Emotion Regulation Strategies That Promote Learning: Reappraisal Enhances Children’s Memory for Educational Information

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The link between emotion regulation and academic achievement is well documented. Less is known about specific emotion regulation strategies that promote learning. Six- to 13-year-olds (N = 126) viewed a sad film and were instructed to reappraise the importance, reappraise the outcome, or ruminate about the sad events; another group received no regulation instructions. Children viewed an educational film, and memory for this was later assessed. As predicted, reappraisal strategies more effectively attenuated children’s self-reported emotional processing. Reappraisal enhanced memory for educational details relative to no instructions. Rumination did not lead to differences in memory from the other instructions. Memory benefits of effective instructions were pronounced for children with poorer emotion regulation skill, suggesting the utility of reappraisal in learning contexts.

Emotion regulation has become a central concern in investigations of children’s emotional development (Campos, Frankel, & Camras, 2004; Thompson, 1994). This growing interest stems from findings that effective emotion management confers a wide range of interpersonal, academic, and mental health benefits for children (e.g., Calkins, 1994; Eisenberg et al., 1995, 2004; Keane & Calkins, 2004; Saarni, Campos, Camras, & Witherington, 2006). Because of these benefits, school-based emotion education programs have become an increasingly common component of children’s elementary school experience (e.g., Domitrovich, Cortes, & Greenberg, 2007; Greenberg, Kusche, Cook, & Quamma, 1995; Izard, Trentacosta, King, & Mostow, 2004). But many questions remain. Little is known about the specific emotion regulation strategies that are most effective in contexts where learning is a priority, how specific strategies affect children’s memory, or whether strategy effectiveness varies for children of different ages and emotion regulatory abilities. The present investigation was conducted to address these questions.

The Effectiveness of Specific Emotion Regulation Strategies

Emotion regulation refers to the processes people use to modify the type, intensity, duration, or expression of emotion (Koole, 2009). To appreciate how children can alter their emotional responses to events, it is useful to consider how emotions are evoked in the first place. According to functionalist theories, people experience emotions when they appraise events as relevant to their goals, values, or well-being (e.g., Ellsworth & Scherer, 2003; Smith & Lazarus, 1993). Because emotions depend on appraisals of the relations between events and goals, one means of decreasing negative emotion is for people to change their appraisals of the relevance of events to their goals. This can be accomplished by reappraising the significance of an emotion-eliciting event (e.g., thinking of a negative event as unimportant) or by reappraising its outcome (e.g., thinking about how things could get better). Both these reappraisal strategies should effectively circumvent the appraisal process, negating the need for further processing of the emotional event, and decreasing the intensity of negative emotion (Gross, 1998; Ochsner et al., 2004).

In contrast to reappraisal, ruminating about the causes and consequences of an emotional response...
highlights the personal relevance of emotional events. As a result, rumination increases attention to emotional events and the intensity of negative emotion (Nolen-Hoeksema, Wise, & Lyubomirsky, 2008). Research on rumination points to adolescence as a key period for the onset of this response, although some research suggests that children display a ruminative response style at younger ages if they have an underlying vulnerability or predisposition (e.g., parental depression; Abela, Aydin, & Auerbach, 2007; Abela, Brozina, & Haigh, 2002). Experimentally induced rumination has been shown to be less effective at reducing negative emotion among adolescents than reappraising an outcome (Rood, Roelofs, Bögels, & Arntz, 2012) or distracting oneself (Park, Goodyer, & Teasdale, 2004), but whether or not instructed rumination prolongs negative emotion for younger children is not yet known. Thus, research with adolescents and adults has shown that specific emotion regulation strategies differ in the extent to which they undercut or extend the appraisal process, and these differences have implications for their effectiveness. Whether or not these strategies carry the same benefits and drawbacks for younger children, however, remains an open question.

One aim of this study, then, was to contrast the effectiveness with which specific emotion regulation strategies decrease children’s attention to sad events and the intensity of their feelings of sadness. We assessed whether or not reappraisal of importance and reappraisal of outcomes were similarly effective when used by children (as has been shown with adults; Ochsner et al., 2004), and contrasted these strategies with rumination. We focused on reappraisal strategies and rumination, rather than other strategies, because research with adults shows that these strategies have strikingly different effects on the cognitive processing of negative events and on the resulting emotional response. Reappraisal strategies effectively undercut the appraisal process and alleviate negative emotion (e.g., Ochsner et al., 2004; Richards & Gross, 2000), whereas rumination prolongs the appraisal process and intensifies negative emotion (Abela & Hankin, 2011; Nolen-Hoeksema et al., 2008). To our knowledge, however, no studies have instructed children to engage in these strategies and assessed their effects on cognitive processing and emotion. We focused on sadness, rather than other negative emotions, because we were interested in examining the effectiveness of cognitive strategies for regulating emotion. Young children tailor the strategies they use to the particular emotion they are trying to regulate. They report using cognitive strategies, such as reappraisal, more often when saddened by irrevocable loss than when angered by obstacles to their goals (Davis, Levine, Lench, & Quas, 2010). Similarly, rumination is more commonly a response to sadness than to anger or fear (Nolen-Hoeksema et al., 2008).

