosocial goals, alpha=.76; SLA response decision, alpha=.80. Because within-grade change and SIP scores could be affected by the intervention, these variables were measured only among children who did not receive the intervention (n=366). Pearson correlations were used for all variables except sex (analysis of variance) and within-grade change (paired t-test).

Results

Table 1.1 displays school and student characteristics. The typical school had close to 650 students, with 45% White, 37% Black, 10% Hispanic, and 60% eligible for free or reduced lunch. The schools were heterogeneous, however. For example, school size ranged from 372 to 882; percentage White, Black, and Hispanic ranged from 3 to 70, 16 to 93, and 2 to 40, respectively; and percentage eligible for free or reduced lunch ranged from 34 to 90 (not shown). The students in the sample had a mean age of 8.6 years at baseline; about half were female, 34% Black, 11% Hispanic, and 47% White. Median household income was not far from the federal poverty guideline. All students were in regular classrooms; 4.2% were special education students with individualized education programs.

Table 1.1
School and Student Characteristics

Variable	Mean or %	SD	Median
School-level variables (N=10)			
Number of students [a]	657.2	158.0	645.5
Pupil:teacher ratio [a]	15.9	2.4	15.3
Percentage of students Black [a]	41.0	22.6	36.8
Percentage of students Hispanic [a]	13.4	11.9	10.4
Percentage of students Native American [a]	3.2	5.9	0.0
Percentage of students White [a]	41.4	20.0	45.0
Percentage of students migrant [a]	2.4	4.8	0.0
Percentage of students eligible for free or reduced lunch [a]	60.4	16.0	60.0
Percentage of students from families below poverty line [b]	19.3	2.3	17.6
Percentage of students with English as second language [b]	5.2	0.3	5.5
Percentage of students with IEPs [b]	15.0	0.1	15.0
Student-level variables (N=691)			
Age in years	8.6	0.5	8.5
Female	52.1%		
Black	33.7%		
Hispanic	11.3%		
White	46.6%		
Household income-to-FPG ratio (lower bound)	1.5	1.1	1.4
Any special education services	4.2%		
Primary caregiver employed full-time	54.0%		
Father or stepfather present in household	68.7%		

Note. FPG federal poverty guideline, IEP individualized education program.
[a] Statistics based on the 2005-2006 school year.
[b] Statistics based on the 2004-2005 school year.

Exploratory factor analysis. Only two eigenvalues were greater than one (the third was 0.87, and the fourth, 0.18), but the scree plot suggested either a 1-factor or a 3-factor solution, and theory supported the 3-factor solution, which was therefore retained. An oblique rotation was selected because it more clearly distinguished the three factors. After applying the item selection criteria, 10 items remained. The pattern matrix (Table 1.2) clearly identified each item with a specific factor (four in Factor 1, three in Factor 2, and three in Factor 3). Although many of the items had substantial correlations with all three factors, the three factors

appeared to be sufficiently distinct (the inter-factor correlations between Factors 1 and 2, 1 and 3, and 2 and 3, were -.496, -.563, and .593 respectively) and to make theoretical sense. Factor 1 corresponded to inhibitory control, Factor 2 to attention control problems, and Factor 3 to impulsivity. The Cronbach's alpha coefficients for the three factors were .843, .876, and .885 respectively.

Table 1.2

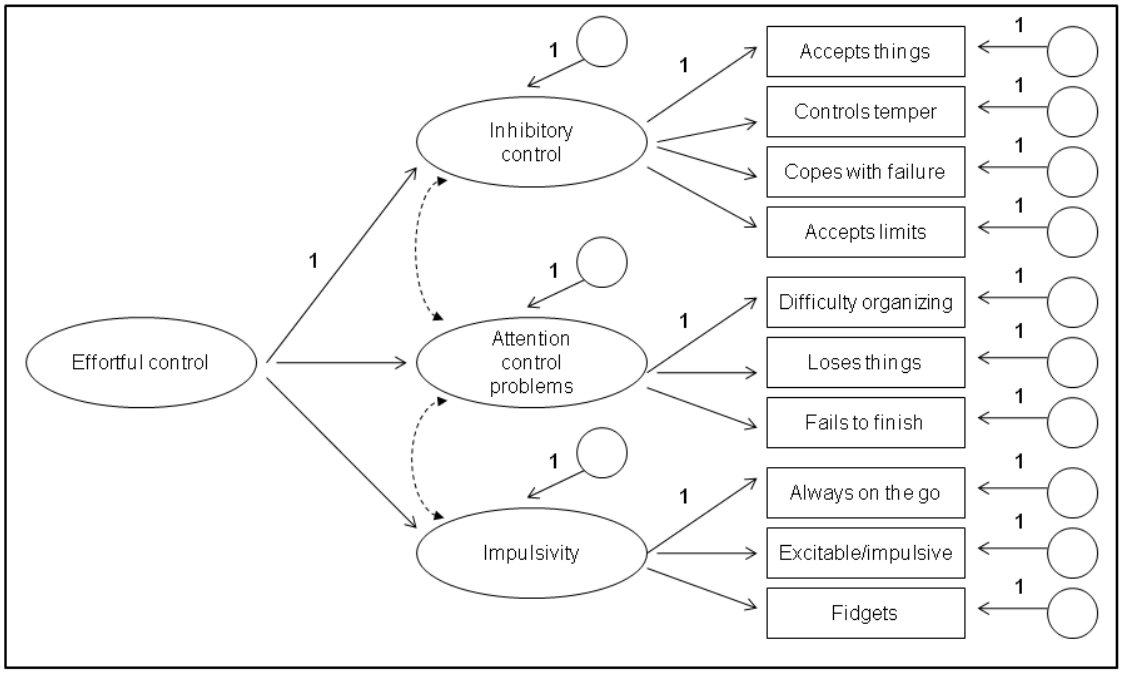
Regression and Correlation Coefficients of Final Exploratory Factor Model with Promax Rotation

	Pattern Matrix (Regression Coefficients)			Structure Matrix (Correlation Coefficients)		
Item	F1	F2	F3	F1	F2	F3
Inhibitory control						
Can accept things not going his or her way	.780	-.063	.062	.776	-.413	-.414
Controls temper when there is a disagreement	.724	.029	-.078	.753	-.376	-.468
Copes well with failure	.710	-.019	.028	.703	-.354	-.383
Accepts legitimate imposed limits	.633	-.015	-.178	.741	-.435	-.544
Attention control problems						
Has difficulty organizing tasks and activities	.019	.834	.058	-.427	.859	.542
Loses things necessary for tasks and activities	-.065	.806	-.071	-.425	.796	.444
Fails to finish things child starts (short attention span)	-.003	.742	.120	-.438	.814	.561
Impulsivity						
Always on the go/acts as if “driven by a motor”	.044	.031	.850	-.450	.513	.844
Is excitable or impulsive	-.090	-.048	.831	-.534	.489	.853
Fidgets	-.062	.247	.620	-.533	.645	.801

Note. Horizontal rules group items according to primary loadings and primary correlations. F1 Factor 1, F2 Factor 2, F3 Factor 3.

Confirmatory factor analysis. Figure 1.1 describes the models tested in the exploratory CFA, and Table 1.3 reports the findings. The three-factor model had unacceptable fit and the one-factor model was clearly worse ($\chi^2[2]=496.2$, $p<.0001$), but the second-order model (with three first-order factors) had acceptable fit according to nearly all criteria (the exception being the normalized χ^2) and had the lowest value of the Aikake Information Criterion, which can be used to compare non-nested models (lower is better).

Figure 1.1
Models Tested in Confirmatory Factor Analysis



Note. The final, second-order model included solid arrows only, plus all latent and observed variables. The three-factor model omitted the second-order effortful control factor, paths from effortful control to the first-order factors, and disturbances for the first-order factors; it included unconstrained inter-factor correlations (dashed arrows). The one-factor model differed from the three-factor model only in that the inter-factor correlations were constrained to equal 1.

Table 1.3
Confirmatory Factor Analysis Results

Model [a]	χ^2	df	χ^2/df	RMSEA (90% CI)	CFI	AIC
3-factor	444.36	33	13.47	.134 (.123, .146)	.899	378.36
1-factor	940.60	35	26.87	.193 (.183, .204)	.777	870.60
Second-order	205.13	32	6.41	.089 (.077, .100)	.957	141.13

Note. AIC Aikake Information Criterion, CFI Comparative Fit Index, RMSEA Root Mean Squared Error of Approximation. Incremental fit index was equal to the CFI for all models.
[a] The second-order model was created by introducing a latent, unmeasured effortful control factor that explained the inter-factor correlations in the three-factor model.

For the assessment of predictive validity, a score for each subscale was calculated as the mean of the subscale items, and effortful control was measured as the mean of the three subscale means. This overall score preserves nearly all the information in the latent factor score for the second-order factor (r=.99). It also has the advantages of being easy to reproduce in subsequent studies and easy to recover from imputed values of the three first-order factor means, in case such studies are affected by missing data.

Table 1.4 displays the predictive validity findings. Effortful control was positively associated with female sex ($F[1,689]=57.75$, $R^2=.08$) and had strong negative associations with aggression and conduct problems. The negative association with internalizing problems was weaker. There were moderate positive correlations with goal formulation and response decision, and a moderate negative correlation with hostile attribution (spring only). Effortful control was not associated with encoding. Effortful control increased during grade 3 ($t[646]2.25$, $p<.05$), but only by 0.04 on a 4-point scale (not shown).

Table 1.4
Predictive Validity of the Effortful Control Measure

Variable	Measurement	Hypothesized direction of association	Correlation
Female sex [a]	Fall	+	.278 ***
Aggression, BASC	Fall	-	-.651 ***
Aggression, ICST	Fall	-	-.654 ***
Internalizing	Fall	-	-.124 **
Conduct problems	Fall	-	-.627 ***
Encoding [b]	Winter	+	.010
Hostile attribution [b]	Winter	-	.134
Goal formulation [b]	Winter	+	.237 ***
Response decision [b]	Winter	+	.187 ***
Encoding [b]	Spring	+	.043
Hostile attribution [b]	Spring	-	-.155 **
Goal formulation [b]	Spring	+	.168 **
Response decision [b]	Spring	+	.155 **

Note. BASC Behavioral Assessment System for Children, ICST Interpersonal Competence Scale-Teacher. All measurements were taken during grade 3.
[a] Significance test was performed using analysis of variance.
[b] Measured in comparison group only (n=366).
* p<.05, ** p<.01, *** p<.001

Discussion

This study of data from the Social and Character Development Project was designed to identify a measure of effortful control for subsequent analyses. The 16 items selected for the initial pool had face validity that was acceptable but could be improved by refining items that are double-barreled or nearly so (e.g., “always on the go/acts as if ‘driven by a motor,’” “controls temper when there is a disagreement”). The EFA pointed to a three-factor solution, and the best-fitting CFA model specified that effortful control is a latent factor explaining the correlations among inhibitory control, attention control problems, and impulsivity. The three first-order scales demonstrated good reliability despite having only three or four items each.

In terms of content validity, three issues warrant elaboration. First, the final scale measures two theoretical dimensions of effortful control (i.e., inhibitory control and attention control) but fails to address activation control. The items on the attention control scale cover attention focusing but not attention shifting. As with many other measures, these omissions were based on decisions made when data collection was being planned. Second, one of the attention control items ("fails to finish things child starts [short attention span]") may relate to short-term tasks as well as larger projects, while the other two items ("has difficulty organizing tasks and activities," "loses things necessary for tasks and activities") may be more closely associated with higher-level executive functioning (i.e., longer-term planning and organizing). Possibly, given a larger item pool, attention control might manifest additional dimensions. Third, impulsivity and inhibitory control emerged as separate dimensions of effortful control, but they may have been distinguished mainly by differences in directionality. Eisenberg and colleagues (2004; Spinrad et al., 2007) described impulsivity as a form of reactive control that is separate from effortful control and occurs in a different part of the brain. On the other hand, Lonigan and Phillips (2001) included impulsivity in their Effortful Control Scale, perhaps to reflect a lack of effortful control. Current theory suggests that (a) effortful control involves pre-frontal cortex processes, (b) reactive control (or impulsivity) involves sub-cortical processes, (c) the two influence each other reciprocally, and (d) excessive impulsivity and deficient effortful control are functionally equivalent (Zucker, Heitzeg, & Nigg, 2011). Therefore, it may be difficult for a paper-and-pencil scale to distinguish between the two constructs.

These content validity issues highlight opportunities for further progress in the measurement of effortful control. For example, isolating and measuring specific dimensions of reactive control along with effortful control would improve understanding of the relation between effortful control and behavior. Impulsivity may relate both to reactive control and to low inhibitory control—and even to activation control, which involves the initiation of behavior—suggesting that finer-grained measures would be in order. Distinguishing "local" measures of the ability to shift and focus attention in specific situations from "global" measures of executive functioning may also prove fruitful.

On a related note, existing effortful control scales overlap little. For example, a quick, informal evaluation revealed the following: six of 20 items on the ACS (Derryberry & Reed, 2002) overlap with four of six items on the EATQ-R attention subscale (Ellis & Rothbart, 2001), the 3-item attention subscale developed in the current study does not overlap with the 20-item ACS, and three of 18 items on the EATQ-R effortful control scale overlap with two of 10 items on the effortful control scale developed in the current study. The measurement of effortful control could likely be improved by conducting a study designed specifically to measure effortful control, rather than a broader construct such as temperament or a narrower one such as attention control. The item pool for such a study should be comprehensive, including items designed to measure activation control and (because of limited overlap among existing scales) a broader selection of items to measure other dimensions of effortful control.

In terms of Cohen's (1992) effect size criteria, the predictive validity of the effortful control score was supported by large correlations with aggression and conduct problems, and small correlations with sex and SIP variables. The weaker correlations with SIP measures may be due in part to the fact that the SIP measures were child-rated, whereas effortful control was teacher-rated, and the SIP measures were collected later in the school year. Interestingly, effortful control was not correlated with encoding skills. Emotional arousal (and therefore effortful control) may influence social information processing only in the later stages, after cues have been encoded.

This study has several limitations. First, because the study is exploratory and involves a convenience sample of schools, the generalizability of the findings is limited. Second, the analysis models did not take into account the uncertainty associated with the imputation process or the clustering of students within classrooms and schools, which may have led to overestimates of associations between scale items and between constructs. The fact that only 11% of items had missing values mitigates this limitation, at least with regard to the imputation. Third, although this opportunistic use of data will make further analyses possible, it would be ideal to start with a much larger initial item pool designed to measure effortful control. Fourth, the items used in this study were measured on a four-point scale, and it is well known that the normality assumption would be better satisfied by items with at least five to seven possible values. Fifth, although collecting data from teachers is convenient, using teacher ratings to capture the internal processes of students is problematic at best. Care must be taken to connect teacher-rated

measures as closely as possible to neuropsychological measures (although even clinical measures such as the Test of Everyday Attention for Children [Manly, Robertson, Anderson, & Nimmo-Smith, 1999; Manly et al., 2001] only approximate the measurement of internal functioning by measuring behavior) and to triangulate with parent-rated and child-rated measures.

Despite these limitations, the effortful control measure and subscales developed in this study appear to have sufficient reliability and validity to be used in subsequent analyses. This measure fits with the theoretical dimensions of effortful control and includes content that is absent from other effortful control scales. Further, this study not only introduces a new measure, but also suggests future directions in the measurement of effortful control, reactive control, impulsivity, and attention control. Finally, the findings show that teacher reports can be used to measure some dimensions of effortful control in a reliable and valid way.

Paper 2

Effortful Control, Social Information Processing Skills, and Aggression Among Children in Elementary School

Introduction

The first and second sections of this introduction address, respectively, the relations between effortful control and externalizing problems, and between social information processing (SIP) skills and aggression. The third section raises the question of how effortful control, SIP, and aggression are interrelated, which motivated the current study.

Effortful control and externalizing problems. Emotional experiences and their impact on behavior are regulated both by automatic processes and by more conscious processes. Within the domain of emotion regulation, reactive control refers to automatic, scripted responses, whereas effortful control refers to the conscious management of emotional experiences (Bridges, Denham, & Ganiban, 2004; Cole, Martin, & Dennis, 2004; Eisenberg et al., 2005; Eisenberg & Spinrad, 2004). Effortful control encompasses three dimensions: inhibitory control, the ability to suppress a preferred behavior; activation control, the ability to initiate a non-preferred behavior; and attention control, the ability to focus and shift attention (Eisenberg et al., 2005; Eisenberg & Spinrad, 2004; Rothbart & Bates, 1998, cited in Eisenberg & Spinrad, 2004). Some researchers consider impulsivity to be a

dimension of effortful control (e.g., Lonigan & Phillips, 2001).

