

School programs targeting stress management in children and adolescents: A meta-analysis

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Abstract

Introduction: This meta-analysis evaluates the effect of school programs targeting stress management or coping skills in school children.

Methods: Articles were selected through a systematic literature search. Only randomized controlled trials or quasi-experimental studies were included. The standardized mean differences (SMDs) between baseline and final measures were computed for experimental and control groups. Experimental groups were groups that either received an intervention of (a) relaxation training, (b) social problem solving, (c) social adjustment and emotional self-control, or (d) a combination of these interventions. If no baseline measurement was available, SMDs were calculated between final measures of the groups. The overall pooled effect size was calculated and the pooled effect sizes of improvement on stress, coping, (social) behavior, and self-efficacy by random effects meta-analysis. The dependence of the results on study characteristics (i.e. methodological quality and type of intervention) was evaluated using meta-regression analysis.

Results: Nineteen publications met the inclusion criteria of controlled trials for class programs, teaching coping skills or stress management. Overall effect size for the programs was -1.51 [95%

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confidence interval (CI) $-2.29, -0.73$], indicating a positive effect. However, heterogeneity was significant ($p < .001$). Sensitivity analyses showed that study quality and type of intervention were sources of heterogeneity influencing the overall result (p values $< .001$). The heterogeneity in quality may be associated with methodological diversity and differences in outcome assessments, rather than variety in treatment effect. Effect was calculated per intervention type, and positive effects were found for stress symptoms with a pooled effect size of -0.865 (95% CI: $-1.229, -0.502$) and for coping with a pooled effect size of -3.493 (95% CI: $-6.711, -0.275$).

Conclusion: It is tentatively concluded that school programs targeting stress management or coping skills are effective in reducing stress symptoms and enhancing coping skills. Future research should use clear quality criteria and strive for less diversity in methodology and outcome assessment.

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Keywords: Meta-analysis; Primary prevention; Mental health; School-based; Stress-management; Coping; Educational programs

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This meta-analysis evaluates the effect of primary prevention programs targeting stress management in schools. Prior research showed that school children frequently experience stress (Compas, 1987; Currie et al., 2004; Lohaus, 1990). Stress is related to a wide range of health and social problems and its effect is modified by coping.

Stress is generally defined as ‘a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and

endangering his or her well-being' (Lazarus & Folkman, 1984). Children are most affected by ongoing, enduring experiences, in particular those over which they have no control. Daily hassles form the main cause of stress experiences in children (Compas, 1987; Hurrelmann, 1990; Jewett, 1997; McNamara, 2000; Lohaus, 1990). For example, in an interview study by Lohaus (1990) with 342 children and adolescents aged 7 to 16 years, 246 children (72%) reported stressful situations related to school and performance-oriented contexts (e.g. written class exercises or homework), and 123 (36%) also reported situations related to social problems (as quarrels with peers or with parents). The interviews showed limited knowledge about specific coping strategies for stress situations. Of the children and adolescents 85 (25%) even believed that nothing could be done to avoid stress experiences and to cope with stress situations (Lohaus, Klein-Hessling, & Shebar, 1997).

These stressors form a non-specific risk factor, for a wide range of health and social problems, such as anxiety, depression, aggression, substance abuse and behavioral problems (Bandell-Hoekstra, Abu-Saad Huijter, Passchier, & Knipschild, 2000; Compas, Connor-Smith, Saltzman, Harding Thomsen, & Wadsworth, 2001; Compas, Orosan, & Grant, 1993; Kristjansdottir, 1996; Lovibond & Lovibond, 1995; Macleod et al., 2004; McNamara, 2000; Passchier & Orlebeke, 1985; Van Praag, De Kloet, & Van Os, 2005). The association between stress and health, however, has remained modest in strength and it has become clear that stress is neither a necessary nor a sufficient condition for any specific illness or for disease in general (Haggerty, Sherrod, Garmezy, & Rutter, 1996).

