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Positive Emotion, Negative Emotion, and Emotion Control in the Externalizing Problems of School-aged Children

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Abstract The present study examined the role of emotion and emotion control in children's externalizing problems. Third- to sixth-grade children were administered a self-report measure of positive emotion, negative emotion, and emotion control. Peer- and teacher-reported adjustment problems were assessed. Structural equations modeling revealed that negative emotion, especially anger, was important in externalizing problems. Less positive emotion was associated with more externalizing problems. However, when negative emotion was examined in a more differentiated manner (anger, sadness and fear), the effect of positive emotion was diminished. Anger consistently emerged as a significant predictor of behavior problems. No interaction between either positive emotion and emotion control or negative emotion and emotion control was significant. Results showed main effects of each emotion component, with small interaction effects. Methodological and conceptual implications of the findings from the present study are discussed.

Keywords Emotion · Emotion control · Children with externalizing problems · Structural equation model

Introduction

The role of emotion in children's aggressive and disruptive behaviors is of great interest to developmental psychopathologists, clinical psychologists, and child psychiatrists. Many studies of children's emotion include one or more of three components of emotion: positive emotion, negative emotion and emotion regulation or

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control. However, the role that each component plays and how the components are interrelated in the context of adjustment problems need greater clarity.

Findings from empirical studies on the relation between positive emotion and children's adjustment have been inconsistent. Early studies by Eisenberg and colleagues found relations between positive emotion and social functioning [1]. However, their findings were not consistently replicated in studies using non-American samples [2]. Few studies have investigated the link between positive emotion and externalizing problems (a wide class of undercontrolled problem behaviors that include disruptive, delinquent, hyperactive, and aggressive behaviors, as well as attention deficits [3]). Instead, investigations of positive emotion have focused on topics such as peer popularity [4, 5]. Theories of positive emotion often assert that high levels of positive emotion are adaptive [6], but the results of several studies suggest that high levels of positive emotion may be associated with conduct problems [7].

Compared with positive emotion, negative emotion, especially anger, has been considered an important factor in understanding childhood externalizing problems [8–14]. Several studies have found associations between externalizing problems and negative emotions such as sadness or fear, but findings involving these emotions are less reliable. Theoretically, some researchers argue that specific negative emotions have evolved to help individuals adapt to specific situations, and may lead to different pathologies and behavioral problems [15]. For example, anger may be particularly related to externalizing problems, whereas sadness or fear may be associated with internalizing problems. On the other hand, researchers including Berkowitz [16] argue that negative emotions are highly related, so unpleasant feelings, including sadness and depression, may give rise to anger and aggression, and vise versa. In fact, due to considerable cormobidity between internalizing and externalizing disorders [17], it is common to find relations between externalizing problem behaviors and 'internalizing emotions' such as sadness or fear [13, 18]. Eisenberg et al. [19], for example, found that children with externalizing problems were sadder than control group children, although group differences in sadness were not as large as those in anger. Wolfe et al. [20] suggested that anxiety related to anger, and a lack of fear in infancy might predict later externalizing problems [21]. In contrast, Jenkins and Oatley [12] reported that children with externalizing problems displayed high levels of anger and low levels of sadness. Similarly, a study by Eisenberg et al. [19] demonstrated that fear was not an important factor in children's externalizing problems. In the context of peer relations, some studies found that aggressive children tended to be sad because they were more likely to be rejected by peers [22]. Other studies, however, found that rejected children showed high levels of anger expression but not high levels of sadness [23]. In sum, anger may be highly related to externalizing problem behaviors, whereas relations with sadness and fear seem to be less strong. These findings are complicated by the fact that few studies simultaneously consider anger, sadness and fear. Thus, accumulating consistent evidence using a more comprehensive research design is needed.

Finally, emotion regulation is one of the most popular topics in current literature of child development. Studies have shown that emotion regulation, regardless of whether it is conscious or reactive (such as impulsivity), is related to externalizing problems [11, 19, 24–27]. That is, children's externalizing problems are linked to low levels of conscious regulation or high impulsivity. A recent longitudinal study also showed that both variables are associated with externalizing problems [28]. In the

present study, 'emotion control' represents the effortful, conscious regulation of emotion.

Most studies use parent or teacher reports to measure emotion components and emotion control. Other methods, including observation, physiological measures, and self-reports have not been used as frequently as parent or teacher reports. Relying upon one particular type of measure is problematic given the risk of shared method variance in measures of emotion and outcome behaviors [14, 29]. Using different methods can also provide new information that current methods cannot address. For example, while most parent report and observational methods focus on behavior, self-reports can assess internal status. Nevertheless, in studies of children's emotion the most common method used is parent or teacher reports.

In sum, externalizing problems are generally related to low levels of emotion control and high levels of negative emotion, especially anger. The role of fear and sadness in externalizing behavior requires more thorough investigation, and the role of positive emotion is even less clear. Many previous findings were based on teacher or parent questionnaires and focused on selected aspects of emotion. Studies providing a more extensive picture of the links between emotion and psychopathology are warranted.