Prior research with children has demonstrated a negative association between effortful control and externalizing problems (Caspi et al., 1995; Dearing, Hubbard, Ramsden, et al., 2002; Eisenberg, 2001; Eisenberg et al., 2004, 2005; Ellis et al., 2004; Lengua, 2002; Oldehinkel et al., 2004, 2007; Olson et al., 2005; Rydell, Berlin, & Bohlin, 2003; Spinrad et al., 2007; Valiente et al., 2003; Verstraeten et al., 2010). For example, Valiente and colleagues (2003) studied the relation between effortful control and externalizing problems in a sample of fourth-to-seventh graders in the southwestern United States (N=169). They measured effortful control using parent and teacher ratings of attention control and observational ratings of children's persistence on a puzzle task. Effortful control was negatively associated with concurrent parent- and teacher-rated externalizing problems (standardized coefficient -.69), controlling for externalizing problem scores collected four years earlier. Likely, effortful control affects externalizing problems not only directly, but also in interaction with individual characteristics such as the tendency to experience strong negative emotions (Valiente et al., 2003), and with environmental variables such as parenting style (Sentse, Veenstra, Lindenberg, & Verhulst, 2009) and family risk factors (Lengua, 2002).

Social information processing skills and aggression. Behavior depends not only on emotional responses to social situations, but also on cognition, which involves both mental structures and cognitive processing. SIP theory acknowledges cognitive theories about knowledge structures such as schemata, scripts, heuristics, and working models, but it focuses primarily on the processing tasks that translate

knowledge into behavior (Dodge & Rabiner, 2004). According to SIP theory, cognitive and behavioral responses to social situations follow a six-step cycle that repeats multiple times during any given situation: the (1) encoding and (2) interpretation of social cues, (3) goal clarification, (4) response generation, (5) response decision, and (6) behavioral enactment (Crick & Dodge, 1994; Dodge, 1980, 1986). At each step, information is stored in or retrieved from an internal social database. As effortful control deficits are associated with externalizing problems, SIP deficits and hostile biases in social knowledge are associated with aggression (Burks et al., 1999; Camodeca & Goossens, 2005; Dodge, 1980; Dodge & Pettit, 2003; Gifford-Smith & Rabiner, 2004; Lochman & Wells, 2002; Richard & Dodge, 1982; Schwartz et al., 1998; Sprague & Walker, 2000). Problems with encoding (Lochman & Wells, 2002) and interpretation (Dodge, 1980; Lochman & Wells, 2002; Schwartz et al., 1998) are associated with reactive aggression, whereas deficits in response generation and response selection are associated with proactive aggression (Camodeca & Goossens, 2005; Lochman & Wells, 2002; Richard & Dodge, 1982; Schwartz et al., 1998). A hostile bias in the social database (i.e., a tendency to think of others as generally hostile or aggressive even when they are not) appears to be associated with hostile attribution bias (the tendency to interpret ambiguous intent as hostile in specific situations) and with the generation and selection of aggressive responses (Burks et al., 1999), as well as with aggressive behavior (Gifford-Smith & Rabiner, 2004).

A pair of early studies by Dodge (1980) helped to make a connection between hostile attribution bias and the generation and enactment of aggressive responses to

conflicts with peers. Fifteen aggressive and 15 non-aggressive boys were identified in each of grades 2, 4, and 6 (total N=90) based on teacher ratings and peer nominations. Each boy worked on a puzzle task and then heard what appeared to be a peer damaging his puzzle, with the peer's apparent intent randomly assigned to one of three experimental conditions: hostile, benign, or ambiguous. In the hostile intent condition, equal proportions of aggressive and non-aggressive boys retaliated, but in the ambiguous intent condition, aggressive boys were more likely to retaliate (e.g., 20% vs. 7% disassembled the peer's puzzle partially or completely), and in the benign intent condition, aggressive boys were more likely to respond positively (e.g., 53% vs. 20% helped assemble the peer's puzzle). In a separate study of the same sample, boys heard hypothetical stories involving negative consequences from an actual peer's behavior. Aggressive boys were more likely to attribute hostile intent ($F[1,84]=3.00$, $p<.09$), predict further aggression by the peer ($F[1,84]=4.28$, $p<.05$), and say that they would not trust the peer in the future ($F[1,84]=5.08$, $p<.03$). Despite the small sample and artificial setting, the clever factorial designs and realistic experimental conditions in these studies made it possible to conclude that only in conflict situations where a peer's intent is ambiguous, aggressive boys tend to attribute hostile intent to the peer—sometimes incorrectly—and then to retaliate based on that attribution.

Effortful control, SIP skills, and aggression. Effortful control and SIP skills usually have been studied separately; therefore, little is known about the relation between them or about their joint relation with aggression. However, (1) both effortful control and SIP skills are negatively associated with aggression, (2) effortful

control is responsible for controlling emotional arousal, and (3) according to theory, uncontrolled emotional arousal can interfere with the capacity of children for social information processing (Crick & Dodge, 1994; Dodge, 1991; Eisenberg & Fabes, 1992; Izard, 1991; Lemerise & Arsenio, 2000). Based on these demonstrated or hypothesized relations, the purpose of the current study was to examine SIP skills as potential mediators of the relation between effortful control and aggression.

Methods

As part of the multi-site Social and Character Development (SACD) Study, 14 schools from three rural North Carolina districts participated in a trial of the Competence Support Program, including the Making Choices intervention (Fraser, Nash, Galinsky, & Darwin, 2000; Nash, Fraser, Galinsky, & Kupper, 2003). The current study involved 691 boys and girls who were present in regular classrooms (as opposed to self-contained special education classrooms) at the beginning of the study in 2004. This first study cohort represented 10 schools, five of which received the intervention.

The data used in the current study were collected in the fall, winter, and spring of the third and fourth grades, with baseline variables measured in the fall of the third grade (2004). The primary measures in the current study were effortful control, measured in the fall of each year; SIP skills, measured in the winter; and aggression, measured in the spring. The aggression outcome was measured using teacher ratings on the aggression subscale of the Behavior Assessment System for Children (BASC; Thorpe, Kamphaus, & Reynolds, 2003). Effortful control, also

teacher-rated, was measured with a 10-item scale composed of items from the Social Competence Scale (SCS-T; Corrigan, 2003), the IOWA Conners Rating Scale (Waschbusch & Willoughby, 2008), and the SNAP-IV scale (Swanson et al., 2001). The effortful control score (Cronbach's alpha=.90) was developed for this study and was calculated as the mean of three subscale means: inhibitory control (alpha=.84), attention control problems (reversed; alpha=.88), and impulsivity (reversed; alpha=.89). SIP skills were measured with the child-rated Skill Level Activity (Nash, Fraser, Galinsky, & Kupper, 2003), which provides scores for encoding, interpretation, goal formulation, and response decision. Baseline covariates included age, sex, an age-by-sex interaction, race (Black versus other), ethnicity (Hispanic versus other), primary caregiver education (measured on a scale from 1-4), ratio of household income to the federal poverty guideline, primary caregiver employed full-time (dichotomous), BASC aggression score, Interpersonal Competence Scale (ICST) aggression score (Cairns, Leung, Gest, & Cairns, 1995), and BASC conduct problems score.

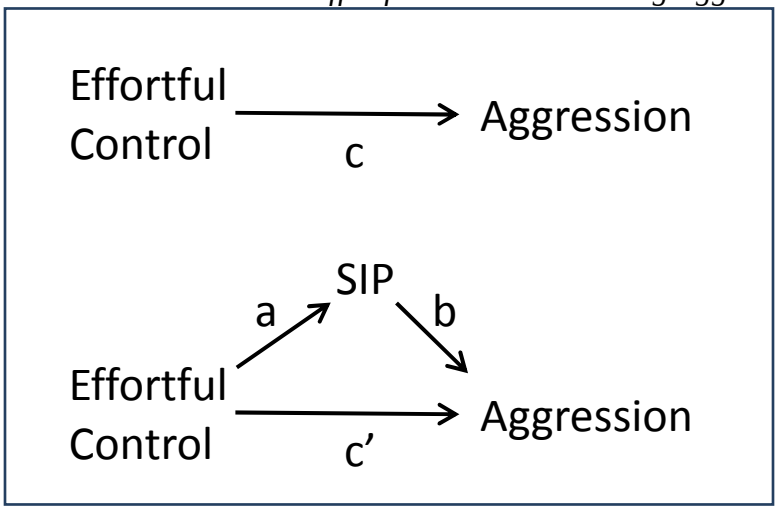
To avoid a biased complete-case analysis (Allison, 2002), missing values were imputed using multiple imputation with chained equations (mice) in R 2.14.1 (R Development Core Team, 2011). The chained equations approach is flexible, allowing a separate imputation model for each variable and making no assumption about joint distribution (van Buuren & Groothuis-Oudshoorn, 2011). Like Markov chain Monte Carlo methods, it accounts for the uncertainty associated with imputation. For each variable with missing values, an imputation model was selected based on the variable's distribution (e.g., linear regression for normally

distributed variables, logistic regression for binary variables, predictive mean matching for ordinal variables). Although 44.1% (305/691) of the children had at least some missing data, missingness affected only 12.0% of the variable values needed for the analysis model (described below), allowing the construction of informative imputation models. In addition to analysis variables and baseline covariates, auxiliary variables were included in order to provide maximal information for each model. Collinearity diagnostics and post-imputation plots were used to avoid collinearity, confirm convergence of means and variances across iterations, and rule out the existence of trends across imputations. Forty imputed datasets were generated, in order to ensure a relative efficiency of at least 99% for the mean of each analysis variable. Relative efficiency measures statistical efficiency compared to the efficiency that would be achieved with an infinite number of imputed datasets.

Within each grade (third and fourth), models were constructed to test for an indirect effect of effortful control (fall) on aggression (spring), mediated by social information processing skills (winter). According to the nomenclature of Krull and MacKinnon (1999, 2001), these were 1-1-1 multilevel models, because students (level 1) were nested within classrooms (level 2) and schools (level 3), and all three variables were measured at the student level rather than at the classroom or school level. To correct standard errors for the hierarchical data structure, each regression model was run as a generalized estimating equation (GEE) in SAS PROC GENMOD (SAS Institute Inc., 2008). GEE was selected because the normality assumption of multilevel modeling would likely be violated with only 10 schools at level 3.

For each grade level, four indirect effects were considered separately, each with a different SIP variable as the potential mediator (Figure 1.1). Each mediation effect was tested using the product method (MacKinnon, 2008), in which the indirect effect is calculated as the product of two regression coefficients: (a) the effect of the predictor on the mediator and (b) the effect of the mediator on the outcome, controlling for the predictor. For each mediation pathway, one regression model measured the effect of effortful control on SIP skills (the "a" path in Figure 1.1) and a second model measured the effect of SIP skills on aggression ("b" path). To estimate a 95% confidence interval for the indirect effect (*a* x *b*), estimates and standard errors for the *a* and *b* coefficients were then entered into the PRODCLIN program (MacKinnon, Fritz, Williams, & Lockwood, 2007). The total effect of effortful control on aggression ("c" path) was also estimated for each grade level.

Figure 2.1
Mediation Model with Effortful Control Predicting Aggression



To assess the effect of adjusting for baseline covariates, both unadjusted and adjusted models were run. In the adjusted models, covariates were centered at their means to reduce collinearity, and fall BASC aggression scores were divided by 10 for the same reason. Also, because baseline effortful control was correlated with the baseline measures of BASC aggression, ICST aggression, and BASC conduct problems (r=-.65, -.65, and -.63 respectively), these three covariates were included after "partialing out" the effect of effortful control (i.e., they were included in the form of residuals from separate models regressing each covariate on baseline effortful control). The intent was to control only for the variation in baseline aggression that cannot be explained by effortful control. For the fourth-grade models, the BASC aggression covariate was measured in the fall of the fourth grade. Because exposure to the intervention might affect the results of mediation models, the models were run separately for the intervention condition (n=325) and comparison condition (n=366) as a sensitivity analysis. Statistical tests were conducted at the .05 level of significance.

Results

Among the 691 students in the sample, 360 (52.1%) were female, 233 (33.7%) Black, 322 (46.6%) White, and 78 (11.3%) Hispanic. The mean age as of third grade fall was 8.6 years (SD=0.5). Twenty-nine students (4.2%) had individualized education programs for special education.

Table 2.1 shows correlations, means, and standard deviations (SDs) for the variables in the mediation models. As expected, effortful control was positively

correlated with SIP skills (encoding, goal formulation, and response decision), negatively correlated with hostile attribution, and negatively correlated with aggression (r=-.52 and -.53 for grade 3 and grade 4 respectively). Among the SIP variables, goal formulation and response decision, representing the later stages of processing, had the strongest pairwise correlations (r=.59 and .65 respectively). Encoding had positive associations with the later-stage SIP variables, but these were significantly different from zero only within grade 4. Hostile attribution was negatively correlated with SIP skills. SIP variables were correlated with aggression in the expected direction, but the association between encoding and aggression was not statistically significant.

Table 2.1

Means, Standard Deviations, and Correlations Among Variables in Mediation Models

Variable or statistic	1	2	3	4	5	6
Mean, grade 4	3.11	0.50	0.60	0.55	0.49	7.28
SD, grade 4	0.62	0.21	0.29	0.39	0.42	8.09
1. Effortful control (fall)	---	0.09 *	-0.11	0.20**	0.25**	-0.53**
2. Encoding (winter)	0.11 **	---	-0.07	0.17**	0.14*	-0.09
3. Hostile attribution (winter)	-0.03	-0.03	---	-0.24**	-0.22**	0.13*
4. Goal formulation (winter)	0.16 ***	0.07	-0.12*	---	0.65**	-0.16**
5. Response decision (winter)	0.15 ***	0.02	-0.19**	0.59**	---	-0.21**
6. BASC aggression (spring)	-0.52 ***	-0.05	0.09	-0.17**	-0.19**	---
Mean, grade 3	3.12	0.48	0.53	0.68	0.64	6.20
SD, grade 3	0.62	0.20	0.31	0.32	0.38	7.02

Note. Statistics for grade 3 appear below the diagonal; those for grade 4 appear above the diagonal. BASC=Behavior Assessment System for Children (Thorpe, Kamphaus, & Reynolds, 2003).

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

Tables 2.2 and 2.3 display the unadjusted and adjusted results of the full-sample mediation models. Effortful control had a negative association with aggression regardless of covariate adjustment. Based on the standard deviations in Table 2.1 and the adjusted estimates of total effect in Table 2.3, a 1-SD increase in effortful control was associated with a decrease in aggression of .51 SD (grade 3) to .48 SD (grade 4).

In the unadjusted models, effortful control had a significant effect in the expected direction on every mediator except third grade hostile attribution. Relations between SIP variables and aggression were in the expected direction, and were significant for hostile attribution, response decision, and third grade goal formulation. Indirect effects were significant for goal formulation, response decision, and third grade hostile attribution. Across the eight mediation models, the ratio of indirect effect to total effect did not exceed 0.04.

In the adjusted models, effortful control generally had smaller effects on mediators, and these effects remained significant only for three grade 4 SIP variables: hostile attribution, goal formulation, and response decision. No significant relation between SIP and aggression remained, and no indirect effect differed significantly from zero. The separate intervention group and comparison group results (not shown) did not differ from the overall results.