Emotion Regulation and Memory for Educational Information

We also examined the effects of reappraisal and rumination on children’s memory for educational information. Emotion directs attention to information that is relevant for understanding and responding to changes in the status of goals (Thompson & Meyer, 2007). Because attention is a limited resource, this narrow focus on goal-relevant information may come at the expense of other information in the environment. For example, if a child feels sad, she may be preoccupied with thoughts about loss and unable to refocus her attention on emotionally neutral—but potentially important—educational information. This would have implications for children’s academic performance. In educational settings, children are presented with neutral information that they are expected to learn. When upset, however, children’s attention is likely to be directed toward emotionally relevant information, and away from ostensibly peripheral concerns like classroom learning. If the educational information is not attended to and encoded, it cannot be remembered, so negative emotion may interfere with children’s memory for educational information.

Impaired memory for emotionally neutral details, but not for emotionally relevant information, has been documented in both adults (for reviews, see Levine & Edelstein, 2009; Mather & Sutherland, 2011) and in children. For example, Peterson and colleagues assessed children’s memory for serious injuries, immediately after an emergency room visit, and again 1 and 2 years later (Peterson, 2002; Peterson & Bell, 1996). Children’s memory was more accurate for information concerning their injury than for emotionally neutral details concerning their medical treatment. Children did remember some main features of their treatment, however, suggesting that central features of events were still being attended to and encoded. On the basis of these findings, we hypothesized that children would recall the main ideas from an educational film fairly well regardless of which regulatory strategy they used, but mnemonic differences would become evident in their ability to recall the details. That is, to the extent
that a child’s attention is captured by emotionally relevant information, we would expect to see poorer memory for details of emotionally neutral events.

Consistent with this view, Rice, Levine, and Pizarro (2007) examined the effects of sadness, and of instructions to regulate sadness, on children’s memory for educational material. Results indicated that children instructed to disengage from their feelings of sadness recalled more details concerning the educational film than did children receiving instructions that directed their attention to their sad feelings or children who received no emotion regulation instructions. This suggests that there may be distinct benefits of emotional disengagement strategies such as reappraisal for school-aged children’s memory for educational information. In the Rice et al. study, however, children were not instructed to use particular strategies (i.e., reappraisal, distraction, suppression, rumination). They were simply instructed to try not to feel or express sadness (disengagement) or to think about their sad feelings and ways to make themselves feel better (engagement). Thus, it is not clear which disengagement strategies enhanced children’s memory for educational information. In addition, the researchers did not assess how these broad instructions affected children’s attention to emotional information or whether children’s preexisting regulatory skill led some children to recruit more effective disengagement strategies. Thus, the present study assessed whether or not particular emotion regulation strategies differ in their effects on children’s memory for educational information, the effectiveness with which particular strategies decrease negative emotion and attention to emotional information, and individual differences in children’s emotion regulatory skill.

Developmental and individual differences in emotion regulation. This investigation focused on 6- to 13-year-old children. Previous work has shown that, by age 5, children can generate and use cognitive regulatory strategies (Davis et al., 2010), but this ability continues to develop during the middle and late childhood years (Altshuler & Ruble, 1989; Campos et al., 2004; Cole, Martin, & Dennis, 2004; Kopp, 1989; Saarni et al., 2006; Thompson, 1994). For instance, Hodgins and Lander (1997) found that among 5- to 13-year-olds undergoing a venipuncture, older children reported using a greater number of strategies to cope with the venipuncture, and these strategies increasingly reflected cognitive efforts, such as shifting attention and distraction. A goal of the present study was to examine whether or not different cognitive strategies effectively alleviate children’s negative emotion across childhood.

Children’s developing emotion regulatory skill is further shaped by intrinsic (e.g., biological) and extrinsic (e.g., socialization) factors that contribute to individual differences in emotion regulation. For example, temperamental or physiological differences in emotional reactivity may lead children to favor particular ways of coping with upsetting events (e.g., Buss, Davidson, Kalin, & Goldsmith, 2004). Children also learn to use specific regulatory strategies by observing how parents, siblings, and peers respond to emotion, and certain strategies may be explicitly encouraged by caregivers (e.g., Calkins & Dedmon, 2000; Calkins & Hill, 2007; Thompson, 1994). Thus, a large body of research has linked differences in children’s emotion regulation skill with their cognitive development and with individual differences in biology and experience. To date, however, no research has assessed the interaction between emotion regulation skill and the effectiveness of specific emotion regulation strategies on memory for educational information.

Research suggests that when it comes to remembering educational material, children with poor emotion regulation skills may benefit most from the use of effective strategies. Emotion regulation skill has been associated with greater academic achievement, in both cross-sectional (Gumora & Arsenio, 2002) and longitudinal studies, using both parent reports (Howse, Calkins, Anastopoulous, Keane, & Shelton, 2003) and teacher reports of emotion regulatory competence (Trentacosta & Izard, 2007). For example, Graziano, Reavis, Keane, and Calkins (2007) showed that children who scored higher on a measure of teacher-rated emotion regulatory ability (Emotion Regulation Checklist [ERC]; Shields & Cicchetti, 1997) had higher scores on literary and math achievement tests, and were viewed as more academically successful by their teachers. In addition, children with higher levels of emotion understanding were rated by teachers as having fewer attention problems (Trentacosta, Izard, Mostow, & Fine, 2006).

Because greater emotion regulation skill predicts academic success, highly skilled children who are told to use an ineffective strategy may nonetheless efficiently alleviate their negative feelings and free up cognitive resources for attending to and remembering educational material. In contrast, children with less skill who use an ineffective strategy would be less likely to successfully alleviate their negative feelings, resulting in fewer available attentional resources and ultimately, poorer memory. If supported, this proposed interplay of existing regulatory skill and instructed emotion regulation strategy effectiveness would highlight specific effective
emotion regulation strategies as potential targets for intervention. Thus, the current study assessed whether or not children’s regulatory skill interacts with the effectiveness of specific regulation strategies to affect memory for educational information.