Research showed that coping modifies stress and psychopathology (Compas et al., 1993). In studies on coping the definition of Lazarus and Folkman (1984) is generally used: constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person. Lazarus and Folkman further distinguished two fundamental types of coping based on their function (1) 'problem-focused coping' and (2) 'emotion-focused coping'. The first refers to efforts to directly change or master the source of the stress; the second refers to efforts to manage or regulate the emotions associated with the stressful episode. In the literature on coping in children and adolescents coping strategies were mostly dichotomized (Compas et al., 2001; Fields & Prinz, 1997). Children and adolescents less proficient at coping with stressors showed more emotional/behavioral problems (Lazarus & Folkman, 1984; Seiffge-Krenke, 1993). Olbrich (1990) argued that it is more important how young people cope with stress than the stressful impact itself with respect to their adaptation, health and development. Underachievement, violent behavior, and physical illness are outcomes of inappropriate coping strategies (Altshuler & Ruble, 1989; Compas and Hammen, 1994; Jewett, 1997; Lewis & Frydenberg, 2002; Roeser, 1998; Ryan, 1989; Seiffge-Krenke, 2000). Recent research of Hampel and Petermann (2005) confirmed that children and adolescents still use maladaptive coping patterns. Maladaptive coping is also found to significantly influence psychological development in young people (Compas et al., 2001; Wolchik & Sandler, 1997). These findings emphasize that coping strategies are key determinants of long-term psychological, emotional, and physiological outcomes of stress (Henderson, Kelbey, & Engebretson, 1992).

Research in the field of stress and coping in children and adolescents resulted in a variety of primary and secondary prevention programs (Segal, 1983). In these programs, skills for emotional coping and/or problem-solving coping are taught to deal with stressors more appropriately (e.g., De Wolfe & Saunders, 1995; Dubow, Schmidt, McBride, Edwards, &

Merk, 1993; Elias et al., 1986; Forman, 1993; King, Ollendick, Murphy, & Molloy, 1998; Robson, Cook, & Gilliland, 1995). Outcome variables can be categorized into four main outcome groups: stress symptoms, (social) behavior, coping and self-efficacy. Stress symptoms are frequently reported by children and occur on the psychological and physiological level (Sharrer & Ryan-Wenger, 2002). Also (social) behavior is an important outcome of stress. Coping skills mainly determine the impact of stressors on health and functioning. Furthermore self-efficacy is a crucial determinant in health behavior change: when a person is motivated, the remaining question is whether the person is able, and feels confident to change the behavior (Bartholomew, Parcel, Kok, & Gottlieb, 2001).

Reviews on programs found encouraging to positive results, although the quality of individual studies varied or was difficult to assess (Durlak & Wells, 1997; Gossette & O'Brien, 1993; Hajzler & Bernard, 1991; King et al., 1998; Pellegrini & Urbain, 1985; Rones & Hoagwood, 2000; Schulink, Gerards, & Bouter, 1988; Urbain & Kendall, 1980). Furthermore, these reviews and meta-analyses were not limited to primary-prevention programs in schools, and included studies with diverse populations, in various settings and used a wide range of outcome variables, which appear to have contributed to substantial heterogeneity.

This meta-analysis was limited to primary prevention programs developed for schools, to evaluate effects of these specific programs on stress and coping. Four categories of stress management outcomes were studied in this meta-analysis: (1) symptoms of stress: psychological and physiological; (2) social behavior; (3) coping; and (4) self-efficacy. Measures included self-report measures, physiological measures, and observational measures. The difference in mean change between treatment and control groups is the primary outcome measure in this meta-analysis.

Inevitably, studies brought together differed in what may influence the effects evaluated. This so-called heterogeneity was investigated to consider to what extent results are consistent. To increase homogeneity only studies with a population of late childhood, early, and middle adolescence (ages 9 to 14 years) were selected. Heterogeneity due to developmental stages was thus confined. Residual heterogeneity was evaluated by examining intervention type and study quality as potential effect modifiers. Stress management programs in schools would help children to develop healthy coping strategies in order to deal with the inevitable stressors of life (Romano, 1992) and thereby decrease the risks of maladjustment or psychopathology due to maladaptive coping strategies.

By examining the effectiveness of these specific programs in the selected population, this meta-analysis aims to contribute to mental health promotion in children and adolescents.

Methods

Search strategy

Relevant publications were identified through a systematic computer search using literature databases (i.e. ERIC-database, PsycINFO, Cochrane Library, Medline) and search machines on the Internet (Google). Furthermore manual searches were conducted through literature references in articles and books. The search period ran from January 2003 through January 2006. Keywords were (stress) prevention, primary prevention, mental health promotion, educational interventions, health care, in combination with the keywords children, school, stress

management, and in combination with the terms stress, coping, problem solving, relaxation, Rational Emotional Education (REE), social support, social skills and social emotional.

Selection criteria

Type of studies

Studies were selected when they met the following criteria concerning program content and research design: programs had to be primary prevention programs with class educational interventions for children and early adolescents. Primary prevention programs were defined as interventions designed specifically to promote mental health and reduce the incidence of adjustment problems in currently normal populations. Studies had to involve a program focusing on promoting mental health, i.e. be directed primarily at children's and adolescents' functioning. It was therefore decided to also include programs that do not directly address stress, but do target adjustment and coping skills. So the term stress management programs was roughly adopted for the comparison of programs within this range and to enlighten the link between adjustment, coping skills and stress (i.e. problem solving, relaxation therapy, social skills training, rational emotive education or different combinations of these strategies).