Table 2.2

Unadjusted Results of Mediation Models for the Full Sample

Grade	Mediator	X->M effect (a path) (95% CI)	M->Y effect (b path) (95% CI)	Indirect effect (a X b) (95% CI)	Total effect (c path) (95% CI)	Ratio of indirect to total effect
3	Encoding	0.0295 * (0.0008,0.0581)	-1.1071 (-3.7776,1.5634)	-0.0326 (-0.1334,0.0421)	-5.8614 *** (-6.8693,-4.8534)	0.0056
	Hostile attribution	-0.0138 (-0.0529,0.0252)	2.1296 * (0.4947,3.7646)	-0.0295 (-0.1276,0.0513)		0.0050
	Goal formulation	0.0819 *** (0.0354,0.1284)	-1.8133 * (-3.4698,-0.1567)	-0.1485 * (-0.3309,-0.0144)		0.0253
	Response decision	0.0888 ** (0.0309,0.1466)	-1.6647 * (-2.9997,-0.3298)	-0.1478 * (-0.3243,-0.0233)		0.0252
4	Encoding	0.0309 * (0.0027,0.0590)	-1.3203 (-4.6671,2.0266)	-0.0407 (-0.1694,0.0578)	-6.7617 *** (-7.8867,-5.6366)	0.0060
	Hostile attribution	-0.0592 ** (-0.1031,-0.0154)	2.1887 * (0.0222,4.3552)	-0.1296 * (-0.3172,-0.0039)		0.0192
	Goal formulation	0.1276 *** (0.0754,0.1799)	-1.4013 (-2.8282,0.0255)	-0.1789 * (-0.3937,-0.0004)		0.0265
	Response decision	0.1696 *** (0.1158,0.2233)	-1.5718 * (-3.0172,-0.1264)	-0.2665 * (-0.5431,-0.0241)		0.0394

Note. X indicates the independent variable, effortful control. M indicates the mediator, a social information processing variable. Y indicates the outcome, aggression. Paths a, b, and c, and product a × b, refer to coefficients labeled in Figure 2.1. CI = confidence interval.

* p<.05, ** p<.01, *** p<.001. For indirect effects, p-values are not easily estimated, so at most one asterisk is displayed.

Table 2.3

Adjusted Results of Mediation Models for the Full Sample

Grade	Mediator	X->M effect (a path) (95% CI)	M->Y effect (b path) (95% CI)	Indirect effect (a X b) (95% CI)	Total effect (c path) (95% CI)	Ratio of indirect to total effect
3	Encoding	0.0143 (-0.0180,0.0467)	-1.9280 (-4.1119,0.2559)	-0.0276 (-0.1125,0.0313)	-5.6112 *** (-6.5086,-4.7139)	0.0049
	Hostile attribution	0.0007 (-0.0453,0.0467)	1.0284 (-0.3239,2.3807)	0.0007 (-0.0507,0.0530)		-0.0001
	Goal formulation	0.0364 (-0.0095,0.0824)	-0.7911 (-2.2412,0.6591)	-0.0288 (-0.1082,0.0216)		0.0051
	Response decision	0.0303 (-0.0233,0.0839)	-0.6616 (-1.8908,0.5675)	-0.0201 (-0.0852,0.0204)		0.0036
4	Encoding	0.0146 (-0.0175,0.0467)	0.6259 (-2.3999,3.6517)	0.0091 (-0.0368,0.0687)	-6.1924 *** (-7.1764,-5.2084)	-0.0015
	Hostile attribution	-0.0621 ** (-0.1093,-0.0150)	0.7881 (-1.1278,2.7040)	-0.0490 (-0.1913,0.0651)		0.0079
	Goal formulation	0.0868 ** (0.0253,0.1483)	-0.0800 (-1.4727,1.3128)	-0.0069 (-0.1352,0.1176)		0.0011
	Response decision	0.0946 ** (0.0382,0.1510)	-0.5306 (-1.7758,0.7146)	-0.0502 (-0.1846,0.0638)		0.0081

Note. X indicates the independent variable, effortful control. M indicates the mediator, a social information processing variable. Y indicates the outcome, aggression. Paths a, b, and c, and product a × b, refer to coefficients labeled in Figure 2.1. Baseline covariates included age, sex, age × sex, race (Black versus other), ethnicity (Hispanic versus other), primary caregiver education (on a scale from 1-4), ratio of household income to the federal poverty guideline, primary caregiver employed full-time (dichotomous), Behavior Assessment System for Children (BASC) aggression (Thorpe, Kamphaus, & Reynolds, 2003), Interpersonal Competence Scale (ICST) aggression (Cairns, Leung, Gest, & Cairns, 1995), and BASC conduct problems.
* p<.05, ** p<.01, *** p<.001.

Discussion

This may be the first longitudinal study to examine SIP variables as potential mediators of the relation between effortful control and aggression. Three cross-sectional studies explored similar research questions. First, using data from 778 boys and girls in grades 4-6, Musher-Eizenman and colleagues (2004) found that social cognitions related to the later stages of SIP partially mediated the relation between anger control and direct aggression. Second, Orobio de Castro and colleagues (2005) studied boys ages 7 to 13 in a small clinical sample (n=54) and a school-based comparison group (n=30). In a structural equation model that included response generation and response evaluation, they found that effortful control (which they labeled as emotion regulation) had a significant negative association with aggression. However, they did not test for mediation and had insufficient power to do so. Third, Muris, Meesters, and Rompelberg (2006) studied a non-clinical sample of 145 children ages 9 to 13 (n=119 for parent reports) and found that the path from attention control to cognitive distortion (i.e., aggressive interpretation, similar to hostile attribution bias, and anxious interpretation) to aggression did not meet Baron and Kenny's (1986) criteria for mediation. However, the authors cautioned that the vignettes they used to measure cognitive distortion may not have allowed them to measure aggressive interpretation adequately. Further, attention control is only one dimension of effortful control and was measured using the Attentional Control Scale (Derryberry & Reed, 2002), the validity of which has not been well-tested with children.

In the current study, social information processing variables were examined as potential mediators of the relation between effortful control and aggression in a sample of third-grade students who were followed through the fourth grade. Raw correlations showed relations in the expected directions among variables in the mediation models. Effortful control and aggression were correlated more strongly with each other than with SIP variables, suggesting an important direct relation. Unadjusted results for five of eight models were consistent with the existence of mediation effects, particularly for goal formulation and response decision. Adjusted results confirmed a negative association between fall effortful control and spring aggression, and partially confirmed the expected associations between effortful control and SIP variables, but did not support the existence of indirect effects mediated through SIP variables.

With regard to the lack of significant indirect effects, the most obvious explanation is that the theory is incorrect and therefore the mediation models do not accurately represent reality. However, it is also possible that the models may have been misspecified in some way. For example, key constructs may have been measured too broadly, too narrowly, or at the wrong time intervals. Approximately five months elapsed between the fall and winter measurements, and two months between the winter and spring measurements. Different spacing (for example, one month between measurements instead of 2-5 months) might better reflect the relation between effortful control and SIP skills, or between SIP skills and aggression.

Measurement error can also interfere with the detection of mediation effects, but the measures used appear to have adequate reliability, with the exception of hostile attribution. Fraser and colleagues (2005, 2009) reported the following reliability statistics from similar samples: encoding, kappa=.96 (for coding), alpha=.79 (among vignettes); hostile attribution, alpha=.52; prosocial goals, alpha=.76; response decision, alpha=.80; BASC aggression, alpha=.95, test-retest r=.91. As reported above, the effortful control measure had an alpha coefficient of .90 in the current sample. Even with reliable measures, though, differences between teacher ratings (on effortful control and aggression) and child ratings (on SIP variables) may have diminished the estimated path coefficients.

The mediation models in this study were adjusted for baseline aggression variables, conduct problems, and several sociodemographic variables. The adjusted and unadjusted results differed, making it worthwhile to examine what covariates other researchers have included in similar mediation models. Studies of similar research questions have been cross-sectional (Muris et al., 2006; Musher-Eizenman et al., 2004; Orobio de Castro et al., 2005), so those studies may not offer meaningful comparisons. In assessing the effects of the PATHS program on internalizing and externalizing problems, Riggs and colleagues (2006) controlled for pretest behavior scores, age, and IQ in the predictor-outcome regression models, and for pretest scores on the mediator, age, and IQ in the predictor-mediator regression model. In examining the effect of Making Choices on overt aggression, Terzian (2007) controlled in all models for sex, race, and pretest scores on the mediator and outcome. These approaches are similar to that used in the current

study, except that pretest scores on the mediators were unavailable in the current study, and that Riggs and colleagues used different sets of covariates for different regression models. Of note, both of these intervention studies used mediators that were measured at the same time as the outcome.

Conclusion. This study found a negative association between effortful control and aggression. In unadjusted models, the relation between effortful control and aggression appeared to be mediated by the later-stage SIP variables (goal formulation and response decision) and, in grade 4 only, by hostile attribution bias. These indirect effects were not statistically significant after adjusting for risk factors for aggression. Even in the unadjusted results the indirect effects were small relative to the total effect of effortful control on aggression. Possibly these findings would be sensitive to model specification. For example, spacing measurements more closely or using narrower measures of effortful control and aggression (attention control, inhibitory control, activation control, impulsivity, direct versus indirect aggression, and reactive versus proactive aggression) might affect the mediation results. Clearly, though, effortful control is a theoretically important predictor of aggression and should be included in efforts to understand and prevent aggression.

Paper 3

Effortful Control and Social Information Processing Skills as Potential Mediators of an Aggression Prevention Program for Children in Elementary School

Aggression prevention programs for elementary school children often target skills in two domains: effortful control and social problem-solving (e.g., Bacon, 2003; Bruene-Butler et al., 1997; Fitzgerald & Edstrom, 2006; Fraser, Nash, Galinsky, & Darwin, 2000; Frey, Hirchstein, & Guzzo, 2000; Greenberg, Kusché, & Mihalic, 1998; Nash, Fraser, Galinsky, & Kupper, 2003). Effortful control is the conscious management of emotional experiences and of the associated behavioral responses (Bridges, Denham, & Ganiban, 2004; Cole, Martin, & Dennis, 2004; Eisenberg & Spinrad, 2004). Effortful control occurs through the shifting and focusing of attention (i.e., attention control), the suppression of dominant or preferred responses (inhibitory control), and the enactment of non-dominant responses (activation control). Many authors refer to effortful control using the more general label "emotion regulation." The second domain, social problem-solving, refers to the cognitive processing that occurs during social interactions. According to the model of Crick and Dodge (1994; Dodge, 1980, 1986), this "social information processing" (SIP) comprises the encoding and interpreting of social cues, goal clarification, and the generation, selection, and enactment of behavioral responses, as well as the

accumulation and use of social knowledge. Theory suggests that both effortful control (Derryberry & Reed, 2002; Ellis, Rothbart, & Posner, 2004; Kochanska et al., 2000; Muris & Ollendick, 2005) and SIP skills (Dodge, 1986; Dolgin, 1986; Crick & Dodge, 1994; Gifford-Smith & Rabiner, 2004; Richard & Dodge, 1982; Rubin & Krasnor, 1986) can be learned. However, only a few studies have examined whether teaching these skills actually reduces aggression (e.g., Riggs, Greenberg, Kusché, & Pentz, 2006; Terzian, 2007). The current study focuses on this question, examining effortful control and SIP skills as potential mediators of the effect of the Competence Support Program (CSP, described in detail in the Methods section) on aggression.

Making Choices, the classroom component of CSP, relies on Crick and Dodge's (1994) SIP model. Making Choices aims to prevent problems such as aggression and social isolation by teaching emotional skills (one unit) and social problem-solving skills (six units) to children in elementary school (Fraser, Nash, Galinsky, & Darwin, 2000; Nash, Fraser, Galinsky, & Kupper, 2003). In order to provide context for the current study, previous findings are reviewed briefly here. Table 3.1 reports effect sizes for the studies reviewed. Table A2.1 in Appendix 2 describes the samples, random assignment mechanisms, measurement occasions, analysis methods, strengths, and limitations.

Researchers have examined the effects of Making Choices in a single-school pilot project among third-graders (Smokowski et al., 2004), a pilot project using an after-school format in conjunction with parenting classes (Fraser et al., 2004), a larger three-year cohort study of third-graders in two schools (Fraser et al., 2005;

Fraser, Lee, Kupper, & Day, 2010; Terzian, 2007), and a three-year cohort study of third-graders in 10 schools (Fraser et al., 2009). Two of the studies used overlapping samples with different comparison groups to evaluate both Making Choices and Making Choices Plus, a version of the program that included additional teacher and family components (Fraser et al., 2005; Terzian, 2007). In one study (Fraser et al., 2009), the Making Choices intervention was carried out by classroom teachers; in the rest, the intervention was implemented by masters-level students or professionals. A pilot pre-post study by Nash and colleagues (Nash, Fraser, Galinsky, & Kupper, 2003) is excluded from this review because no comparison group was used.

Of the Making Choices studies that assessed overt or physical aggression, all found reductions from pretest to posttest or six-month follow-up, relative to the pre-post change in comparison groups. (One study measured only relational aggression [Fraser et al., 2004].) Fall-to-spring effect sizes (Cohen's *d*) ranged from 0.14 to 0.48. (This range excludes findings from Terzian [2007], who reported separate effect sizes by sex for aggression and goal clarification.) The largest study found effects on aggression only for grade 4 (not for grades 3 and 5), with fairly consistent results across aggression measures, analysis samples, and analysis methods (Fraser et al., 2009). In one case the intervention effect was more pronounced among boys (Fraser et al., 2005; Terzian, 2007), and in another, among students of color (Smokowski et al., 2004).

None of the Making Choices studies to date has used an instrument designed to measure multiple dimensions of effortful control. However, three studies,

including the two that evaluated both Making Choices and Making Choices Plus, tested the intervention's effect on emotion regulation and found beneficial effects (*d*=0.01 to 0.52; Fraser et al., 2009; Terzian, 2007 / *eta-squared*=0.06; Fraser et al., 2004). The other studies, measuring emotion regulation as part of a larger "social competence" construct, had mixed results. The Making Choices studies also measured cognitive concentration. This construct includes aspects of attention control, which is part of effortful control, but also includes other elements such as working hard and working well alone. The largest study detected improvement in cognitive concentration among grade 5 intervention participants (*d*=0.32) and a trend toward a grade 4 effect (Fraser et al., 2009). Two studies found a larger intervention effect on cognitive concentration for students with lower baseline scores (Smokowski et al., 2004; Fraser et al., 2005), and one found a larger effect among girls than among boys (Smokowski et al., 2004).

The studies assessing both Making Choices and Making Choices Plus were the only ones to examine effects on SIP skills. They found program effects on encoding (*d*=0.60 to 0.82), hostile attribution (*d*=0.39 to 0.55), goal formulation (*d*=0.28 to 0.66, excluding effects reported separately by sex), and response decision (*d*=0.26 to 0.54). None of these effects emerged for both Making Choices programs in both evaluations (i.e., the ranges reported here exclude the non-significant effects listed in Table 3.1 and Table A2.1). The effects on goal formulation were stronger for males than for females (Terzian, 2007), and also stronger in the higher-income school than in the lower-income school (Fraser et al., 2005).

One study assessed mediation effects (Terzian, 2007), finding that the effects of Making Choices and Making Choices Plus on aggression were mediated by emotion regulation (males: both programs, partial mediation; females: both programs, full mediation), goal clarification (males: both programs, partial mediation; females: Making Choices Plus, partial mediation), and response selection (males: both programs, partial mediation; females: Making Choices, full mediation), but not by encoding or hostile attribution. In that study the mediator and outcome were measured concurrently in the post-test. The mediation models controlled for baseline overt aggression and SIP skills, but not for baseline emotion regulation.