The Present Study

We had three goals in this study. The first was to determine which emotion regulation strategies were more or less effective for children. We defined effectiveness as attenuating cognitive processing of emotional information and reducing negative affect, because both of these outcomes impact subsequent attention to, and memory for, educational information. The second goal was to identify the effects of specific emotion regulation strategies on children’s memory for educational information. The third goal was to examine the role that individual differences in emotion regulation skill play in predicting children’s memory for educational information.

Six- to 13-year-old children first viewed a film clip designed to evoke sadness. Children were then instructed to regulate their feelings of sadness either by: (a) reappraising the importance of the sad events in the film, (b) reappraising the outcome of the sad events, (c) ruminating about the sad events, or (d) receiving no instructions to regulate emotion. Next, children viewed an educational documentary film. Finally, their memory was tested for the educational film.

The order of experimental procedures was modeled after the sequence of events children commonly experience when dealing with upsetting events in daily life, especially in academic contexts. Children experienced a sad event (watching a sad film) and then received instructions to regulate their feelings before educational information was presented. This sequence more closely mirrors children’s experiences in school settings than if we had given emotion regulation instructions before eliciting sadness, as is often done in research on emotion regulation with adult participants. We included two forms of reappraisal in the current study. Work with adults has shown that reappraisal of importance and reappraisal of outcomes have similar effects on emotion, and similar behavioral consequences, but different neural correlates (e.g., Ochsner et al., 2004). Based on these findings, we did not expect these strategies to differ in the effectiveness with which they decreased children’s negative emotion or in their effects on children’s memory. We included both strategies, however, because the effectiveness of these two types of reappraisal has not been assessed in children. It is possible that for younger children, viewing an event as unimportant may tax working memory less than thinking of positive outcomes for a negative situation. Thus, we included both types to explore this possibility but did not predict differences. On the basis of the literature reviewed above, we expected that, relative to rumination and no instructions, both reappraisal of importance and reappraisal of outcomes would attenuate sadness and attention to emotional information, and promote memory for subsequent educational information.

Method

Participants

Children (N = 126), aged 6 years 10 months to 13 years 0 months (M = 9 years 7 months, SD = 1 year 9 months) participated in this study. Children’s parents were recruited in public places (e.g., libraries, parks, family fun day) in Orange County, California (46%), or by phone from a database of families who were interested in research participation at the University of California, Irvine (54%). About half of the participants were boys (54%). Parents (predominantly mothers) reported children’s race and ethnicity as non-Hispanic European American (58%), Asian American (13%), Latino or Latina (10%), African American (3%), Chicano or Chica (2%), Pacific Islander (1%), or did not specify race or ethnicity (13%). Approximately 86% of participants were from homes with an annual income of at least $50,000. Parents did not complete questionnaires for 3 children. For 5 additional children, some or all memory data were not available for analysis due to equipment malfunction. Because analyses included all cases with complete data for the measure in question, sample size varies.

Procedure

Children were randomly assigned to one of four emotion regulation conditions with the restriction that each condition included roughly the same number of children of each age and gender. Two researchers conducted interviews with each child, and collected written information from a parent in their home. Prior to participation, parents and children gave written consent and assent. Interviews with children were videotaped. The lead researcher showed children a sad film, administered emotion regulation instructions, showed an educational film, and then left the room. A research assistant, who
was blind to children’s experimental condition and the study hypotheses, then entered the room and assessed children’s memory for the educational film.

**Verbal ability.** At the beginning of the interview, children completed the picture vocabulary subtest from the Woodcock–Johnson Revised Test of Achievement (Woodcock & Johnson, 1989), which requires them to label a series of progressively more difficult items that are shown in picture form. Age-normalized, standardized scores from this test of verbal ability were computed according to published scoring guidelines, and these scores were covaried in analyses. Verbal ability was used as a covariate because the memory measures relied on verbal responses and because past research shows that verbal ability is an important component of children’s memory performance (Robertso & Köhler, 2007).

**Emotion self-report.** Children were trained to rate their feelings of sadness and happiness using four-point scales that depicted a neutral face and increasingly sad or happy faces. To assess baseline levels of sadness and happiness, children rated their emotions before the emotion elicitation procedure. Children also rated their feelings of sadness and happiness several times during the experiment, with sadness always rated first.

**Emotion elicitation.** Sadness was induced in children by showing a 5-min clip from the film *My Girl*. In the clip, a young girl learns that her friend died (he was allergic to bees and was stung). She attends the funeral, during which she becomes upset and runs out of the room. Immediately after the sad film, children again rated their feelings of sadness and happiness.

**Emotion regulation instructions.** After watching the sad film, children were told, “You just saw a movie about a little girl. Watching this makes some children sad.” Children then received one of four types of instructions. Children in the reappraisal of importance condition were instructed to think about how the sad events in the film were not relevant or important to them: “If you feel sad, I want you to try to think about how it’s only a movie, and those things didn’t happen in real life. Think about how those things didn’t happen to you, so it’s not important.” Children in the reappraisal of outcome condition were instructed to think about how the sad events of the film could turn out to be positive after all: “If you feel sad, I want you to try to think about how everything that was sad for the little girl could turn out okay after all. Think about how everything could get better.” Children in the rumination condition were instructed to think about their feelings and about the causes and consequences of the sad events in the film: “If you feel sad, I want you to think about why you feel that way. Think about what happened to the little girl and her friend that made you sad. Think about how you would feel if that happened to you in real life.” Children in the control condition received instructions that did not mention regulating emotion: “You just saw a movie about a little girl. Before we do the next thing, I have to get some papers ready. Please wait just a second while I get ready for the next thing we are going to do.”