Interactions among Emotion Components

As more studies of children's emotion consider reactive and regulatory components of emotion separately, a logical next step is to demonstrate how those parts are linked to influence adjustment; that is, the possibility of interactions among emotion constructs. This possibility has been discussed in the literature on child psychopathology, yet empirical efforts to test for interactions are relatively scant. Notable exceptions include several studies by Eisenberg et al. [28, 30] in which the authors have shown that externalizing problems are associated with low emotion control and high negative emotionality. In recent studies, the interaction between emotion control and anger was linked to children's externalizing problems; specifically, high levels of anger and low levels of emotion control were related to more externalizing behaviors [8, 28]. Positive emotion might also interact with emotion control. In previous work, we found that an interaction between positive emotion and emotion control significantly predicted children's depression/anxiety symptoms, such that emotion control was associated with depression and anxiety when children were low in positive emotion [31]. For externalizing problems, Rydell et al. [14] found that high positive emotion (exuberance) with low levels of emotion control predicted externalizing problems in certain contexts. That is, both positive and negative emotion may interact with emotion control in influencing children's behavior and adjustment. However, with the exception of a few studies, the effort to identify the nature of interactions among emotion variables has been largely unsuccessful, or its implications were limited (e.g., demonstrated only for one setting, only for one gender, or only for one measure, etc.). Thus, at this point it is difficult to identify stable interaction patterns, and findings are much less robust when compared to the strong main effects of each emotion component on psychopathology.

To some degree, the effort to find significant interactions is hampered by complexities in methodology rather than theory. Traditionally, the most popular method to test interactions in the general linear model has been to split independent variables into two categories (e.g., at the median) and then to test significant coefficient differences between the subgroups (such as the analyses done by Diener and Kim

[8]). This method has been popular because it makes sense and is easy to implement for both relations among indicators (regression analysis) and unobserved variables (Structural Equation Modeling). However, one obvious disadvantage of this technique is the rather arbitrary split of variables. In addition, this technique converts continuous variables into discrete variables, and thus tends to lose statistical power [32]. Therefore, while most SEM software allows multi-group analyses, this technique is more appropriate for discrete variables or variables that are theoretically reasonable to split (such as gender or age).

For continuous variables, a recommended method is the regression approach, that is, by including product terms (in the case of an additive interaction) in the regression equation (such as the analyses done by Eisenberg et al. [28]). In fact, many recent studies showing interactions among emotion variables employed this approach. This method can ameliorate problems of multi-group analyses, because the nature of continuous variables is unchanged. However, there has been controversy over the use of this technique in models with latent variables, as this method tends to produce biased estimates [33]. In either case, testing interactions with present day methods requires the loss of some information, by either changing the variables' attributes or losing the ability to consider errors or method factors. That is, no matter what methods researchers choose, these methods tend to lead to high false disconfirmation, and to discourage researchers to publish their null findings.

The Present Study

Based on the rationale described above, we tested the link between positive emotion, negative emotion, and emotion control, as well as interactions among emotion constructs, in relation to children's externalizing problems. The aims of the study were 3-fold. First, we examined the importance of positive emotion, negative emotion and emotion control for externalizing problems when these factors were modeled simultaneously. We were especially interested in whether different negative emotions (sadness, anger, fear) independently influenced externalizing problems. We hypothesized that anger and emotion control would be related more strongly to externalizing behaviors than fear and sadness. Second, we tested whether interactions among the emotion constructs contributed to externalizing behaviors when interaction terms were included in a structural equations model. Results of contemporary studies are not consistent concerning interaction effects, as some studies have found an interaction between positive emotion and emotion control [14, 31], while other studies have found an interaction between negative emotion and emotion control [8, 28]. In general, however, results of most studies indicate that the main effect of each emotion component is stronger than the interactions among them. Here, we tested whether that pattern held for the present data as well. Finally, most studies of emotion used parent- or teacher-report questionnaires. However, we developed a self-report measure of emotion. Thus, while a third-party questionnaire generally relies upon observed behavior, we were able to assess children's subjective experience of emotion directly. We examined how well these self-reported emotion components were associated with externalizing problems. Using different reporters for each construct (self-reports of emotion, and teacher and peer reports of problem behaviors) provided another advantage, avoiding shared method variance.

Methods

Participants

Students in two of nine metropolitan Nashville schools from a larger investigation of school-based mental health services participated. The schools were selected based on the percentage of students participating in a federal free-lunch program (70% or higher), as an indicator of the number of families experiencing financial difficulties. The current project was part of the school system's systematic mental health screenings, as such all student data were the property of the school system. The data were provided to research staff with identification numbers only (i.e., without names); therefore, school personnel were responsible for securing consent. All students attending school on assessment days participated, thus there were no refusals. Apart from the screenings, no formal clinical evaluations of mental health status in children were conducted. At the project's inception, students were beginning the 3rd–6th grade.

Cross-sectional data from 624 students were obtained. Participants were 8–14 years of age (M = 10.73; SD = 1.20), 52% were female, 45% were Caucasian, 31% African American, 14% Asian, and 10% were from other minority backgrounds. Baseline assessments consisting of teacher-, peer-, and self-report measures covering six domains of psychopathology (delinquency, aggression, hyperactivity, depression, anxiety, and somatization) were administered by the school system. Initial baseline assessment for all children revealed that more than 35% of the children in the schools had significant emotional and behavioral problems. In particular, 31% of children with mental health problems reported delinquency symptoms as their primary or secondary problem areas. The pattern of problem behavior and the level of seriousness in psychopathology were consistent with estimates of mental health problems in at-risk populations [34]. In the general population of children under 18 in the US, 12% suffer from a mental health disorder, and 20% or more of children from disadvantaged backgrounds experience mental health problems [34, 35]. Thus, the children in the present study represent a population in need of mental health services.

Measures

Questionnaires were carefully selected such that informants could readily provide accurate reports on large numbers of students. Measures such as the Teacher Report Form (TRF [36]) are widely used for screening a particular child's symptoms of psychopathology in a small group context; however, they may be inappropriate for a large-scale setting in which a teacher has to report on many children's symptoms. Thus, we selected measures with demonstrated reliability and validity characteristic of more extensive measures.