Table 3.1

"Making Choices" Outcome and Mediation Findings[a]

Study	Intervention effects related to effortful control, social information processing, and aggression
Smokowski et al., 2004[b]	Better adjusted cognitive concentration (ES=.27 overall, .56 high-risk pretest, .54 girls) and overt aggression (ES=.31 overall, .73 minority only) ns: social competence; interactions with covariates unless reported above
Fraser et al., 2004[c]	Greater adjusted posttest scores on emotion regulation (eta-squared=.06) and cognitive concentration (eta-squared=.11)
Fraser et al., 2005[d]	MC: better adjusted social competence (ES=.46), cognitive concentration (ES=.27, but higher for those with high baseline scores than for others), overt aggression (ES=-.17, but higher for boys than for girls), encoding (ES=.82), goal formulation (ES=.28, but greater effect in higher-SES school) MCP: greater adjusted social competence (ES=.56), cognitive concentration (ES=.43), overt aggression (ES=-.17), encoding (ES=.77), hostile attribution (ES=-.55), goal formulation (ES=.66), response decision (ES=.54) ns: MC main effect on cognitive concentration, hostile attribution, response decision; interactions with pretest, gender, or race/ethnicity, and school % FRL, unless reported above
Fraser et al., 2010[d]	Better adjusted 6-month scores on overt aggression (ES=-.14), physical aggression (ES=-.09) ns: cognitive concentration, social competence; interactions with gender
Terzian, 2007[d]	MC: greater relative improvement in ER (ES=.52), encoding (ES=.60), goal clarification (ES=.51 boys, -.04 girls), response selection (ES=.26), CCC-TF overt aggression (ES=-.89 boys, -.07 girls) MCP: greater relative improvement in ER (ES=.47), hostile attribution (ES=-.39), goal clarification (ES=.72 boys, .30 girls), response selection (ES=.52), CCC-TF overt aggression (ES=-.84 boys, -.18 girls) ns: MC effect on hostile attribution; MCP effect on encoding
Fraser et al., 2009[e]	OFM, grade 4: greater relative improvement in ICST aggression (ES=-.15 to -.20), BASC aggression ES=(-.37 to -.48), ER (ES=.02 to .20) ns, OFM: grade 3 and 5 effects; AS, NBAA, cognitive concentration

Study	Intervention effects related to effortful control, social information processing, and aggression
	HLM, grade 4: BASC aggression (ES=-.21 to -.25), ER (ES=.01 to .19) HLM, grade 5: ER (ES=.17), cognitive concentration (ES=.32) ns, HLM: grade 3 effects; AS,NBAA, ICST aggression

[a] AS=Aggression Scale (self-report), BASC=Behavior Assessment Scale for Children (teacher report), CCC-TF=Carolina Child Checklist, Teacher Form, ER=emotion regulation, ES=effect size (Cohen's *d* unless otherwise specified), FRL=free or reduced-price lunch, HLM=hierarchical linear model, ICST=Interpersonal Competence Scale (teacher report), MC=Making Choices, MCP=Making Choices Plus (includes parent and teacher components), NBAA=normative beliefs about aggression, ns=not significant, OFM=optimal full matching, SEM=structural equation modeling, SIP=social information processing

[b] Effect sizes reported by authors (difference between estimated marginal means, divided by average of group standard deviations). Effect sizes for main effects may not make sense in the presence of interactions.

[c] This study tests the outcomes of the Making Choices and Strong Families (i.e., parenting class) programs combined. It is included because other studies examine separately the effects of two similar programs (Fraser et al., 2005, 2010; Terzian, 2007). In 7 of 9 sites, intervention occurred in after-school settings such as Boys and Girls Clubs. Outcomes were measured only for referred children, but prosocial peers participated in the intervention. Effect sizes provided by the authors. Note: these effect sizes are reported to be in Cohen's "medium" range, but calculating Cohen's d from the reported adjusted means and baseline standard deviations—$((mean_{post,treatment}-mean_{pre,treatment})-(mean_{post,control}-mean_{pre,control}))/\sqrt{(s^2_{pre,treatment}+s^2_{pre,control})}$—yields effect sizes of .30 and .22 for emotion regulation and cognitive concentration, respectively, which would be considered "small."

[d] Effect sizes provided by author(s).

[e] Information from this report is supplemented with personal knowledge of the study. Intervention delivered by teachers in grade 3 (28 lessons) and all other grades (8 lessons). Teachers also received training and consultation about behavior management and social dynamics. Effect sizes provided by authors; effect size ranges are across the 3 analysis samples (CCC and ICST measures) or 2 analysis samples (AS, BASC, NBAA).

The studies reviewed suggest that Making Choices reduces aggression and also, less strongly, that the program improves effortful control and SIP skills. A picture of moderation effects is emerging: Making Choices may provide the most benefit to those who need it most (e.g., boys, students of color), and to some extent it may be more effective in lower-risk settings (i.e., a high-income school versus a low-income school). Only one study examined the effects of the program when administered by teachers, and that study had problems at the school level with sample size, matching, and attrition, limiting statistical conclusion validity as well as external validity (Fraser et al., 2009). One study found that the effect of Making Choices on aggression is mediated by emotion regulation and by the later-stage SIP variables.

The current study uses data from the Competence Support Program—which included a teacher-administered version of Making Choices—to assess whether effortful control and SIP variables mediated that program's effects on aggression in fourth-graders. It extends previous work by introducing a multi-dimensional measure of effortful control, assessing the intervention as implemented by teachers rather than program specialists, and employing a fully longitudinal design, with mediators measured at an earlier time point than the outcome.

Methods

Program and participants. The multi-site Social and Character Development Study evaluated seven social skills training programs. A trial of CSP was conducted at the North Carolina site, which included 14 schools in three rural

districts. District administrators nominated eligible schools, whose principals agreed to accept school-level random assignment and not to implement any character education program other than the intervention under study.

Within each district, schools were matched by school size, third grade class size, racial and ethnic composition, math and reading achievement, and percentage of students eligible for free or reduced-price lunch. In general schools could not be matched closely (Fraser et al., 2009; details reported in the Results section). Also, one comparison school withdrew and was replaced without further matching or randomization.

At intervention schools, teachers received two to three hours of initial training on the Making Choices curriculum and another two hours on behavior management and social dynamics. The study team provided curriculum materials as well as consultation twice a month throughout the school year. Teachers administered the Making Choices curriculum, which included about 15 hours of lessons in grade 3 and eight hours in grades 4-5. Making Choices lessons are 45-minute participatory activities (e.g., drawing, discussion, skits) designed to increase social-emotional skills, prevent rejection by peers, and increase interaction with prosocial peers (Fraser et al., 2005; Fraser et al., 2010).

The initial sample for the current study included 691 boys and girls at study schools who were present in regular third-grade classrooms (versus self-contained special education classrooms) in the fall of 2004. These students belonged to the first study cohort, which represented five intervention schools (n=325) and five comparison schools (n=366).

Measures. The current study focused on data collected in the fall, winter, and spring of the fourth grade. Aggression, the outcome, was rated in the spring by teachers using the aggression subscale of the Behavior Assessment System for Children (BASC; Thorpe, Kamphaus, & Reynolds, 2003). Effortful control was measured in the fall using the mean of three teacher-rated scores: inhibitory control (alpha=.84), attention control problems (reversed; alpha=.88), and impulsivity (reversed; alpha=.89). The effortful control measure was developed for this study using 10 items from the Social Competence Scale (SCS-T; Corrigan, 2003), the IOWA Conners Rating Scale (Waschbusch & Willoughby, 2008), and the SNAP-IV scale (Swanson et al., 2001). SIP variables—encoding, hostile attribution, goal formulation, and response decision—were measured in the winter with the child-rated Skill Level Activity (Nash, Fraser, Galinsky, & Kupper, 2003). Baseline covariates, measured in the fall of third grade, included age, sex, an age-by-sex interaction, race (Black versus other), ethnicity (Hispanic versus other), primary caregiver education (measured on a scale from 1-4), ratio of household income to the federal poverty guideline, primary caregiver employed full-time (dichotomous), BASC aggression score, Interpersonal Competence Scale (ICST) aggression score (Cairns, Leung, Gest, & Cairns, 1995), and BASC conduct problems score.

Multiple imputation. Missingness affected 12.0% of the information in the analysis model and 44.1% (305/691) of study participants. To prevent bias (Allison, 2002) and make full use of the available data while also accounting for the uncertainty associated with imputation, multiple imputation with chained equations (mice) in R 2.14.1 (R Development Core Team, 2011) was used to create 40

imputed datasets. Unlike Markov chain Monte Carlo methods, the chained equations method makes no assumption about the joint distribution of variables and allows a separate imputation model for each variable (van Buuren & Groothuis-Oudshoorn, 2011).

Variable distributions, correlations, missingness patterns, and collinearity diagnostics were used to construct and refine the imputation models. Informative imputation models were created by including auxiliary variables as well as analysis variables and baseline covariates. Post-imputation plots confirmed the convergence of means and variances across iterations and showed no evidence of trends across imputations. Relative efficiency was at least 99% for the mean of each analysis variable, indicating that statistical efficiency was close to the efficiency that would be achieved with an infinite number of imputed datasets. Post-imputation analyses were conducted on all of the imputed datasets and summarized using the MIANALYZE procedure in SAS 9.2 (SAS Institute Inc., 2008).

Propensity scoring. Because the sample of schools was small (N=10) and school-level matching worked poorly (details provided in the Results section), random assignment within school pairs could not be expected to prevent between-school differences from biasing estimates of the intervention effect. School-level propensity scoring was considered, but the small sample size would not support a school-level logistic regression model, including exact logistic regression. Person-level and multilevel propensity scoring were also considered for the sample as a whole, but rejected because they would not address selection bias at the level of treatment assignment (i.e., the school level). Instead, to reduce selection bias while

preserving the original design of treatment assignment within school pairs, person-level propensity scores were estimated within school pairs and then propensity-score-matched data from the five school pairs were combined to form the analysis dataset.

The propensity score models included age, sex, an age-by-sex interaction, an indicator for Black race, primary caregiver education, ratio of household income to federal poverty guideline, primary caregiver employed full time, baseline effortful control (measured using all three subscale means), baseline aggression (BASC and ICST), and baseline conduct problems. For the three school pairs with sufficient numbers of Hispanic students, an indicator for Hispanic ethnicity was also included. To reduce collinearity, covariates were centered at their means and baseline aggression was divided by 10.

Matching was performed using a 5-to-1 digit greedy matching algorithm (Parsons, 2001). This algorithm makes five passes through the intervention group in random order, performing caliper matches on the propensity score. The caliper starts at ±.000005 on the first pass and widens by a factor of 10 with each successive pass, ending at ±.05. Potential matches in the comparison group are considered in random order. Whenever a match is found, the matched pair of observations is removed from further consideration and retained for the analysis sample.

After creating the combined analysis dataset, covariate balance was checked at the individual and school levels using the average standardized absolute mean (ASAM) difference. That is, for each covariate in the propensity score model, the

between-group mean difference was calculated and divided by the pooled standard deviation. The absolute values of these standardized mean differences were averaged across the covariates. At the individual level, additional balance measures proposed by Rubin (2001) were also consulted: B, the absolute mean difference on the propensity score logit; R, the between-group variance ratio on the propensity score logit; and variance ratios on individual covariates.

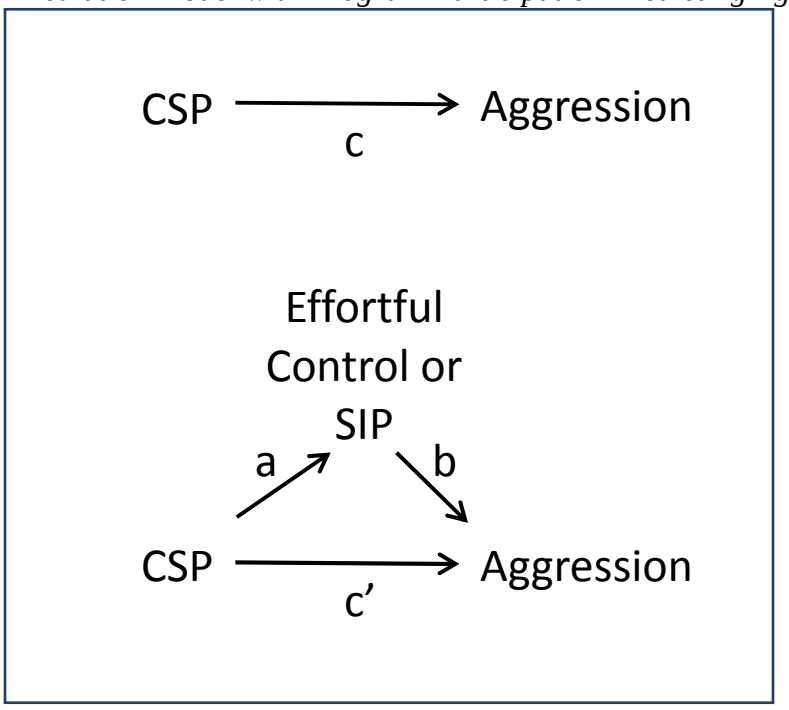
Absolute mean differences are effect sizes and can be evaluated using Cohen's guidelines for small (0.2), medium (0.5), and large (0.8) effects. ASAM differences and B statistics of zero indicate perfect balance on means. Similarly, R statistics and variance ratios equaling one indicate identical variances. A variance ratio (or R statistic) greater than 1.25 (or <0.8) indicates moderate imbalance; a variance ratio greater than 2.0 (or <0.5) indicates severe imbalance.

Mediation analysis. Using the propensity-score-matched sample, means, standard deviations, and pairwise correlations were estimated for effortful control, SIP variables, and aggression. The standard deviation of each variable, x, was estimated from the multiply imputed datasets as the square root of the quantity $[E(x^2)-(E(x))^2]$ (S. Kolenikov, personal communication, September 27, 2010). Five mediation models were constructed to test for indirect effects of third- and fourth-grade exposure to CSP on aggression (measured in the spring of fourth grade), mediated by effortful control (fourth grade fall, one model) or SIP variables (fourth grade winter, four models). These models are represented collectively in Figure 3.1. The "a" path corresponds to the effect of CSP on the mediator, the "b" path to the

effect of the mediator on aggression (controlling for the effect of CSP), and the "c" path to the total effect.

For each mediation model, the *a* and *b* coefficients were estimated in separate generalized estimating equation (GEE) models in SAS PROC GENMOD (SAS Institute Inc., 2008), which corrected standard errors for the nesting of students within classrooms and schools. The first GEE model regressed the mediator on the CSP indicator, and the second regressed the aggression outcome on the mediator, controlling for the CSP indicator. The indirect effect was estimated as the product *a* x *b*, and the PRODCLIN program was used to estimate a 95% confidence interval for the indirect effect (MacKinnon, Fritz, Williams, & Lockwood, 2007). The total effect of CSP on aggression, *c*, was also estimated.

Figure 3.1
Mediation Model with Program Participation Predicting Aggression



Note. CSP=Competence Support Program, SIP=Social information processing.

The GEE models were run for the propensity-score-matched sample without additional covariance adjustment, and were also run after adding the following baseline covariates: age, sex, age-by-sex interaction, Black race, Hispanic ethnicity, primary caregiver education, ratio of household income to federal poverty guideline, primary caregiver employed full time, baseline aggression (BASC and ICST), and baseline conduct problems. As in the propensity score estimation models, covariates were mean-centered and baseline BASC aggression scores were divided by 10 to reduce collinearity. Exploratory mediation models were also run for subgroups defined by the following variables: sex; race (Black versus other); ratio of household income to federal poverty guideline (median split); baseline BASC aggression (median split); minutes of Making Choices classroom intervention in grade 3, for the models with fall effortful control as potential mediator (median split, as well as a higher split at ≥900 minutes of exposure); and minutes of Making Choices classroom intervention from grade 3 fall through grade 4 winter, for the models with winter SIP variables as potential mediators (median split, as well as a higher split at ≥1,220 minutes of exposure). An additional exploratory model was run for each propensity score quintile, after using the propensity score model above (including Hispanic ethnicity) to create an overall propensity score within the matched sample. The propensity-score-stratified models were intended to capture any heterogeneity in the intervention effect that might not be evident when examining subgroups defined by a single variable. Statistical tests were conducted at the .05 level of significance.

Results

Matches on the propensity score were found for 27.0% to 56.4% of students within school pairs and 44.4% of students overall. At the school level, the ASAM difference was reduced from 0.70 (“medium”) before matching to 0.12 (less than “small”) after matching, and the maximum standardized difference was reduced from 1.18 (“large”) to 0.20 (“small”). At the individual level, ASAM difference was reduced from 0.20 (“small”) to 0.05 (less than “small”), and the B statistic was reduced from 1.41 (“large”) to 0.02 (less than “small”). The R statistic changed from 1.06 to 0.89 (both in the acceptable range) and the number of imputations with outlying R statistics in the moderately severe range decreased. (Before matching the range and standard deviation of the R statistic were 0.91 to 1.36, and 0.09, respectively; after matching they were 0.78 to 0.97, and 0.04, respectively.) With regard to variance ratios on individual covariates, none was severe before or after matching, and the percentage in the moderate range decreased from 35.54 to 10.89. Considering these balance statistics together, covariate balance after matching was deemed acceptable.

Table 3.2 describes the intervention and comparison groups before and after propensity score matching. Before propensity scoring, the largest differences were on race, ethnicity, and aggression scores. After matching, the statistics for the two groups were more similar.