After receiving the instructions, children were asked an open-ended question to assess their understanding of the instructions: “So, what are you going to try to do?” Children in the control condition were not asked this question. If children expressed confusion about what to do (n = 17), the instructions were repeated once, and their understanding was assessed again. No children remained confused after the instructions were repeated. Children then rated their feelings of sadness and happiness.

**Educational film.** Children next viewed a brief film showing a girl’s visit to a bread factory during which she learned in detail about how bread is made. This film has been used successfully to assess memory for educational material in prior research (Rice et al., 2007). After watching the educational film, children rated their emotions once more.

**Self-report of thinking about the sad film.** To assess how much children had thought about the sad film, children were told, “Sometimes when we see things, we think about them afterwards, and sometimes we don’t. You watched a movie about a little girl and boy who were best friends. After that movie was over, how much did you keep thinking about it: not at all, a little bit, pretty much, or very much?” Children indicated their response by pointing to a 4-point scale.

**Memory for the educational film.** The research assistant then returned and assessed children’s memory for the educational film. Children were asked 12 cued recall questions about the film. Half of the questions assessed children’s memory for basic plot-related information of direct relevance to making bread (e.g., “What did the baker say is always the first ingredient in bread?” Answer: “Flour”); half assessed children’s memory for details of the bread-making process that provided a more nuanced understanding (e.g., How many loaves are baked in the oven at the same time? Answer: 450).
Central and detail questions were categorized by two research assistants (100% agreement) who were not involved in data collection or other coding procedures using the following criteria: In line with guidelines described by others (Berntsen, 2002; Talarico, Berntsen, & Rubin, 2009), central information was broadly defined as information that could not be omitted without impairing understanding of the process of bread making. Details were broadly defined as information that enhanced understanding of the process of bread making (e.g., provided a more nuanced and complete understanding). Central questions asked about what ingredients were put in bread, what the ingredients were called, how the ingredients were prepared, what order things happened in the baking process, and why certain steps in the baking process were necessary. Detail questions asked about the protagonists’ appearance, the effect of individual ingredients on the dough, the length of time needed for certain steps of the baking process, why machines were used for certain steps, and the number of loaves that could be baked at one time. A complete list of the cued recall questions for the educational film is provided in the Appendix.

Parent-report measures. While the child was watching the films, the research assistant asked the child’s parent to complete a questionnaire on demographics. Parents also completed the ERC (Shields & Cicchetti, 1997), which assesses individual differences in children’s emotion regulation with subscales for Lability–Negativity and Emotion Regulation. The emotion regulation subscale was used for this study. This subscale is composed of the sum of eight items (e.g., “Responds positively to neutral or friendly overtures by peers,”) that are rated on a scale from 1 (never) to 4 (almost always). Published internal consistency for this subscale is good, $\alpha = .83$, and was adequate in this sample, $\alpha = .64$.

Coding and Data Reduction

Trained research assistants, blind to the children’s experimental condition and the study hypotheses, transcribed and coded the interview data. One team of research assistants transcribed the videotaped memory interviews; a second team coded children’s open-ended emotion regulation responses and the cued recall responses. Emotion regulation and cued recall responses were coded in separate passes through the data on different days so that coders did not have access to information about children’s emotion regulation responses when coding the memory data.

Coding recall of the educational film. Cued recall of the educational film was coded by two trained research assistants. Reliability was calculated on a total of 29 transcripts (23% of cases) and was excellent ($\kappa = 0.93$). Children’s responses to the 12 cued recall questions about the educational film clip were scored as completely correct (score of 2), partially correct (score of 1), or not correct (score of 0). For instance, when asked, “What is the ingredient that the baker says all bread starts with?” a child who responded, “Flour,” (the correct response) received a score of 2, a child who responded, “Salt,” (a main ingredient, but not the one the baker indicated as the first and most important ingredient) received a score of 1, and a child who responded, “Crumbs,” or, “I don’t know” (not correct) received a score of 0. Children’s cued recall scores consisted of the sum of their scores for the 12 cued recall questions and ranged from 0 to 24. Six of the 12 cued recall questions referred to central aspects of the film’s plot (e.g., “After the dough rises, where does the baker put the bread?” Answer: “In the oven”), whereas six referred to details (e.g., “How many minutes does it take to bake whole-grain bread?” Answer: “45 min”). Central and detail scores were computed, with a total possible score of 12 for each information type.

Coding of open-ended emotion regulation responses. As a check of children’s ability to understand and implement the emotion regulation instructions, the researcher asked children, “What are you going to try to do?” after administering the emotion regulation instructions. Children’s responses to this open-ended prompt were coded as reappraisal of importance (e.g., “Think about how I’m just watching this on a DVD”), reappraisal of outcome (e.g., “Think about how she could get a new friend”), rumination (e.g., “I would just feel beyond sad if that happened to me”), or no strategy or uncodeable (e.g., “I didn’t do anything”; $\kappa = 0.85$).