Positive Emotion, Negative Emotion and Emotion Control

The How I Feel (HIF) is a self-report measure of 'emotion arousal' and 'emotion control' for elementary school-aged children (See Walden et al. [29] for a description of the HIF). Self-reports may contain valuable information not available in the

reports of other informants. On the other hand, self-reports of emotion for children should be evaluated with caution, as children often have trouble evaluating their own psychological states [37]. Taking both risks and benefits into account, we conducted extensive and systematic validation processes, and found that the HIF demonstrated good reliability and validity [29]. We used this self-report to assess emotion and emotion control in the present study.

Focusing on emotional experiences that occurred over a 3-three month period, the questionnaire consists of 30 items assessing positive and negative emotion and control over emotion when it occurs. Using a 5-point Likert scale ranging from 1 = 'not at all true of me' to 5 = 'very true of me,' children responded to items such as 'I was happy very often (positive emotion),' and 'When I felt sad, my sad feelings were very strong (emotion control).'

In developing the measure, items were selected from five different emotion domains (happy, excited, sad, scared, and mad) and two different aspects of emotion (intensity and frequency), and content validation procedures were performed by ten experts in the area of emotional development. Experts were volunteers from among faculty participants in the 2003 Emotional Development Pre-Conference of the *Society for Research in Child Development* [29].

Internal consistency and factor structures of the scale were examined by series of exploratory factor analyses followed by confirmatory factor analyses, and a three-factor structure was identified: positive emotion (happy and excited), negative emotion (sad, scared, mad), and emotion control [29]. The positive and negative emotion scales focused on frequency and intensity of each specific emotion when it occurred. Likewise, emotion control scales consisted of the frequency and intensity of the experience of control over each emotion when it occurred. Internal consistency of each subscale was as follows: positive emotion $\alpha = 0.88$, negative emotion $\alpha = 0.88$, and emotion control $\alpha = 0.84$. Furthermore, past research indicates that the scale demonstrated good convergent and discriminant validity with existing measurements. Specifically, average correlation with positive emotions and teacher rated happy/cooperation scale in the Affect Expression Rating Scale for Children (AERS [38]) was 0.36, $P < 0.001$, while that with negative emotions are negatively correlated, –0.26, $P < 0.05$. The correlation between the positive emotion scale and the positive affect scale in the Positive and Negative Affect Scale for Children (PANAS-C [39]) was 0.62, $P < 0.001$, while the correlation among negative affect items was 0.54, $P < 0.001$. The HIF emotion control subscale was positively correlated with the 'coping with mad' subscale in the Perceived Control Scale for Children [40] and the 'coping with sad' subscale ($r = 0.26$, $P < 0.05$, and $r = 0.37$, $P < 0.01$, respectively). Finally, temporal stability across five occasions of measurement (baseline and 6, 12, 18, and 24 months later) ranged from 0.30 to 0.56 for positive emotion, 0.39 to 0.63 for negative emotion, and 0.32 to 0.48 for emotion control [29].

Groups of similar items were combined following general recommended practices [41]. This resulted in a final model of the HIF which included 14 mean-centered item parcels, which were represented in the model by (a) three theoretical latent factors, positive emotion, negative emotion, and control over positive and negative emotion, and (b) two uncorrelated, latent method factors, one representing items focusing on the frequency of emotion and one representing items focusing on the intensity of emotion. The measurement model showed a good fit for five different occasions of measurement. Goodness of fit indicators ranged from 0.96 to 0.98 (NFI), 0.94 to 0.97 (TLI), and 0.97 to 0.99 (CFI) (see Fig. 1).

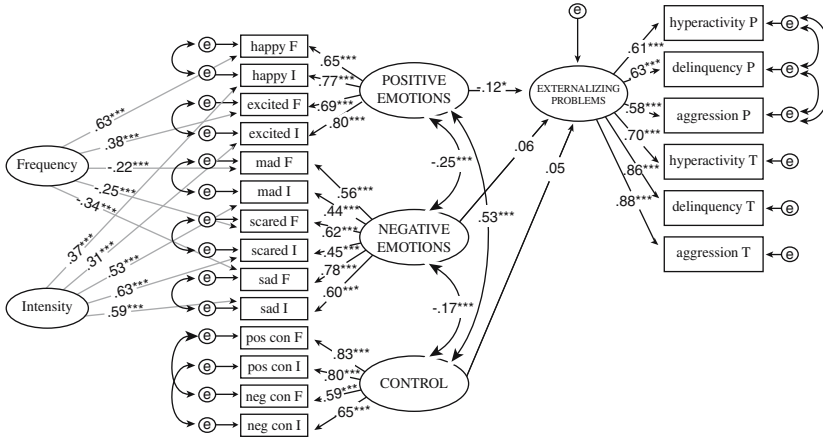

Fig. 1 Latent variable structural equation model for relation between emotion and externalizing problems. *Note*: Numbers represent standardized weight coefficients. happyF(I) = happy frequency(intensity); excitedF(I) = excited frequency(intensity); sadF(I) = sad frequency(intensity); scaredF(I) = scared frequency(intensity); madF(I) = mad frequency(intensity); pos conF(I) = positive control frequency(intensity); neg con F(I) = negative control frequency(intensity); hyperactivityP(T) = peer(teacher) rated hyperactivity; delinquencyP(T) = peer(teacher) rated delinquency; aggressionP(T) = peer(teacher) rated aggression. *** $P < 0.001$

Teacher-reported Externalizing Problems

The Teacher Behavior Questionnaire (TBQ [42]) was used to obtain teacher reports of externalizing problems. The TBQ is comprised of two broadband (Internalizing Problems and Externalizing Problems) and six narrowband scales (Delinquency, Aggression, Hyperactivity, Depression, Anxiety, and Somatic Complaints). Narrowband scales have a reported 6-month test–retest reliability of 0.64 and an average correlation of 0.81 with comparable Teacher Report Form (TRF [36]) narrowband scales (see Catron and Weiss [42] for more detail). To avoid spurious relations due to overlapping items in the emotion and problem behavior scales, items containing emotions in TBQ scales of psychopathology were removed (e.g., mad).