Table 3.3 shows correlations, means, and standard deviations (SDs) for the variables in the mediation models. Effortful control was positively correlated with the later-stage SIP skills (goal formulation and response decision) but not with encoding

or hostile attribution, and was negatively correlated with aggression (r=-.55). Among the SIP variables, goal formulation and response decision had the strongest pairwise correlation (r=.66). Encoding was positively correlated with the later-stage SIP variables. Hostile attribution, goal formulation, and response decision were correlated with each other in the expected directions. SIP variables were correlated with aggression in the expected direction, but only goal formulation and response decision had statistically significant correlations with aggression.

Table 3.2
Baseline Characteristics Before and After Propensity Score Matching

	Mean (SD) or Percentage					
	Before propensity scoring			After propensity score matching		
	Comparison (n=366)	Intervention (n=325)	Total (n=691)	Comparison (n=153)	Intervention (n=153)	Total (n=307)
Age, grade 3 fall	8.6 (0.5)	8.6 (0.5)	8.6 (0.5)	8.6 (0.5)	8.6 (0.5)	8.6 (0.5)
Female	50.0%	54.5%	52.1%	57.0%	56.8%	56.9%
Black	21.0%	48.0%	33.7%	34.1%	33.2%	33.7%
White	58.2%	33.5%	46.6%	53.5%	47.0%	50.3%
Hispanic	13.9%	8.3%	11.3%	5.0%	5.8%	5.4%
Receives special education	3.6%	4.9%	4.2%	3.6%	4.6%	4.1%
Ratio of household income to federal poverty guideline	1.6 (1.1)	1.5 (1.0)	1.6 (1.1)	1.6 (1.1)	1.6 (1.0)	1.6 (1.1)
Primary caregiver employed full-time	56.8%	50.8%	54.0%	54.3%	53.6%	53.9%
BASC aggression	4.3 (5.2)	6.3 (7.1)	5.3 (6.2)	4.8 (5.2)	4.6 (5.2)	4.7 (5.2)
ICST aggression	2.4 (1.3)	2.8 (1.5)	2.6 (1.4)	2.4 (1.4)	2.4 (1.3)	2.4 (1.3)
BASC conduct problems	1.2 (1.5)	1.7 (1.9)	1.5 (1.7)	1.4 (1.6)	1.3 (1.5)	1.3 (1.5)
Effortful control	3.2 (0.6)	3.0 (0.7)	3.1 (0.6)	3.2 (0.6)	3.2 (0.6)	3.2 (0.6)

Note. All statistics, including sample sizes, are averaged across imputed datasets. The sample sizes after propensity score matching are subject to rounding error.

Table 3.3

Means, Standard Deviations, and Correlations Among Variables in Mediation Models, Within Matched Sample

Variable or statistic	1	2	3	4	5	6	7
1. Intervention condition	---						
2. Effortful control (fall)	0.05	---					
3. Encoding (winter)	-0.05	0.10	---				
4. Hostile attribution (winter)	-0.07	-0.06	-0.05	---			
5. Goal formulation (winter)	0.04	0.20 **	0.23 **	-0.26 ***	---		
6. Response decision (winter)	0.11	0.25 ***	0.22 **	-0.22 **	0.66 ***	---	
7. BASC aggression (spring)	-0.02	-0.55 ***	-0.10	0.06	-0.17 *	-0.21 **	---
Mean	0.50	3.12	0.51	0.59	0.57	0.51	7.32
SD	---	0.60	0.21	0.29	0.38	0.42	8.18

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

In the mediation models with no covariate adjustment (not shown), effortful control, goal formulation, and response decision were negatively associated with aggression, controlling for intervention condition, but no other estimate differed significantly from zero, including the indirect effects of interest. Table 3.4 shows the results of the covariate-adjusted mediation models. The negative association between effortful control and aggression remained statistically significant. Based on the standard deviations in Table 3.3 and the adjusted estimates of the *b* coefficient in Table 3.4, a 1-SD increase in effortful control was associated with a decrease in aggression of 0.36 SD. Otherwise, no estimate in the adjusted models differed significantly from zero, including the effect of CSP on mediators, the total effect of CSP on the outcome, the effects of mediators on the outcome, and the indirect effects. In some cases the indirect effect was large relative to the total effect, primarily because the mediators were more strongly related to the outcome (controlling for intervention condition) than the intervention was. In the subgroup models and propensity-score-stratified models, no mediation effect emerged.

Table 3.4

Adjusted Results of Mediation Models for the Matched Sample

Mediator	X->M effect (a path) (95% CI)	M->Y effect (b path) (95% CI)	Indirect effect (a X b) (95% CI)	Total effect (c path) (95% CI)	Ratio of indirect to total effect
Effortful control	0.0475 (-0.0760,0.1709)	-4.9586 *** (-6.8452,-3.0719)	-0.2353 (-0.8839,0.3680)	-0.0891 (-2.2234,2.0453)	2.6417
Encoding	-0.0231 (-0.0741,0.0279)	-1.0020 (-6.4509,4.4468)	0.0231 (-0.1079,0.1886)		-0.2598
Hostile attribution	-0.0454 (-0.1318,0.0410)	0.0990 (-3.5656,3.7635)	-0.0045 (-0.1910,0.1756)		0.0504
Goal formulation	0.0198 (-0.0843,0.1239)	-0.8790 (-3.8693,2.1113)	-0.0174 (-0.1502,0.0895)		0.1955
Response decision	0.0771 (-0.0470,0.2012)	-1.2226 (-3.6157,1.1705)	-0.0943 (-0.3943,0.0935)		1.0585

Note. X indicates the independent variable, intervention condition. M indicates the mediator, effortful control or a social information processing variable. Y indicates the outcome, aggression. Paths a, b, and c, and product a × b, refer to coefficients labeled in Figure 3.1. CI = confidence interval.

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

Due to methodological differences, the findings reported here differ from other findings based on the same overall study. For example, Fraser and colleagues (2009) found that CSP was associated with a relative reduction in BASC aggression during grade 4, as shown in Table 3.1. The current analysis controlled for baseline aggression as a covariate (after partialing out the effect of baseline effortful control), whereas Fraser and colleagues used change scores as outcomes. Also, whereas previous analyses required that children be present in multiple grades, the current analysis required only that they be present at baseline. Finally, the current sample also differs from the previous sample because the current study used propensity score matching. The resulting analysis sample represents a different population than was represented by the previous analysis sample, which was based on inverse probability of treatment weighting. Further, in intervention schools, different portions of the overall student population received different amounts of exposure to the intervention. For reference, Table 3.5 describes grade 3 intervention exposure and propensity score matching results for the intervention schools. The weighted average is 17.1 hours for the full sample and 16.9 hours for the matched sample.

Table 3.5
Grade 3 Intervention Exposure in Hours for Full Sample and Propensity-Score-Matched Sample

School	Exposure in full sample, Mean (SD)	N	n Matched, Mean (SD) [a]	% matched, Mean [a]
11	22.7 (9.0)	67	28.6 (1.7)	42.7%
7	18.7 (1.1)	70	42.3 (2.0)	60.4%
8	18.7 (2.0)	76	24.6 (1.5)	32.4%
3	13.8 (5.5)	59	33.9 (2.1)	57.5%
4	9.2 (4.1)	53	24.1 (2.4)	45.5%

[a] Calculated across 40 imputations.

Discussion

In this study, effortful control and social information processing variables were examined as potential mediators of the relation between exposure to the Competence Support Program and aggression in a sample of third-grade students who were followed through the fourth grade. One mediator (effortful control) was associated with the outcome, controlling for intervention condition, but CSP was not found to affect either the mediators or the outcome, and no mediation effect was evident.

This study employed a convenience sample of schools (like most studies of school-based interventions) and a propensity-score-matched sample of students, so the findings cannot be generalized to a broad population of schools or students. More importantly, the comparison condition in this study represents an alternative intervention rather than no intervention. Although comparison school principals agreed not to implement new social and character development programs during the study, the North Carolina legislature had passed an act in 2001 (three years before the start of the study) requiring all schools to implement character education (Fraser et al., 2009). Therefore, between 2002 and 2004 the comparison schools in this study had begun teaching content that may have been similar to the Making Choices curriculum. In fact, all comparison school principals reported having school programs or activities for violence prevention, social and emotional development, character education, and behavior management (Social and Character Development Research Consortium, 2010). Many comparison school teachers reported promoting those goals in their classrooms—violence prevention, 52.4%, social and

emotional development, 75.6%, character education, 80.9%, and behavior management, 92.7%—and over half (57.0%) used manuals or teacher guides to teach social and character development.

The findings do not support the conclusion that CSP reduced aggression, compared to the alternative intervention. Given that other studies involving Making Choices have found effects on emotion regulation, SIP variables, and aggression, implementation differences may partially explain the current findings. Unlike other implementations of the Making Choices curriculum, CSP required classroom teachers to administer the lessons. Because classroom teachers are burdened with many responsibilities other than the teaching of social skills, they may not have been able to devote sufficient time to Making Choices lessons to yield the desired results. In fact, average exposure varied substantially in the third grade, from a low of 9.0 hours (12.3 lessons) at one intervention school to a high of 23.6 hours (26.3 lessons) at another (Fraser et al., 2009).

Given that the current findings did not reflect a program effect on aggression even at higher levels of exposure, it is possible that even the planned amount of exposure (28 lessons in third grade and 8 lessons in fourth grade) was insufficient. For example, although the PATHS, Second Step, and Positive Action programs yielded mixed results in the Social and Character Development Study (Social and Character Development Research Consortium, 2010), all three were designed to deliver much higher doses than Making Choices. The PATHS intervention includes a 2-3 day initial teacher workshop, 131 classroom lessons (approximately 3 per week for at least 20-30 minutes), and weekly or bi-weekly consultation with program

staff (Greenberg, Kusché, & Mihalic, 1998). Second Step includes a one-day initial teacher workshop, half-day workshop for non-instructional staff, 22-28 classroom lessons per year (approximately 20-45 minutes each depending on grade level), and free ongoing technical support from program staff (Fitzgerald & Edstrom, 2006; Frey, Hirchstein, & Guzzo, 2000). The comprehensive Positive Action program includes approximately 140 15-20 minute lessons per year, plus school-wide, family, and community involvement components (Beets et al., 2009).Measurement issues may also explain the findings to some extent. For example, Cronbach's alpha coefficient for the hostile attribution measure was only .49 to .52 (Fraser et al., 2005; Terzian, 2007), which could be expected to attenuate correlations between hostile attribution and other variables. Also, in this study only the SIP variables were child-reported; other variables were teacher-reported. This difference in measurement methods may have weakened the associations among variables in the mediation models. Using the same rater for each variable in the mediation model—and, preferably, using multiple raters for each—might produce more informative findings by reducing the impact of method variance. Furthermore, only general aggression measures were available, but problems in the earlier stages of SIP (encoding and interpretation) are associated with reactive aggression (Dodge, 1980; Lochman & Wells, 2002; Schwartz et al., 1998), whereas problems in the later stages (e.g., goal formulation, response decision) are associated with proactive aggression (Camodeca & Goossens, 2005; Lochman & Wells, 2002; Richard & Dodge, 1982; Schwartz et al., 1998). Similarly, effortful control is probably more closely related to reactive aggression than to proactive aggression. Mediation models that paired

specific mediators with specific types of aggression would be more likely to result in statistically significant indirect effects, or at least significant values of *b* coefficients. More specific mediation models would also provide more detailed information about intervention effects and underlying mechanisms. Finally, the timing of measurements may have been incorrect. Measuring mediators and outcomes more frequently would provide information about the time required for the intervention to take effect, and might also allow data to be used as a guide for mid-course corrections as the intervention is being implemented.

In conclusion, this study found a negative association between effortful control and aggression. It failed to find associations between SIP variables and aggression or to find that CSP, compared to alternative social and character development activities, had affected mediators or outcomes. Likely explanations include implementation variation and measurement. The intervention and its evaluation could be improved by supporting teachers to implement the classroom component more fully (Fraser et al., 2009), engaging more (or more similar) schools, and increasing the specificity, reliability, and frequency of measurements. Even so, successful aggression prevention may require more intense or longer-term exposure to program content.

Discussion

Early aggression is a problem in its own right and a risk factor for further developmental problems. Aggressive behavior is influenced by complex interactions among risk and protective factors that operate at the environmental, family, and individual levels (e.g., neighborhood exposure to violence, parenting style, biological factors, effortful control, SIP skills). Effortful control, the conscious management of emotional experience and of related behaviors, is negatively associated with externalizing problems. SIP skills are negatively associated with aggression. Both effortful control and SIP skills are thought to be malleable and have often been targeted, at least to some degree, by aggression prevention programs. However, little is known about the relation between effortful control and SIP skills or about their joint relation with aggression. Further, in studies of aggression prevention, effortful control generally has not been measured well.

The three papers included in this dissertation address these knowledge gaps. Paper 1 describes the use of teacher-reported data to develop a reliable and valid measure of effortful control measure with three dimensions: inhibitory control, attention control problems, and impulsivity. Paper 2 confirms the negative association between effortful control and aggression and suggests that if any SIP variables mediate that relation, it may be the later-stage variables, goal formulation and response decision. That paper also identifies issues that may need to be addressed in using longitudinal data to study SIP variables as potential mediators of

the relation between effortful control and aggression. Paper 3 reports findings from a study examining the effect of the Competence Support Program on aggression, with effortful control and SIP variables as potential mediators. That paper also discusses problems that may have contributed to the failure to find program effects on mediators or outcomes, and identifies potential solutions. The remainder of this chapter discusses the strengths and limitations of these three studies (Studies 1, 2, and 3) as a whole, implications for practice, and recommendations for future research.

Strengths and Limitations

These three studies have three main strengths. First, they rest on a strong theoretical framework that identifies effortful control and SIP skills as malleable risk factors for early aggression, suggests that SIP variables may mediate the relation between effortful control and aggression, and further suggests that effortful control and SIP skills may be appropriate targets for aggression prevention programs. Second, each study used appropriate statistical procedures to mitigate data limitations and to address the question at hand. For example, the Study 1 used single imputation, exploratory factor analysis, and confirmatory factor analysis to develop a measure of effortful control in a sample with missing data. Studies 2 and 3 (collectively) employed multiple imputation, propensity score matching, and generalized estimating equations to examine longitudinal mediation models in a setting with missing data and selection bias. Thorough diagnostic testing was conducted, including pre- and post-imputation diagnostics and a detailed

assessment of covariate balance in the propensity-score-matched sample. Third, the findings of Studies 1 and 2 were generally consistent with theory, and Study 3 included a thorough exploration of potential reasons for findings that were inconsistent with theory.

These strengths must be weighed against at least seven limitations. First, multiple measurement problems affected all three studies. Only teacher ratings were used to measure effortful control and aggression, and only child ratings were used to measure SIP variables. The effortful control measure was developed using a limited item pool that did not include items related to activation control. Effortful control items were measured on a four-point scale, and the SIP and aggression variables showed modest departures from normality. Further, the effortful control and aggression measures were relatively broad. Any or all of these measurement problems may have attenuated the effects being examined. Second, several additional factors threatened the internal validity of the mediation studies (Studies 2 and 3). For example, the apparent effect of effortful control on aggression may have been due to a third, unmeasured variable. In addition, Study 3 was affected by a history effect that produced treatment contamination, as indicated by reports of social and character development activities in comparison schools (Social and Character Development Research Consortium, 2010). That study was also subject to school-level selection bias, which may not have been resolved fully by propensity score matching (i.e., unmeasured confounding or the small amount of residual imbalance on measured variables may have affected the findings). As a result, a selection-maturation threat may have existed: children in the (higher-risk)

intervention schools and the (lower-risk) comparison schools may have been on different developmental trajectories before the study began. These actual and potential threats prevented an ideal test of the effects of the Competence Support Program. Third, teachers in intervention schools did not fully implement the Making Choices curriculum. Fourth, although care was taken to use appropriate imputation procedures and analysis models, model assumptions may have been violated. In particular, Study 1 ignored the uncertainty associated with the imputation process and the clustering of students within classrooms and schools. Fifth, it is unknown how well the effortful control and SIP measures captured children's internal functioning. Scores on pencil-and-paper scales do not always match task performance (Verstraeten et al., 2010), and it is difficult to know whether scale scores and responses to hypothetical scenarios accurately reflect the emotional and cognitive processes that occur during actual social situations (Crick & Dodge, 1994). Sixth, in Studies 2 and 3, the timing of measurements may not have matched the timing of developmental changes or intervention effects. Seventh and finally, all three studies used the same convenience sample of schools, and the third relied on a propensity-score-matched sample in which few potential matches were available for children who received the intervention. These factors limit external validity.