Assessing strategy effectiveness. We created a composite variable indexing the effectiveness of children’s emotion regulation during the study. The composite included the following: (a) the difference between children’s sadness rating after the sad film and their sadness rating after implementing the emotion regulation instructions, and (b) children’s ratings of how much they thought about the sad film ($r = .16, p = .08$). Although distinct, these variables were combined because they are conceptually related; both reflect how successful children were at regulating their response to sad events. The decrease in sadness immediately after implementing emotion regulation instructions indexes the
strategy’s immediate effectiveness, whereas the later self-report of emotional processing indexes the strategy’s longer term effectiveness by providing a measure of the extent to which cognitive resources were allocated to the sad film instead of educational information. These ratings were standardized and aggregated. Lower scores on this composite indicated more effective regulation (decreased sadness after implementing the emotion regulation instructions; less thinking about sad information). Higher scores indicated less effective regulation (less of a decrease in sadness after using instructed strategies; more thinking about sad information).

Results

Overview

The results are organized into four sections. The first section reports the results of preliminary analyses of potential covariates, moderators, and manipulation checks. The second section examines the effectiveness of the strategies children were instructed to use to regulate sadness. The third section examines the effects of these emotion regulation strategies on children’s memory for educational information. The final section assesses how strategy effectiveness and individual differences in emotion regulation skill interacted to predict memory accuracy.

Preliminary Analyses

Table 1 presents descriptive statistics and correlations among study variables. Because verbal ability and age were related to memory outcomes, they were included as covariates in all primary analyses. Emotion regulation skill was also covaried in primary analyses, to rule out the possibility that children’s existing skill could explain effects otherwise attributable to the emotion regulation instructions. In the final section of the results, we explored whether or not age and individual differences in emotion regulation skill moderated the association between emotion regulation strategies and memory. Boys and girls did not differ significantly on any memory outcome or control variable, ts < 1.41, ps > .16. Because gender was not a primary focus of this study, this variable was not included in subsequent analyses.

To find out whether or not the sad film successfully elicited sadness, we conducted a repeated measure analysis of covariance (ANCOVA) with baseline sadness and sadness reported immediately after the sad film as the dependent variables. Emotion regulation condition was the independent variable, and age and verbal ability were included as covariates. Children reported greater sadness after the film (M = 1.88, SE = 0.07) than before it (M = 1.03, SE = 0.02), F(1, 120) = 5.97, p = .02, partial η² = .05. As expected, given that emotion regulation instructions were provided after children had watched the sad film, no effect of experimental condition was found. Thus, the emotion elicitation procedure was effective.

To find out whether or not children understood the emotion regulation instructions, we examined their responses to the question, “So, what are you going to try to do?” which followed the instructions. Children in the control condition were not asked this question. The strategies that children reported corresponded to the instructions given for 78% of the children in reappraisal of importance condition, 70% of children in reappraisal of outcome condition, and 69% of children in the rumination condition. Thus, the majority of children in each condition indicated that they understood the instructions and intended to follow them.

Which Emotion Regulation Strategies Were Most Effective?

To assess the effectiveness of specific emotion regulation strategies, we examined two aspects of

| Table 1 | Means (and Standard Deviations) and Bivariate Correlations for Study Variables |
|---------|----------------------|-------------------|----------------|----------------|----------------|----------------|
|         | M        | (SD)          | 1   | 2     | 3       | 4   | 5       |
| Verbal ability | 106.98   | (14.53)       |     |       |         |     |         |
| Emotion regulation skill | 27.57    | (3.74)        | 0.11|       |         |     |         |
| Age     | 9.61     | (1.74)        | −0.19*| −0.02|         |     |         |
| Cued recall (overall) | 12.50    | (4.57)        | 0.32***| 0.161| 0.50***|     |         |
| Cued recall (central) | 6.54     | (2.89)        | 0.22* | 0.14  | 0.50***| 0.83***|         |
| Cued recall (detail) | 5.96     | (2.38)        | 0.35***| 0.13  | 0.35***| 0.84***| 0.50*** |

*p < .10. *p < .05. ***p < .001.
effectiveness: (a) the extent to which the intensity of sadness changed between children’s ratings immediately after viewing the sad film and after implementing the emotion regulation strategy, and (b) the extent to which children reported that they continued to think about the sad film. We first created a composite index of these two conceptually related measures of strategy effectiveness by standardizing each measure and adding the two z scores together. Thus, lower scores represent more effective regulation. An ANCOVA on the strategy effectiveness composite showed a significant effect of condition, \( F(3, 121) = 4.36, p = .006 \), partial \( \eta^2 = .10 \). Post hoc weighted contrast tests showed that the two types of reappraisal (weighted together; reappraisal of importance: \( M = -.44, SD = 1.46 \); reappraisal of outcomes: \( M = -.46, SD = 1.17 \)) were more effective than rumination (\( M = .75, SD = 1.58 \)) and no instructions (\( M = 0.16, SD = 1.58 \)) combined. \( t(120) = 3.75, p < .001, d = 0.68 \). In addition, the two kinds of reappraisal were more effective than no instructions, \( t(120) = 2.12, p = .036, d = 0.39 \). Parent report of children’s emotion regulation skill was not a significant covariate, indicating that strategy effectiveness was attributable to the emotion regulation instructions rather than to children’s preexisting regulatory abilities.