Peer-reported Externalizing Problems

The Peer Report Measure of Internalizing and Externalizing Behavior (PMIEB [43]), was used to obtain peer reports of adjustment problems. The PMIEB produces two broadband (Internalizing Problems and Externalizing Problems) and six narrowband (Delinquency, Aggression, Hyperactivity, Depression, Anxiety, and Somatic Complaints) scales, and contains 20 behavioral descriptors (e.g., ''Who are three children who don't seem to have much fun?''). Total PMIEB nominations for each descriptor were summed for each child, standardized within classroom, and then summed to create the peer-report scores. For the six domains, the average correlation with the TRF narrowband scales was 0.42, and the average 6-month test–retest reliability of the PMIEB was 0.65 [43], which is typical for correlations between teacher and peer ratings [44]. As with the TBQ, items containing overlapping emotions in PMIEB scales of externalizing problems were removed (see Weiss et al. [43] for detailed validation procedures).

Procedures

The child report measures (i.e., HIF, PMIEB) were administered to groups of students by pairs of examiners in classrooms during 1½-h sessions. One examiner read the items aloud while a second monitored the students to prevent mistakes. The HIF and the PMIEB required about 45 min; the remaining time in each session was used to complete other measures. Teachers completed questionnaires after school hours.

Results

Preliminary and Descriptive Analysis

Table 1 contains correlations among all indicators, as well as means and standard deviations. Mean levels of externalizing problems differed significantly by age and sex (see Table 2). Generally, older children had more externalizing problems than younger children, and males showed higher rates of problem behaviors than females. Given that externalizing problems have been a concern mainly for boys, this was not surprising.

Main Effects Model in Emotions and Externalizing Problems

Structural equations modeling (SEM) was used to examine the relations among indicators of emotion, emotion control and externalizing problems. All analyses were conducted using a structural equations modeling approach with a maximum likelihood method of estimation, using AMOS, an SPSS procedure.

The main effects model included two exogenous measurement models, one representing the original 5-factor HIF model, and the other with 8 factors (the negative emotion factor was further divided into 3 specific emotions: sad, mad, and scared). Some factors and error terms were allowed to correlate to represent structurally important relations and to remove suspected method factors (e.g., factors specifically related to nomination methods). For the first analysis, paths from our original model to externalizing problem factors were calculated. That is, teacher- and peer-rated hyperactivity, delinquency, and aggression were represented by one latent factor, which was predicted by three exogenous constructs (see Fig. 1). This main effects model fit the data well: $\chi^2(112, N = 624) = 249.04$; TLI = 0.97; CFI = 0.98; RMSEA = 0.045. A main effect of positive emotion was negatively related to heightened externalizing problems, whereas the effects of negative emotion and control were not significantly related to externalizing problems.

On the other hand, when negative emotions were further differentiated into three specific emotions, anger emerged as a significant predictor (see Fig. 2). The 3 negative emotions model also showed a good fit ($\chi^2(112, N = 624) = 246.46$; TLI = 0.97; CFI = 0.98; RMSEA = 0.044).

Interactions among Emotion Constructs and Externalizing Problems

Due to the methodological difficulty of modeling interactions in Structural Equation Model (SEM) [45–49], we decided to use a 'product-indicator analysis' for the present study. This procedure can overcome some limitations of contemporary

Table 1 Descriptive statistics and inter-correlations among all indicators

Indicator	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6	C1	C2	C3
A. Positive emotion													
A1. Happy frequency		0.51a	0.70a	0.52a	–0.30a	–0.11b	–0.21a	0.01	–0.38a	–0.08	0.37a	0.23a	0.36a
A2. Happy intensity			0.55a	0.75a	–0.17a	0.11b	–0.05	0.23a	–0.17a	0.16a	0.36a	0.25a	0.33b
A3. Excited frequency				0.61a	–0.28a	–0.10c	–0.11b	0.09c	–0.29a	–0.05	–0.36a	0.25a	0.33a
A4. Excited intensity					–0.14a	0.11b	–0.04	0.20a	–0.18a	0.12b	0.38a	0.26a	0.37a
B. Negative emotion													
B1. Mad frequency						0.54a	0.41a	0.24a	0.50a	0.37a	–0.14a	–0.07	–0.13a
B2. Mad intensity							0.32a	0.54a	0.35a	0.58a	0.02	0.07	–0.02
B3. Scared frequency								0.48a	0.58a	0.39a	–0.09c	–0.07	–0.11b
B4. Scared intensity									0.35a	0.65a	0.09c	0.11b	0.05
B5. Sad frequency										0.47a	–0.17a	–0.09c	–0.21a
B6. Sad intensity											0.04	0.04	0.01
C. Emotion control													
C1. Positive emotion control frequency												0.53a	0.61a
C2. Negative emotion control frequency													0.43a
C3. Positive emotion control intensity													
C4. Negative emotion control intensity													
D. Teacher reported adjustment problems													
D1. Teacher report aggression													
D2. Teacher report delinquency													
D3. Teacher report hyperactivity													
E. Peer reported adjustment problems													
E1. Peer report aggression													
E2. Peer report delinquency													
E3. Peer report hyperactivity													