Implications for Practice

Because of the studies' strengths and despite their limitations, they have at least two implications with regard to the prevention of childhood aggression. As described above and in the introductory chapter, theory suggests that effortful

control and SIP skills are malleable factors that should be targeted by aggression prevention programs. These studies consistently showed a negative association between effortful control and aggression, and Study 2 suggested that this relation may be mediated by the later-stage SIP variables, goal formulation and response decision. The findings lend modest support to the notion that aggression prevention programs should focus on effortful control and SIP as proximal outcomes. They also suggest that incorporating more emotional content may increase the effectiveness of such programs. Specifically, training in attention focusing and inhibitory control (e.g., ignoring distractions, delaying action, refraining from automatic responses to triggers) may help children to avoid aggressive behavior.

Recommendations for Future Research

In terms of future research, the studies described here have implications in five areas: the measurement of effortful control; the measurement of internal processes more generally; the specificity of effortful control, SIP, and aggression measures; the use of longitudinal mediation models; and aggression prevention research. With regard to the measurement of effortful control, Study 1 extended prior research by using teacher ratings of children's behavior to develop a brief, valid, reliable multidimensional scale with some content not covered by existing effortful control scales (Derryberry & Reed, 2002; Ellis & Rothbart, 2001; Lonigan & Phillips, 2001). The Attentional Control Scale (Derryberry & Reed, 2002) is a longer (20-item) self-rated scale, measures only attention control, and was developed with an adult sample. The Early Adolescent Temperament Questionnaire-Revised (Ellis

& Rothbart, 2001) is multidimensional and has parent and self-report versions; its attention control subscale has an alpha coefficient of only .65. The self-reported Effortful Control Scale (Lonigan & Phillips, 2001) includes impulsivity and persistence factors, but not inhibitory control; also, it was developed using scale-level factor analysis, which may complicate administration and scoring. Further, Study 1 highlighted the fact that, collectively, existing scales (including the one developed here) provide incomplete coverage of the effortful control construct. Content validity could be improved by developing a comprehensive item pool and conducting a new study designed specifically to measure effortful control. Study 1 also identified two theoretical questions requiring clarification: (1) given that executive functioning is required for effortful control (Eisenberg & Spinrad, 2004; Eisenberg et al., 2004), does this executive functioning represent a dimension of attention control apart from attention shifting and focusing, and (2) is impulsivity part of effortful control (e.g., Lonigan & Phillips, 2001), perhaps identical to low inhibitory control, or is impulsivity a separate construct (e.g., Eisenberg et al, 2004; Spinrad et al., 2007)? The second question could be addressed more effectively by measuring reactive control as well as effortful control, thus bringing the latter into sharper relief.

A related issue is the measurement of internal processes in general. The use of paper-and-pencil scales for this purpose (e.g., to measure effortful control and SIP) is necessary, perhaps, but difficult. More frequent use of neuropsychological measures might help to connect paper-and-pencil measures more closely to internal functioning (Verstraeten et al., 2010). Still, even task performance scores are behavioral measures. In the process of refining effortful control and SIP measures,

it may be possible to use biofeedback devices and/or imaging studies for triangulation. With regard to imaging studies, Boni and colleagues (2001) found that in children with sickle cell disease, cerebral injury (detected using magnetic resonance imaging [MRI]) was associated with difficulty encoding and interpreting emotional cues. Further, researchers have begun to use functional MRI to identify specific regions of the brain associated with social cognition in adults (Semrud-Clikeman, Goldenring Fine, & Zhu, 2011) and with "bottom-up" emotional arousal and "top-down" effortful control in young adults (Ochsner et al., 2009). This type of imaging study could be used along with scales and task performance to gain a better understanding of effortful control and SIP. As for biofeedback devices, pilot studies have explored the use of respiratory feedback to reduce anxiety in dental patients (Morarend et al., 2011); respiratory, hand temperature, and electromyography feedback to lower stress among children with asthma (Long et al., 2011); and functional MRI feedback to train adults to increase activity in brain areas associated with positive emotion (Johnston et al., 2010). Potentially this type of procedure could be used to measure and improve children's effortful control skills. Wearable biofeedback, an emerging technology (Liu, Huang, & Wang, 2011), might be particularly useful for this purpose.

Another measurement-related recommendation is to assess specific dimensions of effortful control, SIP, and aggression whenever possible. Broad measures may be useful for exploring new ideas or assessing overall program effects, but in order to refine theory and understand causal mechanisms, specific measures are required. For example, individual dimensions of effortful control could

be used as predictors in mediation models to determine whether they affect aggression through different mechanisms. Also, different forms of aggression (proactive versus reactive, relational versus physical) are associated with different theories and different social-cognitive mechanisms (Heilbron & Prinstein, 2008; Fontaine, 2006). An intervention to prevent reactive aggression should be expected to improve encoding and interpretation skills and decrease reactive aggression, but may not affect goal formulation, response decision, or global aggression scores.

Given appropriate measures of the key constructs, longitudinal mediation models present two unique challenges. First, mediation models require correct spacing of measurements (MacKinnon, 2008). In the context of research on effortful control, SIP, and aggression, measurements must be spaced according to developmental or program theory. Alternatively, many closely-spaced measurements could be taken in order to provide sufficient information to build theory. Second, in models with effortful control as a predictor, further work may be necessary in order to find an appropriate way to adjust for baseline aggression without artificially removing the effect of effortful control on later aggression. In Study 2, effortful control was “partialed out” of the baseline aggression and conduct problem measures (i.e., each of these covariates was regressed on effortful control and the resulting residuals were included in the mediation models) and both unadjusted and adjusted results were reported.

Finally, with regard to assessing the effect of a prevention program on aggression, several unsurprising recommendations can be made on the basis of the studies reported here: prevent selection bias, ensure treatment fidelity, avoid

treatment contamination, and use reliable and valid measures collected from multiple informants. However, these steps will be ineffective unless the program design includes sufficient exposure. For example, children may need much greater exposure to Making Choices curriculum content than the 12 to 26 lessons they received as part of the Competence Support Program. Related to this, the Competence Support Program (unlike previous Making Choices interventions) required regular teachers to administer the curriculum. Teachers attended brief training sessions (4 hours total) and had access to consultation twice a month, but classroom teachers may need more support than this in order to implement the curriculum fully. For comparison, the PATHS, Second Step, and Positive Action programs also use regular teachers. Although these programs had mixed results in the Social and Character Development Study (Social and Character Development Consortium, 2010), they generally include more teacher training (2-3 days, 1 day, and approximately 1 day, respectively) and more classroom content (131, 22-28, and 140 lessons respectively) than were provided by the Competence Support Program, and Positive Action also includes school, family, and community components (Beets et al., 2009; Fitzgerald & Edstrom, 2006; Flay & Allred, 2010; Frey, Hirchstein, & Guzzo, 2000; Greenberg, Kusché, & Mihalic, 1998). An alternative to dramatically increasing program exposure for teachers and students (and implementation burden for teachers and schools) would be to deliver program content through a small group of professional or graduate student trainers.

Conclusion

Based on a strong theoretical framework and using appropriate statistical methods, the three studies described here made three contributions: (1) Study 1 developed a reliable and valid teacher-reported measure of effortful control, (2) Studies 2 and 3, the mediation studies, provided modest support for the theory underlying many aggression prevention programs, and (3) collectively, the studies resulted in recommendations for improvements in the measurement of effortful control, SIP, and aggression; the use of longitudinal mediation models to assess the relations among them; and research on aggression prevention. Despite their limitations, they belong to a body of research that is incrementally improving the prevention of childhood aggression.

Appendix 1

Items Eliminated During Exploratory Factor Analysis

Expresses needs and feelings appropriately

Thinks before acting

Can calm down when excited or all wound up

Can wait in line patiently when necessary

Blurts out answers before questions have been completed

Is inattentive or easily distracted

Appendix 2

Detailed "Making Choices" Outcome and Mediation Findings

Table A2.1
Detailed "Making Choices" Outcome and Mediation Findings

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
Smokowski et al., 2004[a]	98	Regular ed. students, grade 3 (46% male; 685% European American non-Latino, 22% African American; approx. 25% FRL)	4 classes in 1 rural Southeastern school	By class	Pretest (fall), posttest (spring)	Stepwise regression model comparing posttest scores, adjusting for pretest score, gender, minority status; tested interactions with covariates	Better adjusted cognitive concentration (ES=.27 overall, .56 high-risk pretest, .54 girls) and overt aggression (ES=.31 overall, .73 minority only) ns: social competence; interactions with	+ reliable measures of cognitive concentration (CCC, alpha=.84), social competence (CCC, alpha=.91), aggression (CBCL-TRF, alpha=.91) + logical stepwise regression procedure + detailed reporting on handling of

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
							covariates unless reported above	outliers - possible contamination of comparison condition - insufficient power for HLM to control for clustering within class
Fraser et al., 2004[b]	86	Regular ed. students referred by teachers due to aggression and rejection by peers (63% male; 85% African American, 15% White non-Latino; mean age 8.9, SD	9 NC sites with interest in program and available resources (6 urban, 3 town/rural)	By individual	Pretest (fall), posttest (spring)	MANCOVA comparing posttest scores of children receiving Making Choices (mean 28 hours) and Strong Families (mean 26 hours) interventions during one school year to	Greater adjusted posttest scores on emotion regulation (eta-squared=.06) and cognitive concentration (eta-squared=.11)	+ appropriate attrition analysis (but used alpha=.05 with only 29 participants in lost group) + reliable measures of emotion regulation (alpha=.82), cognitive concentration (alpha=.95) + detailed reporting on

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
		1.4)				comparison group, adjusting for pretest, race/ethnicity, gender (dropped due to non-significance), site (2 sites with baseline differences vs. others); stepdown ANCOVA		handling of outliers - small sample - 25% attrition (11 dropouts and 18 participants with missing pretest or posttest data, out of 115 in original sample) - apparently no tests of interactions (but very limited power for such tests) - unclear whether eta-squared values are partial - teacher measures only - impossible to separate effect

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
								of MC from effect of Strong Families program
Fraser et al., 2005[c]	548	Regular ed. students, grade 3 (3 successive years; 51% male; 41% Latino, 34% European American, 20% African American; 53% FRL)	Approx. 30 classrooms (9 in cohort 2, 11 in cohort 3) in 2 schools	None. Cohort design with comparison group (cohort 1), MC (cohort 2), and MCP (cohort 3)	Pretest (Oct.), posttest (May)	HLM (student within grade 3 class) comparing pairs of cohorts on posttest scores, adjusted for pretest score on outcome variable, race/ethnicity (Latino, African American vs. European American), gender, school; tested interactions with	MC: better adjusted social competence (ES=.46), cognitive concentration (ES=.27, but higher for those with high baseline scores than for others), overt aggression (ES=-.17, but higher for boys than for girls), encoding (ES=.82), goal formulation	+ narrow overt aggression measure developed from CBCL-TRF (alpha=.80) + reliable measures of social competence, cognitive concentration (CCC; alpha=.92, .96 respectively) + most SIP measures reliable: encoding kappa=.96 (for coding), alpha=.78 (among

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
						covariates	(ES=.28, but greater effect in higher-SES school) MCP: greater adjusted social competence (ES=.56), cognitive concentration (ES=.43), overt aggression (ES=-.17), encoding (ES=.77), hostile attribution (ES=-.55), goal formulation (ES=.66), response decision (ES=.54)	vignettes); prosocial goals .76; response decision .80 + diverse sample + appropriate attrition analysis (but used alpha=.05 with only 26 participants in lost group) + logical stepwise procedure for HLMs - hostile attribution alpha=.52 - no control for rater effects (grade 3 teachers provided ratings at pre, post)

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
							ns: MC main effect on cognitive concentration, hostile attribution, response decision; interactions with pretest, gender, or race/ethnicity, and school % FRL, unless reported above	- excluded retained students - program taught by specialists - possible cohort, history effects - no control for nesting within school (n=2) or specialist - SIP measured only in spring - 1-tailed tests for intervention effects - effect sizes for main effects may not make sense where interactions were found -suburban/rural sample only
Fraser et	443 (based	Regular ed.	(see above)	(see above)	Pretest	HLM	Better	+ reliable

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
al., 2010[d]	on same sample as Fraser et al., 2005)	students, grade 3 (3 successive years; 51% male; 41% Latino, 36% European American, 18% African American)			(Oct.), posttest (May), 6-month follow-up (Oct.)	(student within grade 3 class) comparing pairs of cohorts on 6-month scores, adjusted for all baseline scores, race/ethnicity (Latino, African American vs. European American), gender, school. 2 intervention indicators coded to compare (1) comparison vs. average of intervention conditions and (2) MC	adjusted 6-month scores on overt aggression (ES=-.14), physical aggression (ES=-.09) ns: cognitive concentration, social competence; interactions with gender	measures of overt aggression (see above) and social competence, cognitive concentration, physical aggression (CCC, re-factored; alpha=.93, .95, .85 respectively) + diverse sample + appropriate analyses of attrition and differential attrition + pretest equivalence well demonstrated - 19% attrition

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
						vs. MCP. Tested interactions with gender.		(105/548) - no control for rater effects (grade 3 teachers provided ratings at pre, post; grade 4 teachers at follow-up) - teacher measures only - program taught by specialists - possible cohort, history effects - no control for nesting within school (n=2) or specialist - effect sizes may be overestimated due to use of total residual

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
								variance (vs. unconditional variance) in denominator and to use of (2*comparison-MC-MCP) contrast rather than (comparison-(MC-MCP)/2) - suburban/rural sample only
Terzian, 2007[c]	480 (based on same sample as Fraser et al., 2005, with a different comparison cohort)	Regular ed. students, grade 3 (3 successive years;50% male; 45% Latino, 34% European American, 17% African American)	28 classrooms in 2 schools	None. Cohort design with MC (cohort 1), MCP (cohort 2), and comparison group (cohort 3)	Pretest (Oct.), posttest (April)	Single-level and multilevel (student within classroom) SEM, using product method to test indirect effects	MC: greater relative improvement in ER (ES=.52), encoding (ES=.60), goal clarification (ES=.51 boys, -.04 girls), response	+ narrow overt aggression measure developed from CBCL-TRF (pre/post alpha=.79/ .81) + reliable measure of ER (CCC-TF alpha=.83/.84) + most SIP measures

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
							selection (ES=.26), CCC-TF overt aggression (ES=-.89 boys, -.07 girls) MCP: greater relative improvement in ER (ES=.47), hostile attribution (ES=-.39), goal clarification (ES=.72 boys, .30 girls), response selection (ES=.52), CCC-TF overt	reliable: encoding alpha=.71/.66, goal clarification .73/.79; response selection .75/.82 + diverse sample + appropriate selection bias and attrition analyses + appropriate use of multilevel models and SEM + SIP measured in fall and spring - hostile attribution alpha=.49/.49

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
							aggression (ES=-.84 boys, -.18 girls) ns: MC effect on hostile attribution; MCP effect on encoding	- mediator and outcome measured concurrently - no control for rater effects (grade 3 teachers provided ratings at pre, post) - excluded retained students - program taught by specialists - possible cohort, history effects - no control for nesting within school (n=2) or specialist -suburban/rural sample only
Fraser et	559	Regular ed.	10 schools	By school,	Fall and	OFM and	OFM, grade	+ reliable

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
al., 2009[e]		students, grade 3, followed through grade 5 ()	in 2 rural NC districts	after within-district matching on 5-variable Mahalanobis distance score (school size, class size, ethnic composition, math and reading achievement, % FRL)	spring of grades 3, 4, 5 (but not all measures administered at all time points)	HLM, both using piecewise methods to test for significant differences in within-grade change scores	4: greater relative improvement in ICST aggression (ES=-.15 to -.20), BASC aggression ES=(-.37 to -.48), ER (ES=.02 to .20) ns, OFM: grade 3 and 5 effects; AS, NBAA, cognitive concentration HLM, grade 4: BASC aggression (ES=-.21 to -.25), ER (ES=.01 to .19)	measures of ICST aggression (alpha=.78), CCC cognitive concentration (.97), CCC emotion regulation (.85), BASC-T aggression (alpha=.95, test-retest r=.91); normative beliefs about aggression (NBAA, alpha=.90); self-reported aggression (AS, alpha=.87) + analyses controlled for primary caregiver

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
							HLM, grade 5: ER (ES=.17), cognitive concentration (ES=.32) ns, HLM: grade 3 effects; AS,NBAA, ICST aggression	education and employment, age, sex, race/ethnicity, income-to-poverty ratio, and presence of (step)father in household + appropriate use of multiple imputation + 2 analysis techniques: OFM, HLM + within-grade change scores to control for rater effect + improvement in BASC aggression consistent across samples and analysis methods; improvement

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
								in ER consistent across methods but not present in one sample - in one school pair, comparison school withdrew prior to intervention and was replaced without further randomization; intervention school ceased to have a 5th grade - poor matches at school level, with treatment schools lower-performing, lower-income, and higher % students of

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
								color - wide variation in fidelity during Year 1 - analysis ignored school pairings and used person-level propensity scores despite school-level selection - substantial imbalance between groups after OFM on propensity scores - no control for clustering within class - insufficient diagnostics for propensity-score-weighted analysis

Study	N	Participants	# schools or classes	Random assignment mechanism	Measurement occasions	Analysis methods	EC-, SIP-, aggression-related intervention effects	Strengths (+), Limitations (-)
								- use of 3 different analysis samples due to school-level attrition and poor matching - interaction effects not reported

Note. AS=Aggression Scale (self-report), BASC-T=Behavior Assessment Scale for Children (teacher report), CBCL-TRF=Child Behavior Checklist Teacher Report Form, CCC(-TF)=Carolina Child Checklist(, Teacher Form) (based on TOCA-R), EC=effortful control, ER=emotion regulation, ES=effect size (Cohen's *d* unless otherwise specified), FRL=free or reduced-price lunch, HLM=hierarchical linear model, ICST=Interpersonal Competence Scale (teacher report), MC=Making Choices, MCP=Making Choices Plus (includes parent component), NBAA=normative beliefs about aggression, ns=not significant, OFM=optimal full matching, SEM=structural equation modeling, SIP=social information processing, TOCA-R=Teacher Observation of Classroom Adaptation-Revised

[a] Effect sizes reported by authors (difference between estimated marginal means, divided by average of group standard deviations). Effect sizes for main effects may not make sense in the presence of interactions.