After analyzing the strategy effectiveness composite, we examined whether or not experimental condition predicted differences in each of the two components separately. An ANCOVA (controlling for age, verbal ability, and emotion regulation skill) on differences scores for sadness showed a significant main effect of condition, \( F(3, 121) = 3.98, p = .01, \) partial \( \eta^2 = .10 \). After receiving emotion regulation instructions, the intensity of reported sadness decreased for children in the reappraisal of importance condition (\( M_{adj} = -.48, SE = 0.13 \), \( t(30) = 3.72, p < .01, d = 1.36 \); the reappraisal of outcome condition (\( M_{adj} = -.39, SE = .12 \), \( t(32) = 2.81, p < .01, d = 0.99 \); and the control condition (\( M_{adj} = -.33, SE = 0.13 \), \( t(29) = 3.01, p < .01, d = 1.12 \); in contrast, no decrease of sadness was found for children in the rumination condition (\( M_{adj} = .09, SE = 0.13 \), \( t(31) = 1.07, ns \)). An ANCOVA on the extent to which children continued to think about the sad film showed a marginal effect of condition, \( F(3, 121) = 2.38, p = .07, \) partial \( \eta^2 = .06 \). Children tended to think about the sad film less in the reappraisal of importance (\( M_{adj} = 2.31, SE = 0.17 \)) and reappraisal of outcome (\( M_{adj} = 2.25, SE = 0.16 \)) conditions (weighted together) than in the rumination (\( M_{adj} = 2.61, SE = 0.16 \)) and control (\( M_{adj} = 2.76, SE = 0.16 \)) conditions (weighted together), \( t(122) = 2.63, p < .05, d = 0.48 \).

In summary, the intensity of emotion elicited by the sad film decreased for children in the reappraisal and control conditions but not for children in the rumination condition. This finding is consistent with Koole’s (2009) meta-analysis of emotion regulation studies which showed that participants in control conditions frequently show a decrease of negative emotion. This may occur because participants engage in emotion regulation regardless of whether they are instructed to do so by researchers. However, the reappraisal conditions were more successful than either the rumination condition or the control condition in preventing children from dwelling on the sad events that had occurred in the film, showing the efficacy of reappraisal for regulating emotion. Taken together, analyses of strategy effectiveness showed no significant differences between the two types of reappraisal, but reappraisal was more effective than ruminating or receiving no regulation instructions.

Emotion Regulation Strategies and Memory for Educational Information

To assess the effects of specific emotion regulation strategies on children’s memory for central information and details of the educational film, we conducted a repeated measures ANCOVA that controlled for age, verbal ability, and emotion regulation skill. The results showed a significant interaction between condition and information type, \( F(3, 112) = 3.00, p = .03, \) partial \( \eta^2 = .07 \). Unadjusted means (and standard errors) are shown in Table 2. To explore this interaction, we conducted contrast tests to examine memory for central and detail information separately, weighting the combined reappraisal conditions against the rumination and no instructions conditions. The results for memory for details from the educational film showed that children who were instructed to reappraise importance or outcomes remembered more details than children who received no emotion regulation instructions, \( t(118) = 2.03, p = .04, d = 0.37 \). Children instructed to ruminate did not differ in the number of details recalled from children in the other three conditions. The results for memory for central information showed that there were no differences by condition. Children instructed to reappraise outcomes, \( t(32) = 2.08, p = .046, d = 0.74 \), and children in the control condition, \( t(28) = 2.67, p = .013, d = 1.01 \), remembered more central information than peripheral details.
Strategy Effectiveness and Individual Differences in Regulatory Skill Predicting Memory

To assess whether or not individual differences in children’s emotion regulation skill were related to their memory for educational information, we conducted two regression analyses. The dependent variables were memory for central and detail information from the educational film. In each model, we entered verbal ability in Step 1. In Step 2, we entered age, strategy effectiveness, and parent-reported emotion regulatory skill (For ease of interpretation, strategy effectiveness was reverse scored for this analysis so that higher scores indicate greater effectiveness). In Step 3, we entered two-way interactions of all centered terms (Age × Strategy Effectiveness, Age × Regulatory Skill, Strategy Effectiveness × Regulatory Skill). In Step 4, we entered the three-way interaction of age, strategy effectiveness, and regulatory skill.

The results showed that better memory for central information was predicted only by increasing age, $b = 0.57$, $t = 7.55$, $p < .001$. Table 3 shows the results of the regression analyses for memory for detail information. An interaction of strategy effectiveness and emotion regulatory skill was found. As shown in Figure 1, children rated by parents as having better emotion regulatory skill remembered detail information from the educational film comparably well regardless of strategy effectiveness. Children rated as having poorer regulatory skill, on the other hand, showed enhanced memory for details when strategy effectiveness was higher.

### Discussion

The effectiveness with which children can regulate emotion has important consequences for learning and memory. Emotions direct attention to information that seems immediately relevant to maintaining well-being or attaining goals. Because attentional capacity is limited, emotions can divert attention from other information, such as educational material, likely to be relevant in the long run. So a child who can regulate his or her feelings has an intellectual advantage over one whose emotions continue to command attention. This basic insight provides part of the motivation for the growing number of emotion education programs in schools. But what kinds of regulation strategies should such programs teach? This study examined the effects of reappraisal of importance, reappraisal of outcomes, and rumination on children’s memory for educational

<table>
<thead>
<tr>
<th>Emotion regulation instruction</th>
<th>$n$</th>
<th>$M$</th>
<th>$SE$</th>
<th>$M$</th>
<th>$SE$</th>
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<tr>
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<td>0.49</td>
<td>6.87</td>
<td>0.38</td>
</tr>
<tr>
<td>No instructions*</td>
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<td>6.62</td>
<td>0.55</td>
<td>5.28</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Note. Asterisks (*) denote a significant pairwise difference in the type of information recalled (central vs. detail) for that instruction condition. Subscript letters denote significant differences between different letters in weighted contrasts tests ($p < .05$).