Table 1 continued

Indicator	C4	D1	D2	D3	E1	E2	E3	F1	F2	M	SD
A. Positive emotion											
A1. Happy frequency	0.36a	–0.07	–0.06	–0.03	–0.04	–0.04	–0.02	–0.07	–0.10c	0.00	1.18
A2. Happy intensity	0.28a	–0.08c	–0.09c	–0.07	–0.07	–0.08c	–0.04	–0.10c	–0.08	–0.01	1.30
A3. Excited frequency	0.34a	–0.06	–0.06	–0.03	–0.02	–0.04	–0.06	–0.06	–0.09c	0.01	1.27
A4. Excited intensity	0.33a	–0.06	–0.07	–0.03	–0.01	–0.04	0.01	–0.07	–0.06	0.00	1.33
B. Negative emotion											
B1. Mad frequency	–0.13b	0.14a	0.16a	0.19a	0.09c	0.09c	0.06	0.11b	0.15a	–0.05	1.20
B2. Mad intensity	0.06	0.13a	0.12b	0.11b	0.10c	0.10c	0.10c	0.13a	0.17a	–0.01	1.42
B3. Scared frequency	–0.10b	–0.03	–0.01	0.08	–0.07	–0.04	–0.00	–0.02	0.02	–0.04	1.04
B4. Scared intensity	0.12b	–0.00	0.03	0.04	–0.06	–0.05	–0.06	0.01	0.02	–0.01	1.34
B5. Sad frequency	–0.17a	0.02	0.08	0.11b	–0.07	–0.06	–0.03	0.03	0.06	–0.05	1.12
B6. Sad intensity	0.04	0.01	0.05	0.04	–0.07	–0.06	–0.06	–0.01	0.00	–0.02	1.31
C. Emotion control											
C1. Positive emotion control frequency	0.50a	–0.04	–0.02	–0.02	0.01	–0.03	0.03	–0.04	–0.03	–0.01	1.28
C2. Negative emotion control frequency	0.58a	–0.05	–0.02	–0.04	–0.01	–0.03	–0.03	–0.06	–0.04	–0.01	1.15
C3. Positive emotion control intensity	0.55a	–0.02	0.00	–0.02	0.05	0.00	0.01	–0.00	–0.04	0.00	1.23
C4. Negative emotion control intensity		0.00	0.03	0.03	–0.01	0.01	0.01	0.00	–0.00	0.00	1.22
D. Teacher reported adjustment problems											
D1. Teacher report aggression			0.75a	0.58a	0.59a	0.58a	0.55a	0.83a	0.84a	0.00	1.00
D2. Teacher report delinquency				0.63a	0.45a	0.51a	0.47a	0.67a	0.62a	0.00	1.00
D3. Teacher report hyperactivity					0.36a	0.43a	0.50a	0.49a	0.56a	0.00	1.00
E. Peer reported adjustment problems											
E1. Peer report aggression						0.87a	0.67a	0.51a	0.49a	–0.04	0.90
E2. Peer report delinquency							0.45a	0.63a	0.56a	–0.04	0.87
E3. Peer report hyperactivity								0.46a	0.50a	0.01	0.89

Note: $N = 624$; M = Mean, SD = Standard deviation

a, $P < 0.001$; b, $P < 0.01$; c, $P < 0.05$

Table 2 Age and Sex differences in externalizing problems

Measure	Age		*t*	Sex		*t*
	Young *M* (SD)	Old *M* (SD)		Boys *M* (SD)	Girls *M* (SD)	
Teacher report						
A. Hyperactivity	–0.10 (0.98)	0.08 (1.01)	2.14*	0.17 (1.07)	–0.15 (0.90)	4.08***
B. Delinquency	–0.14 (0.51)	0.11 (1.09)	3.26**	0.15 (1.16)	–0.14 (0.80)	3.58***
C. Aggression	–0.13 (0.93)	0.10 (1.04)	2.99**	0.17 (1.12)	–0.16 (0.84)	4.18***
Peer report						
D. Hyperactivity	–0.12 (0.76)	0.11 (0.97)	3.28***	0.29 (1.02)	–0.25 (0.66)	7.89***
E. Delinquency	–0.15 (0.75)	0.03 (0.94)	2.57**	0.20 (1.04)	–0.26 (0.59)	6.87***
F. Aggression	–0.14 (0.78)	0.04 (0.98)	2.43*	0.29 (1.10)	–0.33 (0.54)	9.09***

Notes: *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$

$N = 273$ for 10 and under, 351 older than 10: 297 for boys, 327 for girls

techniques [48], but has other limitations, such as a high likelihood of a poor fit and complicated reprogramming. To avoid those problems, we chose a 'two-step estimation' procedure [49]. This method allowed us to compute an interaction term without substantial loss of power in the fit indices, yet provided adequate approximations of complex moderation effects.