[b] This study tests the outcomes of the Making Choices and Strong Families (i.e., parenting class) programs combined. It is included because other studies examine separately the effects of two similar programs (Fraser et al., 2005, 2010). In 7 of 9 sites, intervention occurred in after-school settings such as Boys and Girls Clubs. Outcomes were measured only for referred children, but prosocial peers participated in the intervention. Effect sizes provided by the authors. Note: according to the authors, these effect sizes are in Cohen's "medium" range, but calculating Cohen's d from the reported adjusted means and baseline standard deviations—$((mean_{post,treatment}-mean_{pre,treatment})- (mean_{post,control}-mean_{pre,control}))/\sqrt{(s^2_{pre,treatment}+s^2_{pre,control})}$—yields effect sizes of .30 and .22 for emotion regulation and cognitive concentration, respectively, which would be considered "small."

[c] Effect sizes provided by author(s).

[d] Effect sizes provided by authors. See note under Strengths/Limitations.
[e] Information from this report is supplemented with personal knowledge of the study. Intervention delivered by teachers in grade 3 (28 lessons) and all other grades (8 lessons). Teachers also received training and consultation about behavior management and social dynamics. Effect sizes provided by authors; effect size ranges are across the 3 analysis samples (CCC and ICST measures) or 2 analysis samples (AS, BASC, NBAA).

References

Allison, P. (2002). *Missing data: Sage University Papers series on quantitative applications in the social sciences*. Thousand Oaks, CA: Sage.

Bacon, T. P. (2003). *Technical report: The effects of the Too Good for Violence prevention program on student behaviors and protective factors*. Available at http://www.mendezfoundation.org/resources/evaluation/documents/TGFV_Study_2003.pdf

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182. doi:10.1037/0022-3514.51.6.1173

Beets, M. W., Flay, B. R., Vuchinich, S., Snyder, F. J., Acock, A., Li, K.-K., . . . & Durlak, J. (2009). Use of a social and character development program to prevent substance use, violent behaviors, and sexual activity among elementary-school students in Hawaii. *American Journal of Public Health, 99*(8), 1438-1445. doi:10.2105/AJPH.2008.142919

Belfer, M. L. (2008). Child and adolescent mental disorders: The magnitude of the problem across the globe. *Journal of Child Psychology and Psychiatry, 49*(3), 226-236. doi:10.1111/j.1469-7610.2007.01855.x

Boni, L. C., Brown, R. T., Davis, P. C., Hsu, L., & Hopkins, K. (2011). Social information processing and magnetic resonance imaging in children with sickle cell disease. *Journal of Pediatric Psychology, 26*(5), 309-319. doi:10.1093/jpepsy/26.5.309

Bridges, L. J., Denham, S. A., & Ganiban, J. M. (2004). Definitional issues in emotion regulation research. *Child Development, 75*(2), 340-345. doi:10.1111/j.1467-8624.2004.00675.x

Bruene-Butler, L., Hampson, J., Elias, M. J., Clabby, J. F., Jr., & Schuyler, T. F. (1997). The Improving Social Awareness-Social Problem Solving Project. In G. W. Albee & T. P. Gullotta (Eds.), *Primary prevention works*. Newbury Park, CA: SAGE.

Burks, V. S., Laird, R. D., Dodge, K. A., Pettit, G. S., & Bates, J. (1999). Knowledge structures, social information processing, and children's aggressive behavior. *Social Development, 8*(2), 220-236. doi:10.1111/1467-9507.00092

Cabrera-Nguyen, P. (2010). Author guidelines for reporting scale development and validation results in the Journal of the Society for Social Work and Research. *Journal of the Society for Social Work and Research, 1*(2), 99-103. doi:10.5243/jsswr.2010.8

Cairns R. B., Leung, M-C., Gest, S. D., & Cairns, B. D. (1995). A brief method for assessing social development: Structure, reliability, stability, and developmental validity of the Interpersonal Competence Scale. *Behaviour Research and Therapy, 33*, 725-736. doi:10.1016/0005-7967(95)00004-H

Camodeca, M., & Goossens, F. A. (2005). Aggression, social cognitions, anger and sadness in bullies and victims. *Journal of Child Psychology and Psychiatry, 46*(2), 186-197. doi:10.1111/j.1469-7610.2004.00347.x

Capaldi, D. M., & Rothbart, M. K. (1992). Development and validation of an early adolescent temperament measure. *Journal of Early Adolescence, 12*, 153-173. doi: 10.1177/0272431692012002002

Caspi, A. (2000). The child is father of the man: Personality continuities from childhood to adulthood. *Journal of Personality and Social Psychology, 78*(1), 158-172. doi:10.1037/0022-3514.78.1.158

Caspi, A., Henry, B., McGee, R. O., Moffitt, T., & Silva, P. A. (1995). Temperamental origins of child and adolescent behavior problems: From age three to age fifteen. *Child Development, 66*(1), 55-68. doi:10.2307/1131190

Centers for Disease Control and Prevention. (2010). Youth risk behavioral surveillance—United States, 2009. *Morbidity and Mortality Weekly Report, 59*(SS-5). Available at http://www.cdc.gov/mmwr/PDF/ss/ss5905.pdf

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155-159. doi:10.1037/0033-2909.112.1.155

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317-333. doi:10.1111/j.1467-8624.2004.00673.x

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317-333. doi:10.1111/j.1467-8624.2004.00673.x

Corrigan, A. (2003). Social Competence Scale - Teacher Version, Grade 2/Year 3 (Fast Track Project Technical Report). Available at http://www.fasttrackproject.org

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social-information processing mechanisms in children's development. *Psychological Bulletin, 115*, 74-101. doi:10.1037/0033-2909.115.1.74

Dearing, K. F., Hubbard, J. A., Ramsden, S. R., Parker, E. H., Relyea, N., Smithmyer, C. M., & Flanagan, K. D. (2002). Children's self-reports about

anger regulation: Direct and indirect links to social preference and aggression. *Merrill-Palmer Quarterly, 48*(3), 308-336. doi: 10.1353/mpq.2002.0011

Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology, 111*, 225–236. doi:10.1037/0021-843X.111.2.225

Dinkes, R., Kemp, J., & Baum, K. (2009). *Indicators of school crime and safety: 2009 (NCES 2010–012/NCJ 228478)*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, and Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice. Retrieved September 7, 2010, from http://nces.ed.gov

Dodge, K. A. (1980). Social cognition and children's aggressive behavior. *Child Development, 51*, 162-170. doi:10.2307/1129603

Dodge, K. A. (1986). A social information processing model of social competence in children. In M. Perlmutter (Ed.), *Cognitive perspectives on children's social and behavioral development: The Minnesota Symposia on Child Psychology* (Vol. 18, pp. 77–125). Hillsdale, NJ: Erlbaum.

Dodge, K. A. (1991). Emotion and social information processing. In Garber, J., & Dodge, K. A. (Eds.) *The development of emotion regulation and dysregulation*. New York: Cambridge University Press.

Dodge, K. A., & Pettit, G. S. (2003). A biopsychosocial model of the development of chronic conduct problems in adolescence. *Developmental Psychology, 39*(2), 349-371. doi:10.1037/0012-1649.39.2.349

Dodge, K. A., & Rabiner, D. L. (2004). Returning to roots: On social information processing and moral development. *Child Development, 75*(4), 1003-1008. doi:10.1111/j.1467-8624.2004.00721.x

Dolgin, K. G. (1986). Needed steps for social competence: Strengths and present limitations of Dodge's model. In M. Perlmutter (Ed.), *Cognitive perspectives on children's social and behavioral development: The Minnesota Symposia on Child Psychology* (Vol. 18). Hillsdale, NJ: Erlbaum.

Egger, H. L., & Angold, A. (2006). Common emotional and behavioral disorders in preschool children: Presentation, nosology, and epidemiology. *Journal of Child Psychology and Psychiatry, 47*(3/4), 313-337. doi:10.1111/j.1469-7610.2006.01618.x

Eisenberg, N. (2001). The core and correlates of affective social competence. *Social Development, 10*(1), 120-124. doi:10.1111/1467-9507.00151

Eisenberg, N., & Fabes, R. A. (1992). Emotion, regulation, and the development of

social competence. In Clark, M. S. (Ed.) *Emotion and social behavior: Review of personality and social psychology* (Vol. 14). San Francisco: Jossey-Bass.

Eisenberg, N., & Spinrad, T. L. (2004). Emotion-related regulation: Sharpening the definition. *Child Development, 75*(2), 334-339. doi:10.1111/j.1467-8624.2004.00674.x

Eisenberg, N., Fabes, R. A., Carlo, G., & Karbon, M. (1992). Emotional responsivity to others: Behavioral correlates and socialization antecedents. In Eisenberg, N., & Fabes, R. A. (Eds.) *Emotion and its regulation in early development*. San Francisco: Jossey-Bass.

Eisenberg, N., Fabes, R. A., Guthrie, I. K., & Reiser, M. (2000). Dispositional emotionality and regulation: Their role in predicting quality of social functioning. *Journal of Personality and Social Psychology, 78*(1), 136-157. doi:10.1037/0022-3514.78.1.136

Eisenberg, N., Sadovsky, A., Spinrad, T. L., Fabes, R. A., Losoya, S. H., Valiente, C., Reiser, M., Cumberland, A., & Shepard, S. A. (2005). The relations of problem behavior status to children's negative emotionality, effortful control, and impulsivity: Concurrent relations and prediction of change. *Developmental Psychology, 41*(1), 193-211. doi:10.1037/0012-1649.41.1.193

Eisenberg, N., Spinrad, T. L., Fabes, R. A., Reiser, M., Cumberland, A., Shepard, S. A., Valiente, C., Losoya, S. H., Guthrie, I. K., & Thompson, M. (2004). The relations of effortful control and impulsiveness to children's resiliency and adjustment. *Child Development, 75*(1), 25-46. doi:10.1111/j.1467-8624.2004.00652.x

Ellis, L. K. (2002). Individual differences and adolescent psychological development. Unpublished doctoral dissertation, University of Oregon. Available from http://www.bowdoin.edu/~sputnam/rothbart-temperament-questionnaires/pdf/ellis-dissertation-2002.pdf

Ellis, L. K., & Rothbart, M. K. (2001). Revision of the Early Adolescent Temperament Questionnaire. Poster presented at the Biennial Meeting of the Society for Research in Child Development. Minneapolis, Minnesota.

Ellis, L. K., Rothbart, M. K., & Posner, M. I. (2004). Individual differences in executive attention predict self-regulation and adolescent psychosocial behaviors. *Annals of the New York Academy of Science, 1021*, 337-340. doi:10.1196/annals.1308.041

Ferdinand, R. F., & Verhulst, F. C. (1995). Psychopathology from adolescence into young adulthood: An 8-year follow-up study. *American Journal of Psychiatry, 152*(11), 1586-1594. Retrieved from http://ajp.psychiatryonline.org

Fitzgerald, P. D. & Edstrom, L. V. (2006). SECOND STEP: A violence prevention

curriculum. In S. Jimerson & M. Furlong (Eds.), *The handbook of school violence and school safety: From research to practice*. Mahwah, NJ: Erlbaum Associates, Inc.

Flay, B. R., & Allred, C. G. (2010). The Positive Action Program: Improving academics, behavior and character by teaching comprehensive skills for successful learning and living. In T. Lovat & R. Toomey (Eds.), *International handbook on values education and student well-being*. Dirtrecht: Springer. Available at http://www.positiveaction.net

Fontaine, R. G. (2006). Evaluative behavioral judgments and instrumental antisocial behaviors in children and adolescents. *Clinical Psychology Review, 26*, 956-967. doi:10.1016/j.cpr.2006.07.003

Fraser, M. W. (1996). Aggressive behavior in childhood and early adolescence: An ecological-developmental perspective on youth violence. *Social Work, 41*(4), 347-361.

Fraser, M. W., Day, S. H., Galinsky, M. J., Hodges, V. G., & Smokowski, P. R. (2004). Conduct problems and peer rejection in childhood: A randomized trial of the Making Choices and Strong Families programs. *Research on Social Work Practice, 14*, 313-324. doi:10.1177/1049731503257884

Fraser, M. W., Galinksy, M. J., Smokowski, P. R., Day, S. H., Terzian, M. A., Rose, R. A., & Guo, S. (2005). Social information-processing skills training to promote social competence and prevent aggressive behavior in the third grade. *Journal of Consulting and Clinical Psychology, 73*(6), 1045-1055. doi:10.1037/0022-006X.73.6.1045

Fraser, M. W., Guo, S., Ellis, A. R., Day, S. H., Li, J., Wike, T. L., & Farmer, T. W. (2009). Social and character development in elementary school: Effects from a controlled trial. Report to Institute for Education Sciences. Chapel Hill, NC: Author.

Fraser, M. W., Lee, J.-S., Kupper, L. L., & Day, S. H. (2010). A controlled trial of the Making Choices program: Six-month follow-up. *Research on Social Work Practice*. Advance online publication. doi:10.1177/1049731510386626

Fraser, M. W., Nash, J. K., Galinsky, M. J., & Darwin, K. M. (2000). *Making Choices: Social problem-solving skills for children*. Washington, DC: NASW Press.

Frey, K. S., Hirchstein, M. K., & Guzzo, B. A. (2000). Second Step: Preventing aggression by promoting social competence. *Journal of Emotional and Behavioral Disorders, 8*(2), 102-112. doi:10.1177/106342660000800206

Gifford-Smith, M., & Rabiner, D. L. (2004). Social information processing and children's social competence: A review of the literature. In J. Kupersmidt & K. A. Dodge (Eds.), *Children's peer relations: From development to intervention*

to policy. Washington, DC: American Psychological Association.

Greenberg, M. T., Kusché, C., & Mihalic, S. F. (1998). *Promoting Alternative Thinking Strategies (PATHS): Blueprints for Violence Prevention, Book Ten. Blueprints for Violence Prevention Series* (D.S. Elliott, Series Editor). Boulder, CO: Center for the Study and Prevention of Violence, Institute of Behavioral Science, University of Colorado.