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$\Delta R^2$</th>
<th>$\Delta F$</th>
<th>$\beta$</th>
<th>$t$</th>
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<tr>
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<tr>
<td>Verbal ability</td>
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<td>15.67***</td>
<td>.40</td>
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<tr>
<td>Step 2</td>
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<td>.08</td>
<td>1.06</td>
</tr>
<tr>
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<td>1.55</td>
</tr>
<tr>
<td>Strategy effectiveness</td>
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<td></td>
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<td>5.40***</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>.04</td>
<td>2.20$^*$</td>
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<td>1.96*</td>
</tr>
<tr>
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<td>1.30</td>
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<tr>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
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Note. Strategy effectiveness was based on children’s self-reports. The measure was reverse scored so that higher scores indicate greater effectiveness in alleviating sadness and attenuating processing of sad information. $p < .10$, $p < .05$, $***p < .001$. 

Table 2

<table>
<thead>
<tr>
<th>Type of information</th>
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<th>Detail</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>$SE$</td>
</tr>
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<tr>
<td>No instructions*</td>
<td>6.62</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Table 3

Hierarchical Regression Analyses Predicting Children’s Memory for Details From an Educational Film ($N = 119$)
information. We investigated the extent to which these strategies reduced sadness and attenuated processing of the sad information, and their effects on children’s memory. We also explored whether or not age and individual differences in children’s regulatory skill moderated the relation between strategy effectiveness and memory. Taken together, the results of this study highlight the benefits of instructing children to use reappraisal strategies to effectively regulate sadness and improve memory for educational information.

In adults, reappraisal has been shown to be effective, and rumination ineffective, for regulating negative emotion (e.g., Nolen-Hoeksema et al., 2008; Ochsner et al., 2004). This study is one of the first to compare the effectiveness of these strategies when used by elementary school-aged children. Drawing on prior work (Rice et al., 2007) and appraisal theories of emotion (Ellsworth & Scherer, 2003; Levine, 1995; Thompson & Meyer, 2007), we expected reappraisal strategies to be more effective for regulating children’s sadness than rumination or no regulation instructions because reappraisal diminishes the extent to which children construe emotional information as goal relevant or as negative. We measured strategy effectiveness based on children’s reports of attenuation of sadness and reduction in processing of sad information. As predicted, we found that reappraising the importance or outcome of sad events was more effective for regulating sadness than rumination or no emotion regulation instructions. Importantly, strategy effectiveness was not explained by preexisting individual differences in children’s regulatory skill but instead was accounted for by the emotion regulation instructions. Thus, although mental reframing may not be desirable in all contexts, it certainly holds promise for contexts in which children must manage distress efficiently and turn their attention to other concerns.

Instructions concerning how to regulate emotion did not affect children’s memory for the central points of the educational film. This finding is consistent with prior work showing that children recall central features of past experiences even when distressed (Peterson, 2002; Peterson & Bell, 1996). As predicted, though, instructions to reappraise the importance or outcome of sad events led to better memory for the details of the educational film, compared to not being instructed to use any strategy. Also in line with our predictions, ruminating did not improve memory relative to receiving no instructions. Somewhat surprisingly, though, using reappraisal did not lead to better memory than rumination, even though there was a clear difference in how effectively these strategies regulated sadness.

Two factors may have contributed to finding no memory impairment in children instructed to ruminate. First, instructing children to ruminate after watching the sad film may have inadvertently prompted children to pay closer attention to the educational film than they otherwise would have done. Rumination instructions encouraged children to think about the content of the sad film in a manner that highlighted the personal relevance of the events. Children may have carried over instructions to think carefully about events to the next film, attending closely to the educational content. In contrast to this experimental context, ruminating on sad events in daily life would not be expected to promote careful attention to emotionally neutral information. Second, the short-term rumination we elicited may have less deleterious effects than the chronic, cyclical response style that has been the focus of most empirical research on rumination. As typically studied, rumination is a trait-like response to negative events that involves a continued focus on the causes and consequences of negative emotion (Abela & Hankin, 2011; Nolen-Hoeksema, 1991; Park et al., 2004). Although children instructed to ruminate in our study reported feeling sadder and thinking more about sad events, our instructions did not appear to elicit the persistent focus on sad feelings and events that would have resulted in

![Figure 1. Interaction of emotion regulation strategy effectiveness and emotion regulation skill predicting cued recall of details from the educational film.](image)

Note. Strategy effectiveness was based on children’s self-reports. High strategy effectiveness indicates greater effectiveness in alleviating sadness and attenuating processing of sad information. High and low labels correspond to values ±1 SD from the mean. Emotion regulation skill was based on parents’ reports.
poorer memory for educational information. Children within the age range studied (6–13 years) may be resistant to engaging in rumination at a level comparable to this response style unless they have an underlying vulnerability or predisposition (e.g., parental depression; Abela et al., 2007; Abela et al., 2002). In summary, our findings suggest that reappraisal strategies are good candidate strategies for use in emotion education programs in schools, but additional work is needed to clarify whether or not rumination has deleterious effects on children’s memory.