Concerning research design only randomized controlled trials (RCTs), or quasi-experimental trials were included because of their strong causal credibility (Kleinbaum, Kupper, & Morgenstern, 1982). Studies that focused on drug prevention were excluded as these concerned a different concept.

Type of participants

In this meta-analysis the age groups were operationalized by school grades: late children attended 3rd and 4th grade, early adolescents 5th and 6th grade, and middle adolescents 7th and 8th grade. The experimental group received a class educational program on coping or stress management. The control group received no intervention, a delayed intervention, a placebo treatment, or 'usual care'.

Coding of study reports

Eligible studies were coded by the first author on several items classifying methodological quality, change scores, outcomes, and intervention type. Next, members of the coding team independently reviewed coding on change scores, outcomes, or type of intervention, depending on their field of expertise; quality items were independently coded by the third author, who was blind to the coding of the first author. Disagreements or questions were resolved through discussion between the first author and the coding team. The third author was supervising the coding process.

Study quality coding

Study quality was coded using criteria based on the Agency for Health-care Research and Quality domains for RCTs [AHRQ (West et al., 2002)]. Two criteria were added: presenting a theoretical framework, and reporting follow-up data. These criteria were added because health promotion programs take a problem-driven perspective and theory is merely a tool to

enable better choices (Bartholomew et al., 2001); follow-up measurements give insight into long-term effects. This coding list (see Table 2) was used to evaluate the (methodological) quality of each study, to identify any poor quality study, possibly influencing profoundly summary estimates of the effects of a treatment (Khan, Daya, & Jadad, 1996; Moher et al., 1998; West et al., 2002). The higher score a study received, the stronger the methodological quality, and thus the validity of the effects reported. In total a study could get 16 points at the most. If a criterion was only partly met, half a point was credited. The first and third author independently rated study-quality (inter-rater reliability .79). Mean quality score per intervention type was calculated to determine whether significant differences in quality emerged between categories. Afterwards quality as potential source of heterogeneity was investigated.

Intervention type coding

The intervention programs studied targeted one or both of the different fundamental types of coping: problem solving or/and emotional coping. For the several coping skills, items were coded that indicated specific components of the program. Programs were also coded according to whether they used one fundamental type of coping or combined problem solving and emotional skills. This coding enabled us to distinguish the main program components. Based on the coding of the main components intervention programs were categorized into: social problem-solving skills and three forms of emotional coping: relaxation, social-adjustment and emotional self-management; and finally combined coping skills, in which several main components are targeted simultaneously. As social-adjustment and emotional self-management skills both aimed at adjustment of (social) behavior, these programs were combined. This resulted in four intervention types (trial arms) aiming at: a) relaxation skills, b) social-emotional skills, c) problem solving skills, and d) combined programs.

Outcome variables coding

In most studies a variety of instruments were used to measure a variety of outcomes. Items were formulated to code dependent variables for each study. These outcome variables were categorized into four groups [symptoms, (social) behavior, coping and self-efficacy] as described below.

Outcome measures on the psychological and physiological symptom level were categorized as ‘symptoms of stress’. Instruments used in studies to assess these symptoms were, for example: Stress Assessment Scale–Child (De Wolfe & Saunders, 1995); Somatic Stress Symptoms (Lohaus, Fleer, Freytag, & Klein-Hessling, 1996).

Outcome measures that assessed various coping skills (either emotional or problem solving coping) were categorized as ‘coping’. Instruments used in studies to assess these skills were, for example: social skills rating system (Gresham & Elliott, 1990); Decision-Making Questionnaire (Gersick, Grady, & Snow, 1988). Behaviors in observational test situations were considered as coping and coded as such.

Actual behavior in the classroom or with peers was categorized into (social) behavior, and the measurement instruments used in studies were for example: Child Behaviour Rating Scale (Weisberg et al., 1981) and Devereux Elementary School Behavior Rating Scale (Spivack & Swift, 1967).

Outcome measures on self-efficacy and self-esteem were assigned to a category ‘self-efficacy’. General self-efficacy is a competence belief, whereas general self-esteem is a trait

referring to individuals' degree of liking or disliking for themselves. However, both concepts are closely related and opinions differ on whether they concern distinct constructs (Chen, Gully, & Eden, 2004; Stanley & Murphy, 1997). Both outcomes were assessed in most studies with a variety of instruments, e.g.: Children's self-efficacy for peer interaction (Wheeler & Ladd, 1982), Coopersmith's self-esteem (1967). In this meta-analysis they were both assigned to the category 'self-efficacy'.