Heilbron, N., & Prinstein, M. J. (2008). A review and reconceptualization of social aggression: Adaptive and maladaptive correlates. *Clinical Child and Family Psychology Review, 11*, 176-217. doi:10.1007/s10567-008-0037-9

Hemphill, S. A., Smith, R., Toumbourou, J. W., Herrenkohl, T. I., Catalano, R. F., et al. (2009). Modifiable determinants of youth violence in Australia and the United States: A longitudinal study. *Australian and New Zealand Journal of Criminology, 42*(3), 289-309. doi:10.1375/acri.42.3.289

Izard, C. E. (1991). *The Psychology of Emotions.* New York: Plenum.

Johnston, S., Linden, D. E. J., Healy, D., Goebel, R., Habes, I., & Boehm, S. G. (2010). Upregulation of emotion areas through neurofeedback with a focus on positive mood. *Cognitive, Affective & Behavioral Neuroscience, 11*, 44-51. doi:10.3758/s13415-010-0010-1

Keenan, K., Shaw, D., Delliquadri, E., Giovannelli, J., & Walsh, B. (1998). Evidence for the continuity of early problem behaviors: Application of a developmental model. *Journal of Abnormal Child Psychology, 26*(6), 441-454. doi:10.1023/A:1022647717926

Kline, R. B. (2005). *Principles and practice of structural equation modeling*. (2nd ed.). New York : Guilford.

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology, 36*(2), 220-232. doi:10.1037/0012-1649.36.2.220

Krull, J. L., & MacKinnon, D. P. (1999). Multilevel mediation modeling in group-based intervention studies. *Evaluation Review, 23*, 418-444.

Krull, J. L., & MacKinnon, D. P. (2001). Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research, 36*(2), 249-277.

Lemerise, E. A., & Arsenio,W. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Development, 71*, 107-118. doi:10.1111/1467-8624.00124

Lengua, L. J. (2002). The contribution of emotionality and self-regulation to the

understanding of children's response to multiple risk. *Child Development, 73*(1), 144-161. doi:10.1111/1467-8624.00397

Liu, G.-Z., Huang, B.-Y., & Wang, L. (2011). A wearable respiratory biofeedback system based on generalized body sensor network. *Telemedicine and e-Health, 17*(5), 348-357. doi:10.1089/tmj.2010.0182

Lochman, J. E., & Wells, K. C. (2002). Contextual social-cognitive mediators and child outcome: A test of the theoretical model in the Coping Power program. *Development and Psychopathology, 14*, 945-967. doi:10.1017/S0954579402004157

Long, K. A., Ewing, L. J., Cohen, S., Skoner, D., Gentile, D., Koehrsen, J., . . . & Marsland, A. L. (2011). Preliminary evidence for the feasibility of a stress-management intervention for 7- to 12-year-olds with asthma. *Journal of Asthma, 48*, 162-170. doi:10.1089/tmj.2010.0182

Lonigan, C. J., & Phillips, B. M. (2001). Temperamental influences on the development of anxiety disorders. In M. W. Vasey & M. R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 60–91). New York: Oxford University Press.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis.* New York: Lawrence Erlbaum.

MacKinnon, D. P., Fritz, M. S., Williams, J., & Lockwood, C. M. (2007). Distribution of the product confidence limits for the indirect effect: Program PRODCLIN. *Behavior Research Methods, 39*, 384-389.

Manly, T., Anderson, V., Nimmo-Smith, I., Turner, A., Watson, P., & Robertson, I. H. (2001). The differential assessment of children's attention: The Test of Everyday Attention for Children (TEA-Ch), normative sample, and ADHD performance. *Journal of Child Psychology and Psychiatry*, *42,* 1065–1081. doi:10.1111/1469-7610.00806

Manly, T., Robertson, I., Anderson, V., & Nimmo-Smith, I. (1999). *The test of everyday attention for children*. London: Thames Valley Test Company.

Marsh, H. W., & Hau, K.-T. (1999). Confirmatory factor analysis: Strategies for small sample size. In R. H. Hoyle (Ed.), *Statistical strategies for small sample research*. Thousand Oaks, CA: Sage.

Mirsky, A. F. (1996). Disorders of attention: A neuropsychological perspective. In G. R. Lyon & N. A. Krasnegor (Eds.), *Attention, memory, and executive function* (pp. 71 – 93). Baltimore: Brookes.

Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review, 100*(4), 674-

701. doi:10.1037/0033-295X.100.4.674

Morarend, Q. A., Spector, M. L., Dawson, D. V., Clark, S. H., & Holmes, D. C. (2011). The use of a respiratory rate biofeedback devices to reduce dental anxiety: An exploratory investigation. *Applied psychophysiology and biofeedback, 36*, 63-70. doi:10.1089/tmj.2010.0182

Muris, P., & Ollendick, T. H. (2005). The role of temperament in the etiology of child psychopathology. *Clinical Child and Family Psychology Review, 8*(4), 271-289. doi:10.1007/s10567-005-8809-y

Muris, P., Meesters, C., & Rompelberg, L. (2006). Attention control in middle childhood: Relations to psychopathological symptoms and threat perception distortions. *Behaviour Research and Therapy, 45*, 997-1010. doi:10.1016/j.brat.2006.07.010

Musher-Eizenman, D. R., Boxer, P., Danner, S., Dubow, E. F., Goldstein, S. E., & Heretick, D. M. L. (2004). Social-cognitive mediators of the relation of environmental and emotion regulation factors to children's aggression. *Aggressive Behavior, 30*, 389-408. doi:10.1002/ab.20078

Nash, J. K., Fraser, M. W., Galinsky, M. J., & Kupper, L. L. (2003). Early development and pilot testing of a problem-solving skills-training program for children. *Research on Social Work Practice, 13*, 432-450. doi:10.1177/1049731503013004002

Norris, M., & Lecavalier, L. Evaluating the use of exploratory factor analysis in developmental disability psychological research. *Journal of Autism and Developmental Disorders, 40*(8), 8-20. doi:10.1007/s10803-009-0816-2

Ochsner, K. N., Ray, R. R., Hughes, B., McRae, K., Cooper, J. C.,Weber, J., . . . Gross, J. J. (2009). Bottom-up and top-down processes in emotion generation: Common and distinct neural mechanisms. *Psychological Science, 20*(11), 1322-1331. doi:10.1111/j.1467-9280.2009.02459.x

Oldehinkel, A. J., Hartman, C. A., De Winter, A. F., Veenstra, R., & Ormel, J. (2004). Temperament profiles associated with internalizing and externalizing problems in preadolescence. *Development and Psychopathology, 16*, 421-440. doi:10.1017/S0954579404044591

Oldehinkel, A. J., Hartman, C. A., Ferdinand, R. F., Verhulst, F. C., & Ormel, J. (2007). Effortful control as modifier of the association between negative emotionality and adolescents' mental health problems. *Development and Psychopathology, 19*, 523-539. doi:10.1017/S0954579407070253

Olson, S. L., Sameroff, A. J., Kerr, D. C. R., Lopez, N. L., & Wellman, H. M. (2005). Developmental foundations of externalizing problems in young children: The role of effortful control. *Development and Psychopathology, 17*, 25-45.

doi:10.1017/S0954579405050029

Orobio de Castro, B., Merk, W., Koops, W., Veerman, J. W., & Bosch, J. D. (2005). Emotions in social information processing and their relations with reactive and proactive aggression in referred aggressive boys. *Journal of Clinical Child and Adolescent Psychology, 34*(1), 105-116. doi:10.1207/s15374424jccp3401_10

Parsons, L. S. (2001). *Reducing Bias in a Propensity Score Matched-Pair Sample Using Greedy Matching Techniques*. Paper presented at the 26th annual SAS Users Group International Conference, Long Beach, California. Available at http://www2.sas.com/proceedings/sugi26/p214-26.pdf

Petras, H., Schaeffer, C. M., Ialongo, N., Hubbard, S., Muthén, B., Lambert, S. F., Poduska, J., et al. (2004). When the course of aggressive behavior in childhood does not predict antisocial outcomes in adolescence and young adulthood: An examination of potential explanatory variables. *Development and Psychopathology, 16*, 919-941. doi:10.1017/S0954579404040076

R Development Core Team (2011). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.

Rappaport, N., & Thomas, C. (2004). Recent research findings on aggressive and violent behavior in youth: Implications for clinical assessment and intervention. *Journal of Adolescent Health, 35*, 260-277. doi:10.1016/j.jadohealth.2003.10.009

Richard, B. A. & Dodge, K. A. (1982). Social maladjustment and problem solving in school-aged children. *Journal of Counseling and Clinical Psychology, 50*(2), 226-233. doi:10.1037/0022-006X.50.2.226

Riggs, N. R., Greenberg, M. T., Kusché, C. A., & Pentz, M. A. (2006). The meditational role of neurocognition in the behavioral outcomes of a social-emotional prevention program in elementary school students: Effects of the PATHS curriculum. *Prevention Science, 7*(1), 91-102. doi: 10.1007/s11121-005-0022-1

Roisman, G. I., Aguilar, B., & Egeland, B. (2004). Antisocial behavior in the transition to adulthood: The independent and interactive roles of developmental history and emerging developmental tasks. *Development and Psychopathology, 16*, 857-871. doi:10.1017/S0954579404040040

Rothbart, M. K., & Bates, J. E. (1998). Temperament. In W. Damon (Series Ed.) N. Eisenberg (Vol. Ed.), *Handbook of child psychology, Vol. 3. Social, emotional, and personality development* (5th ed., pp. 105-176). New York: Wiley.

Rothbart, M. K., Ahadi, S. A., & Evans, D. E. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology, 78*, 122-

135. doi:10.1037/0022-3514.78.1.122

Rubin, D. B. (2001). Using propensity scores to help design observational studies: Application to the tobacco litigation. *Health Services and Outcomes Research Methodology. 2*(3), 169-188. DOI:10.1023/A:1020363010465

Rubin, K. H. & Krasnor, L. R. (1986). Social-cognitive and social behavioral perspectives on problem solving. In M. Perlmutter (Ed.), *Cognitive perspectives on children's social and behavioral development: The Minnesota Symposia on Child Psychology* (Vol. 18). Hillsdale, NJ: Erlbaum.

Rutherford, A., Zwi, A. B., Grove, N. J., & Butchart, A. (2007). Violence: A priority for public health? (part 2). *Journal of Epidemiology and Community Health, 61*, 764-770. doi:10.1136/jech.2006.049072

Rydell, A., Berlin, L., & Bohlin, G. (2003). Emotionality, emotion regulation, and adaptation among 5 to 8 year old children. *Emotion, 3*, 30-47. doi:10.1037/1528-3542.3.1.30

Sameroff, A. J., Peck, S. C., & Eccles, J. S. (2004). Changing ecological determinants of conduct problems from early adolescence to early adulthood. *Development and Psychopathology, 16*, 873-896. doi:10.1017/S0954579404040052

SAS Institute Inc. (2008). *SAS/STAT 9.2 user's guide*. Cary, NC: Author.

Schachar, R. J., & Logan, G. D. (1990). Impulsivity and inhibitory control in normal development and childhood psychopathology. *Developmental Psychology*, *26,* 710-720. doi:10.1037/0012-1649.26.5.710

Schaeffer, C. M., Petras, H., Ialongo, N., Masyn, K. E., Hubbard, S., Poduska, J., & Kellam, S. (2006). A comparison of girls' and boys' aggressive-disruptiive behavior trajectories across elementary school: Prediction to young adult antisocial outcomes. *Journal of Consulting and Clinical Psychology, 74*(3), 500-510. doi:10.1037/0022-006X.74.3.500

Schwartz, D., Dodge, K. A., Coie, J. D., Hubbard, J. A., Cillessen, A. H. N., Lemerise, E. A., & Bateman, H. (1998). Social-cognitive and behavioral correlates of aggression and victimization in boys' play groups. *Journal of Abnormal Child Psychology, 26*(6), 431-440. doi:10.1023/A:1022695601088

Semrud-Clikeman, M., Goldenring Fine, J., & Zhu, D. C. (2011). The role of the right hemisphere for processing of social interactions in normal adults using functional magnetic resonance imaging. *Neuropsychobiology, 64*, 47-51. doi:10.1159/000325075

Sentse, M., Veenstra, R., Lindenberg, S. & Verhulst, F. C. (2009). Buffers and risks in temperament and family for early adolescent psychopathology: Generic,

conditional, or domain-specific effects? The TRAILS Study. *Developmental Psychology, 43*(2), 419-430. doi:10.1037/a0014072

Singer, M. I., Miller, D. B., Guo, S., Flannery, D. J., Frierson, T., & Slovak, K. (1999). Contributors to violent behavior among elementary and middle school children. *Pediatrics, 104*, 878-884. doi:10.1542/peds.104.4.878

Smokowski, P. R., & Kopasz, K. H. (2005). Bullying in school: An overview of types, effects, family characteristics, and intervention strategies. *Children & Schools, 27*(2), 101-110.

Smokowski, P. R., Fraser, M. W., Day, S. H., Galinsky, M. J., & Bacallao, M. L. (2004). School-based skills training to prevent aggressive behavior and peer rejection in childhood: Evaluating the Making Choices program. *Journal of Primary Prevention, 25*(2), 233-251. doi:10.1023/B:JOPP.0000042392.57611.05

Social and Character Development Research Consortium (2010). *Efficacy of schoolwide programs to promote social and character development and reduce problem behavior in elementary school children* (NCER 2011-2001). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education.

Spinrad, T. L., Eisenberg, N., Gaertner, B., Popp, T., Smith, C. L., Kupfer, A., Greving, K., Liew, J., & Hofer, C. (2007). Relations of maternal socialization and toddlers' effortful control to children's adjustment and social competence. *Developmental Psychology, 43*(5), 1170-1186. doi:10.1037/0012-1649.43.5.1170

Sprague, J., & Walker, H. (2000). Early identification and intervention for youth with antisocial and violent behavior. *Exceptional Children, 66*(3), 367-379.

Stouthamer-Loeber, M., Wei, E., Loeber, R., & Masten, A. S. (2004). Desistance from persistent serious delinquency in the transition to adulthood. *Development and Psychopathology, 16*, 897-918. doi:10.1017/S0954579404040064

Swanson, J. M., Kraemer, H. C., Hinshaw, S. P., Arnold, L. E., Conners, C. K., Abikoff, H. B., et al. (2001). Clinical relevance of the primary findings of the MTA: Success rates based on severity of ADHD and ODD symptoms at the end of treatment. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 168-179. doi:10.1097/00004583-200102000-00011

Terzian, M. A. (2007). Preventing aggressive behavior by promoting social information-processing skills: a theory-based evaluation of the Making Choices program. (Doctoral dissertation). Retrieved from http://www.lib.unc.edu/reference/hum/diss.html

Thomas, D. E., Bierman, K. L., & Conduct Problems Prevention Research Group. (2006). The impact of classroom aggression on the development of aggressive behavior problems in children. *Development and Psychopathology, 18, 471-487*. doi:10.1017/S0954579406060251

Thorpe, J., Kamphaus, R.W., & Reynolds, C.R. (2003). The Behavior Assessment System for Children. In C. R. Reynolds & R. W. Kamphaus (Eds.), *Handbook of psychological and educational assessment of children* (2nd ed.). New York: Guilford.

Valiente, C., Eisenberg, N., Smith, C. L., Reiser, M., Fabes, R. A., Losoya, S., Guthrie, I. K., & Murphy, B. C. (2003). The relations of effortful control and reactive control to children's externalizing problems: A longitudinal assessment. *Journal of Personality, 71*(6), 1171-1196. doi:10.1111/1467-6494.7106011

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software, 45*(3).

Verstraen, K., Vasey, M. W., Claes, L., & Bijttebier, P. (2010). The assessment of effortful control in childhood: Questionnaires and the Test of Everyday Attention for Children compared. *Personality and Individual Differences, 48*, 59-65. doi :10.1016/j.paid.2009.08.016

Waschbusch, D. A., & Willoughby, M. T. (2008). Parent and teacher ratings on the IOWA Conners Rating Scale. *Journal of Psychopathology and Behavioral Assessment, 30*, 180-192. doi:10.1007/s10862-007-9064-y

Zucker, R. A., Heitzeg, M. M., & Nigg, J. T. (2011). Parsing the undercontrol-disinhibition pathway to substance use disorders: A multilevel developmental problem. *Child Development Perspectives, 5*(4), 248-255. doi:10.1111/j.1750-8606.2011.00172.x