Individual differences in children’s existing emotion regulatory skill did not directly predict memory, but regulatory skill moderated the relation between strategy effectiveness and memory for details of the educational film. Specifically, children with a higher level of parent-reported skill recalled details of the educational film equally well, regardless of the effectiveness of the strategy they had been instructed to use. Given that emotion regulation skill has been associated with fewer attentional problems (Trentacosta et al., 2006) and academic achievement (Graziano et al., 2007; Howse et al., 2003), these children may have been able to draw on supplementary regulatory resources to attend to the educational material. Children who were rated as less skilled at emotion regulation, in contrast, recalled more details of the educational film as strategy effectiveness increased. In fact, when the emotion regulation strategies children used were highly effective, less skilled children recalled educational details at a level comparable to that of children with greater preexisting regulatory skill. These findings suggest that instructing children to engage in reappraisal strategies should be especially useful for enhancing learning in children with less preexisting emotion regulatory skill.

This study included a wide range of ages, so we also assessed whether or not there were age differences in the mnemonic benefits of using effective strategies. As expected, children recalled more information (central and detail) from the educational film with increasing age, but age did not interact with regulatory skill or strategy effectiveness to predict memory. The lack of an interaction between age and strategy suggests that children in the early elementary school years are able to employ the instructed strategies to the same effect as older children. This finding is important because prior work has shown that children can generate cognitive emotion regulation strategies as early as age 5 (Davis et al., 2010), but our study is one of the first to investigate whether or not they are able to effectively implement a cognitive emotion regulation strategy that has been suggested by someone else. This indicates that children across the elementary school years could benefit from being taught to use reappraisal strategies.

Overall, findings supported our expectation that reappraisal strategies would lead to memory improvements, possibly because they were the most effective strategies for alleviating lingering sadness. Instructed reappraisal strategies for regulating emotion were particularly effective for promoting accurate memory for details of an educational film among children who were not skilled at emotion regulation to begin with. Because the details were not irrelevant or unimportant aspects of the film, but rather supplementary information, children with better recall of details had a more complete and nuanced understanding of the educational content (in this case, bread making). In settings in which learning is a priority, children who are better able to regulate emotion and retain a more thorough understanding of educational information would have a distinct intellectual advantage. Our findings suggest that reappraisal may be a specific emotion regulation strategy that would be useful for parents and teachers to encourage children to use when facing negative emotions in educational contexts, to promote subsequent learning.

Limitations and Directions for Future Research

Limitations of this study should also be noted. The present study focused on one emotional state. The emotion regulation strategies that would be effective for coping with one emotion are not necessarily the same strategies that would best allow children to cope with another emotion (Davis et al., 2010). Future research should examine strategies for regulating other emotions, such as anger and fear, to more fully elucidate the emotion regulation strategies that enhance children’s learning. In addition, watching a sad film is very different from experiencing a sad event in one’s own life. Children may have been able to reappraise the importance or outcome of the film’s events in part because it was simply a film, and was not happening in real life. Future studies should investigate whether or not reappraisal confers the same benefits to memory for educational information when children are coached to use this strategy to cope with events in their own lives. Finally, reappraisal appears to work in part because it minimizes the self-relevance of an upsetting outcome. This strategy is clearly useful in situations that require children to move
beyond negative feelings and concentrate on educational pursuits, but it may not be a useful strategy for dealing with extremely emotional events like a trauma or natural disaster. Our findings suggest, however, that reframing an upsetting outcome, whether by reappraising its importance or outcome, is an effective approach to emotion regulation for children in contexts where learning is the principal objective.

Conclusion

Findings from the present study contribute to our understanding of children’s emotion regulation in several ways. Previous research has indicated the importance of effective emotion regulation for children’s academic success, but little work has examined the effectiveness or mnemonic consequences of specific strategies. The present research identifies effective emotion regulation strategies, clarifies the effects of specific strategies on children’s memory for educational information, and has important implications for designing programs to help children to learn effectively. Reappraisal was found to be a highly effective strategy that allowed children to focus attention on details of subsequent educational information and remember it better. The benefits of effective strategy use were especially striking for children who were not very skilled at emotion regulation to begin with. The aim of this study was to identify specific emotion regulation strategies that can best help children manage emotion so that they can focus on and remember educational material. Our findings suggest that cognitive reappraisal is an excellent candidate for use in educational contexts.

References


Appendix

Cued Recall Questions (and Answers) From the Educational Film

Central Information

When they make the bread in the bakery they use many different ingredients. What did the baker say that every kind of bread begins with? (Flour)
The girl tastes some black stuff from a spoon. What is the black stuff called? (Molasses)
How long do the raw, rye kernels have to soften before they put them in the bread? (1 day)
After the dough rises, where does the baker put the dough? (In the oven)
After the bread comes out of the oven, they leave it in a room for a while. Why do they leave the bread in this room? (To cool)
Why do they have to cool the bread? (To slice it)

Detail Information

When the man is showing the girl around the bread factory, the man and girl are both wearing the same kind of clothing. What are they both wearing? (Hats or aprons)
What does that black stuff, molasses, do to the bread? (Gives it color and flavor)
Why do they use a machine to make the dough into round balls? (It makes them faster and rounder than a baker could)
They put the dough in a cabinet to warm it before cooking. How long do they leave it in the cabinet? (15 min)
How many loaves are baked in the oven at the same time? (450)
How many minutes does it take to bake whole-grain bread? (45 min)