Statistics

Change scores coding

Study results were coded for each trial arm to represent the mean change from pretest to posttest on each outcome variable measured. The difference in mean change between treatment and control groups is the primary outcome measure in this meta-analysis. For studies wherein only posttest effects measures were reported, the difference between the posttest estimates was calculated. All mean differences were standardized by division with the standard error of these estimates. The publications often presented continuous data on different outcome scales. Therefore the effect sizes were calculated for each study. If variance estimates were not given, a correlation of .50 was assumed between the variances at baseline and at follow-up within each group. In a sensitivity analysis correlation values (ranging from .30 to .60) were investigated.

$$\text{Effect size (ES)} = (\text{mean improvement}_i - \text{mean improvement}_c) / \text{pooled standard deviation}$$

$$\text{Pooled standard deviation} = \sqrt{\{(n_i - 1)SD_i^2 + (n_c - 1)SD_c^2\} / (n_i + n_c - 2)}$$

Standard deviation (SD)

$$= \sqrt{[(SD_{\text{baseline}})^2 + (SD_{\text{posttest}})^2 - (2 \times 0.5 \times SD_{\text{baseline}} \times SD_{\text{posttest}})]}$$

For intervention group (i) or control group (c)

n number of subjects at post-test

For studies with post-measures only:

$$\text{Effect size (ES)} = (\text{mean posttest}_i - \text{mean posttest}_c) / \text{pooled standard deviation}$$

$$\text{Pooled standard deviation} = \sqrt{\{(n_i - 1)SD_i^2 + (n_c - 1)SD_c^2\} / (n_i + n_c - 2)}$$

For intervention group (i) or control group (c)

n number of subjects at post-test

Effect sizes and 95% confidence intervals were calculated using the effect size calculator [Coe, (n.d.)]. Most of the studies included a relatively small number of participants, and a correction procedure, using Hedges's g was applied to the effect size (Cooper & Hedges, 1994).

Sensitivity analysis

Because of potential heterogeneity between studies, random effects meta-analyses were performed for each outcome category to generate summary estimates. To detect publication bias, heterogeneity was explored by using Egger's unweighted regression asymmetry test (Egger, Davey Smith, Schneider, & Minder, 1997).

Type of intervention and quality of studies were investigated as potential sources of heterogeneity by using two methods: (1) meta-regression analyses, by including the study characteristics as covariates in the regression model (statistical significance indicates an effect modifier) and (2) stratification. The Stata Statistical Software Package (StataCorp., 1999) was used.