In this method, each interaction term is specified with a single fixed indicator using previously calculated loading and error terms. This method was chosen because it has several advantages over other techniques. First, including an interaction effect using product-indicator analysis often results in many more parameters to be estimated than a main effects model, and thereby increases the chance that the model will not demonstrate an acceptable fit. However, two-step estimation requires only one additional parameter over the main effects model, so it is more likely than other estimation techniques to show reasonable fit. Second, rather than free

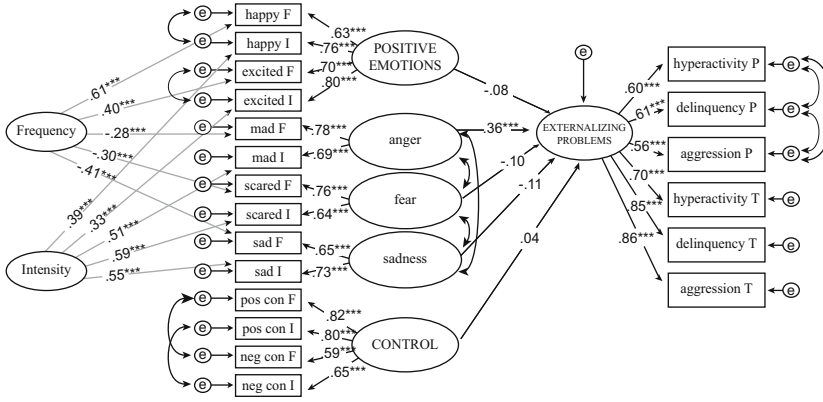

Fig. 2 Latent variable SEM for relation between 3 negative emotions and externalizing problems. *Note*: Numbers represent standardized weight coefficients. happyF(I) = happy frequency(intensity); excitedF(I) = excited frequency(intensity); sadF(I) = sad frequency(intensity); scaredF(I) = scared frequency(intensity); madF(I) = mad frequency(intensity); pos conF(I) = positive control frequency(intensity); neg con F(I) = negative control frequency(intensity); hyperactivityP(T) = peer(teacher) rated hyperactivity; delinquencyP(T) = peer(teacher) rated delinquency; aggressionP(T) = peer(teacher) rated aggression

estimation, this method uses fixed values from previous calculations. Therefore, it is easily implemented with existing SEM software such as AMOS or CALIS, without serious reconstruction of programming syntax. Using synthetic data with known population parameters, Ping [49] demonstrated that this estimation technique generated satisfactory approximations for detection of significant effects and model fit. On average, this procedure yielded results equivalent to well-known, yet more complicated, Kenny and Judd estimates [47], while showing less-biased results than regression analysis.

In this method, it is necessary to run an SEM model without interaction effects and to calculate the parameters of the interaction terms using the results of the main effects model. The loading and error variance of each interaction is computed by taking the expected value of corresponding parameters from the mean-centered indicators in the main effects model.

Thus, when two (X and Z) latent variables each having N indicators interact, the loading of the interaction ($\lambda_{x:z}$) will be the product of the expected values of the X indicators and the Z indicators,

$$\lambda_{x:z} = ((\lambda_{x1} + \lambda_{x2} + \cdots + \lambda_{xn-1} + \lambda_{xn})/N)((\lambda_{z1} + \lambda_{z2} + \cdots + \lambda_{zn-1} + \lambda_{zn})/N)$$

Likewise, the error variance of interaction ($\theta_{\epsilon x:z}$) will be,

$$\begin{aligned}\theta_{\varepsilon x:z} =& ((\lambda_{x1}+\lambda_{x2}+\cdots+\lambda_{xn-1}+\lambda_{xn})/N)^2 \mathrm{Var}(X)((\theta_{\varepsilon z1}+\theta_{\varepsilon z2}+\cdots+\theta_{\varepsilon zn-1}+\theta_{\varepsilon zn})/N^2) \\ &+ (\lambda_{z1}+\lambda_{z2}+\cdots+\lambda_{zn-1}+\lambda_{zn})/N)^2 \mathrm{Var}(Z)((\theta_{\varepsilon x1}+\theta_{\varepsilon x2}+\cdots+\theta_{\varepsilon xn-1}+\theta_{\varepsilon xn})/N^2) \\ &+ ((\theta_{\varepsilon x1}+\theta_{\varepsilon x2}+\cdots+\theta_{\varepsilon xn-1}+\theta_{\varepsilon xn})/N^2)((\theta_{\varepsilon z1}+\theta_{\varepsilon z2}+\cdots+\theta_{\varepsilon zn-1}+\theta_{\varepsilon zn})/N^2)\end{aligned}$$

As each value from the right side of these formulae is available from the main effect model, $\lambda_{x:z}$ and $\theta_{\epsilon x:z}$ can be calculated separately and entered as fixed values. Using this procedure, error variances and regression weights were computed for the 3 two-way interactions between positive emotion, negative emotion and emotion control.

Three interaction models (positive emotion*control, positive emotion *negative emotion, and negative emotion*control) were generated by adding one of the interaction terms at a time to the main effects model. Each model showed acceptable fit, but no interaction was significant (see Table 3). We also tested whether there were unique interactions among negative emotions, by using our second model (the model in which the negative emotion construct was differentiated into 3 specific emotions: anger*sadness, anger*fear, and sadness*fear). Like the analysis using one negative emotion construct, each model containing an interaction term showed an acceptable fit, but no interaction was significant.

Regression Analyses

Results of SEM analyses were replicated using regression analysis, which is simpler, but less efficient in the sense that it loses more information than SEM analysis (e.g., error terms and method factors). Seemingly redundant, this analysis was conducted because many aspects of our SEM analyses were new and required some assumptions to be met. A composite score for each emotion variable and externalizing

Table 3 Regression weights and fit index of emotions for broadband externalizing problems

Indicators	β	Standard β	SE	Fit index		
				TLI	CFI	RMSEA
Model with 1 negative emotion						
Positive emotion[a]	–0.08	–0.12*	0.04			
Negative emotion[a]	0.06	0.06	0.05			
Emotion control[a]	0.03	0.05	0.04			
Positive emotion*control[b]	0.01	0.02	0.02	0.96	0.97	0.048
Negative emotion*control[b]	0.03	0.04	0.03	0.95	0.96	0.051
Negative*positive emotion[b]	–0.01	–0.01	0.03	0.95	0.96	0.051
Model with 3 negative emotions						
Positive emotion[a]	–0.07	–0.09	0.05			
Negative emotion: sadness[a]	–0.13	–0.12	0.14			
Negative emotion: anger[a]	0.33	0.35***	0.08			
Negative emotion: fear[a]	–0.11	–0.10	0.12			
Emotion control[a]	0.03	0.04	0.05			
Sadness*anger[b]	–0.06	–0.08	0.04	0.94	0.95	0.057
Sadness*fear[b]	–0.01	–0.01	0.04	0.93	0.95	0.059
Anger*fear[b]	–0.04	–0.04	0.04	0.93	0.94	0.061

Notes: Numbers represent coefficients from a = main effect model with no interaction, and b = a model including one interaction construct represented in the first column. Each fit index also corresponds to the model including one interaction represented in the first column

SE, Standard error; TLI, Tucker-Lewis Index; CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation

***$P < 0.001$; *$P < 0.05$

problems was generated by taking the mean of standardized scores for each indicator (e.g., Z scores of peer- and teacher-reported hyperactivity, delinquency, and aggression were averaged to represent an externalizing composite score). Each interaction term was calculated by multiplying the composite scores of the emotion variables. Regression analysis showed that a model with 5 effects (positive emotion, anger, sadness, fear, and emotion control) significantly predicted externalizing problems, multiple $R = 0.22$, $R^2 = 0.05$. Anger showed a significant independent contribution (standardized $\beta = 0.27$, $P < 0.001$) and positive emotion contributed significantly, as well (standardized $\beta = –0.11$, $P = 0.049$). No interaction was significant. That is, regression analysis showed patterns similar to the results of SEM analyses, although the regression effect sizes were smaller.

In conclusion, the most salient finding throughout these analyses was the role of negative emotion, especially anger. The effect of positive emotion was less strong, and no interaction effect was found in any analysis.[1]

[1] Additional analyses were performed using SEM multi-group analyses (see introduction section for details). Three analyses in which sex, race, and age were added as an exogenous (independent) variable at a time were conducted to test whether the path coefficients from emotion components to the externalizing problems were equal based on the levels of those variables. Results showed that there was no apparent evidence that the models showed different patterns. Thus, despite mean differences, the patterns of relationships between emotion and externalizing problems did not change according to gender, age, and race. To save spaces and to avoid distraction, we did not report specific SEM analyses for sex, age, and race here. We also tested models by separating each symptom of externalizing problems (aggression, delinquency, and hyperactivity). Again, no distinctive relations were found, so we reported only overall symptoms here.

Discussion

The present study addressed several questions about relations between children's emotion, emotion control and externalizing problems: (1) the effect of positive emotion, negative emotion, and emotion control on externalizing problems, (2) the effect of differentiated negative emotion (anger, sadness, and fear) on externalizing problems, and (3) putative interactions among emotion variables. Consistent with previous studies, anger was a key variable in predicting externalizing problems. On the other hand, no significant interactions among the emotion variables emerged. Further, the effect of emotion control was not statistically significant. This is surprising given that previous studies have indicated that emotion control is related to children's adjustment [2, 6, 9, 19, 26]. Why might our measure of emotion control have failed to predict externalizing problems? First, many studies of emotion regulation use the same reporters for both emotion control and subsequent outcome behaviors. However, we chose to use a self-report measure of emotion control, with peer- and teacher-reports of outcome behaviors. The weaker relations found in the present study are not likely to be attributable to poor measurement as the HIF has demonstrated stability, reliability, and concurrent validity [29]. Rather, using multiple reporters avoided shared method variance that may have inflated reported correlations between emotion control and externalizing problems. Another possible reason why our findings may not replicate previous findings is that our measure of emotion control measured children's perceptions, whereas most reports from other persons have focused on behavioral aspects.

Both positive emotion and negative emotion were related to externalizing problems. When negative emotion was modeled as one latent construct (combining anger, sadness and fear), positive emotion, but not negative emotion, contributed to externalizing problems. Although the three negative emotions were positively related to one another, they did not all have the same predictive relation with externalizing behavior. Specifically, externalizing problems were associated positively with anger but negatively with sadness and fear. Therefore, combining those emotions into one construct masked specific relations. This finding suggested that differentiation of negative emotion into specific components better reflects the complex relation between negative emotion and externalizing behavior. Additional empirical evidence was found in our previous study of depression and anxiety, in which sadness, but not anger, contributed to internalizing problems [31]. That is, specific negative emotions may each contribute uniquely to childhood psychopathology, as indicated by Rydell et al. [14].

Although the finding was not robust in all analyses, positive emotion may play a role in adjustment, as has been suggested in previous empirical and theoretical work. That is, positive emotion may play an important role in psychological well-being, as it involves one's motivation for future events [50]. However, whereas negative emotions are highly differentiated and processed promptly, positive emotion tends to be weaker in intensity and less differentiated than negative emotion [51]. Rather, whereas different negative emotions predict different adjustment problems, positive emotion and control may work similarly across outcomes (i.e., high positive emotion and control are related to good adjustment, and low positive emotion and emotion control are related to poor adjustment).

The differences between positive and negative emotion imply several interesting possibilities about the role of emotion and control in problem behaviors. For example, each emotion may provide unique information about adjustment problems: Strongly differentiated negative emotions may be more helpful in predicting which behavioral manifestation one will show and in what degree, while positive emotion may be largely related to the stability of a given problem. If this is the case, the nature of emotion control might also differ, as control for negative emotion can be more differentiated than control of positive emotion. This possibility could not be tested in the present study due to some technical difficulties (e.g., the number of indicators per latent variable would have been too few for an appropriate analysis). However, this possibility is worth considering in future studies.

Interpretation of Interaction among Emotion Constructs

We had suspected that previous null findings might be partly due to high false-disconfirmation rates resulting from methodological practices (such as median splits and failing to account for the influence of method factors). However, despite using techniques that improved our ability to detect interactions, we did not find that particular combinations of positive and negative emotion and emotion control explained the presence of externalizing behavior problems. We tentatively conclude that the effect of emotion components on externalizing problems might operate primarily through main effects, rather than interactions.

It should be noted that, although the method we used may be an improvement, this technique does not solve all problems, and it is not a technique to 'boost up' low statistical power. Finding a significant result depends on number of participants, number of parameters, and effect sizes. Rather, this procedure has advantages over other interaction estimation techniques when one is concerned about poor fit due to many indicators. Thus, we reported technical details for future studies intending to examine interactions in structural models.

Finally, we would like to emphasize that the technique uses 'acceptable approximation' for testing interactions among latent variables, given that several assumptions are met. In reality, however, it is difficult to meet these assumptions in studies of child psychopathology using normal subjects, in which distributions may be skewed or kurtotic. There are several methods to improve distributions; outliers can be deleted, as has been done in several studies [52]. Alternatively, scores can be transformed, or special estimation methods such as 2-stage least squares estimation [45] can be employed instead. The present study used raw scores for the main analyses for several reasons. First, descriptive statistics for the data revealed that the possible suspected outliers in the data overly represented children who had adjustment problems. This made sense given that many participants in the present study, in spite of being from a high-risk group, were nevertheless a non-clinical sample. Thus, rather than being random outliers, they might be true representations of the population of interest. Second, log transformation was considered but it became complicated when dealing with complex models, in which multiple indicators were used for a single construct, and the coefficients from those indicators were again used to estimate interaction parameters. Finally, the 2-stage least squares estimation technique was a simple alternative that did not require many assumptions to be met, but it did not address our question adequately because its interpretation was more limited than that of the method used for the present study. We conducted OLS

regression analyses to investigate whether the relations found in the SEM analyses would replicate using other techniques. Readers and those who consider adopting this method are strongly encouraged to be knowledgeable about this technique.

Clinical Implications

Currently most treatments of externalizing behavior problems are focused on managing behavior through behavior contingencies, external supports and structure, and behavior modification, rather than on emotional contributions to problem behavior. Results of the present study suggest that attention also be directed to children's emotion, for example, anger. Efforts to reduce externalizing behaviors in children are likely to benefit from consideration of the link between anger and externalizing behavior. Children who report frequent and intense feelings of anger are higher in externalizing problems. Once able to identify frequent and intense anger, clinical treatment can focus on emotion or behavior control to limit problematic behavior.

In addition, this study suggests that there is a role for self-report when examining children's experience of emotion. Results of the present study and our previous studies [31] showed strong associations of specific emotional components with problem behaviors, suggesting that self-reports of emotional states can be a convenient, yet rich addition in evaluating childhood mental problems. The usefulness of self-reports of emotion can be especially highlighted when dealing with specific types of problems in which a certain emotional state is a major feature, or when behavioral criteria alone are not sufficient. Absolute numbers of studies on emotions and specific symptoms are still few, and the present study provides a step toward better understanding of the important relations between emotion and behavioral problems.

Summary

Recently, a considerable number of investigations of the role of emotion and its regulation in children's adjustment have been published, implying keen interest in this topic from diverse fields of developmental sciences. Externalizing problems are generally related to high levels of negative emotion and low levels of emotional control. Most studies, however, have been characterized by limitations that did not allow for definitive conclusions. For example, there are still very few studies in which the multiple dimensions of emotion (positive emotion, negative emotion, and emotion control) have been modeled simultaneously, so that the specific effects of each component could be properly identified and weighted. In addition, many studies have depended on information from only one source, thus inflating correlations due to the single-informant factor. The present study aimed to provide a reliable and comprehensive picture of the relations between emotion and externalizing problems. Thus, careful consideration was given to (1) the emotion theory upon which the study was grounded, (2) identifying known method factors, and (3) selecting appropriate methodologies and statistical techniques for use with large numbers of urban high-risk children and from multiple informants. Results showed a strong impact of anger on externalizing problems, compared with weaker effects of emotion control and interactions among emotion components. In addition, the role

of anger was apparent when negative emotion was split into the specific emotions of anger, sadness, and fear. The effect was weak when negative emotions were combined. This finding has important implications for assessment and diagnosis of emotional symptoms and problem behaviors of children. Furthermore, the results of the present study indicated that more thorough investigations involving a wide range of psychopathological symptoms are still necessary. Additionally, the role of specific emotion components, including moderation and/or mediational relations among emotion components and outcome behaviors, are important areas of inquiry.

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