Results

Search strategy and article selection

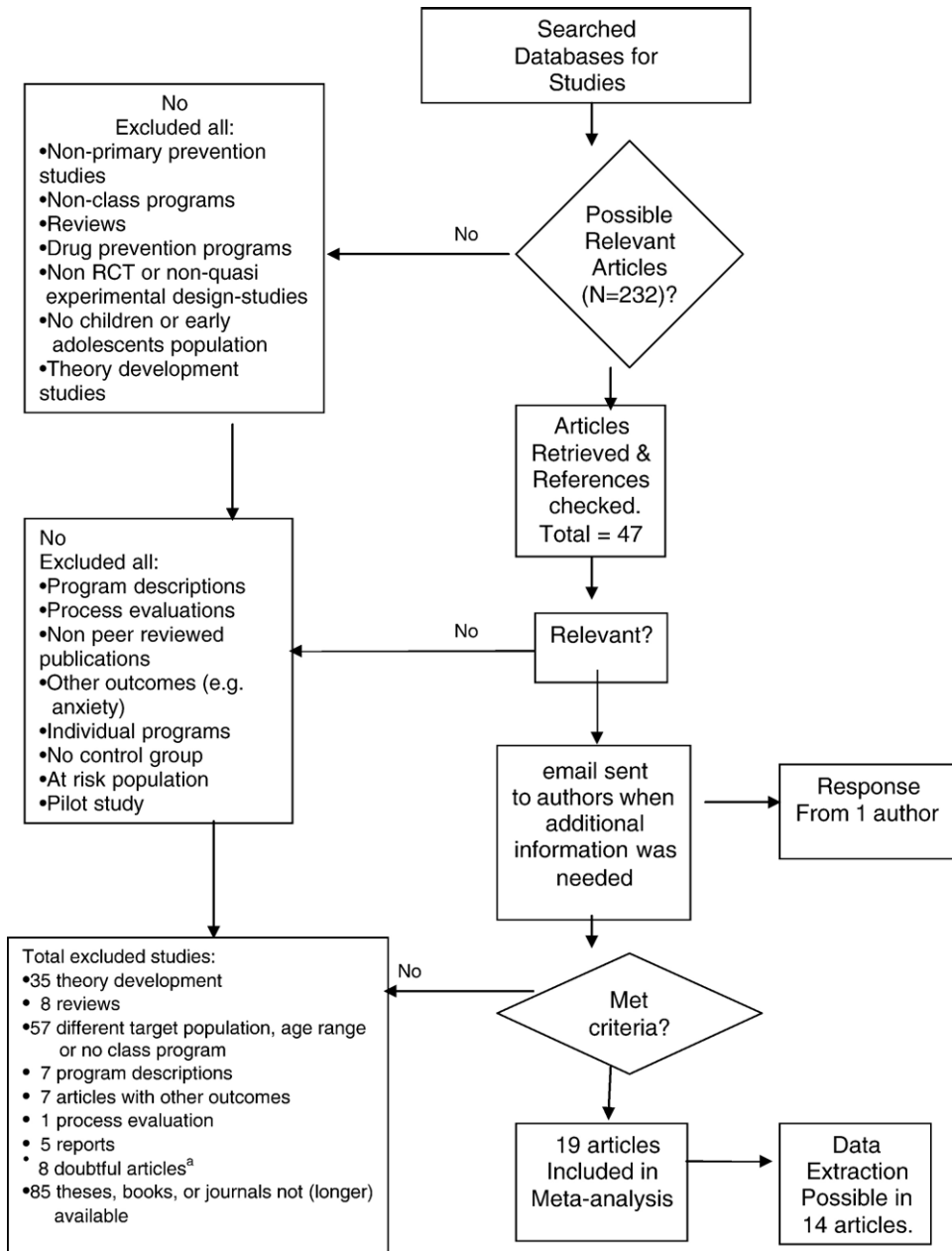
The search identified 232 titles and abstracts of potentially eligible studies. The researcher (first author) determined possible eligibility for inclusion by screening the title and abstract. A number of publications referred to books, and abstracts of theses. For titles and abstracts that raised questions, a student-assistant independently rated potential eligibility. The student-assistant was blind to the results of the screening by the researcher. Possibly relevant literature was then applied for. Complete theses could not be retrieved and some journals and books were no longer available (resulting in 85 unavailable studies). From the publications obtained, studies with a different target population, age range or individual programs were excluded. Articles only describing programs, studies with other outcomes (e.g. aggression, depression), process evaluations, and non peer reviewed publication were also excluded. This resulted in 27 eligible studies of which 8 articles were doubtful. After careful reading by the researcher and student-assistant independently, these 8 articles were excluded by both because they concerned anxiety outcomes, individual programs, used no control group, targeted children at risk, and one study concerned a pilot study. Finally, 19 articles met the inclusion criteria and were selected for this meta-analysis. This process was reviewed by the third author. Fig. 1 describes the article selection, and Table 1 gives a detailed description of the studies selected.

Study quality

Articles were coded for quality. The percentage of studies that met the quality criteria is presented in Table 2.

The quality score ranged from 8 through 13 points, with a mean score of 10.8, standard deviation of 1.41. There was no indication that year of publication had an impact on the methodological quality of the studies. Compliance, inclusion criteria and blinding of the conductor or observer were hardly mentioned. This should be mentioned as it may be a cause of bias and consequently affect the quality of the study. Only two studies reported (response) data and number of participants at follow-up.

The mean quality score and standard deviation (between parentheses) per intervention category was also calculated. Scores were 11.8 (1.06) for programs based on relaxation techniques, 11.5 (.61) for social-emotional programs, 11.13 (.99) for programs based on



^aAfter careful reading 1 article concerned anxiety outcomes, 4 studies concerned individual programs, 1 study used no control group, 1 study targeted children at risk, and 1 study was a pilot-study.

Fig. 1. Article selection.

Table 1
Description of the selected studies in detail

Authors	Participants, grade or age	Therapist and length of sessions	Type of training	Control group	Measurement instruments	Psychometric characteristics
1. Sanz de Acedo Lizarraga, Ugarte, Iriart, and Sanz de Acedo Baquedano (2003)	$N=40$; mean age 13	Experimenter; thirty 1-h classes/week	Social–emotional training (IDEAL): self-regulation, assertiveness, empathy and social skills	No training	Learning strategy scales (ACRA, subscale IV), EPIJ Personality questionnaire, Social scale BAS-3, a developed Teacher's report questionnaire	Reliability coefficients were reported for ACRA, subscale; EPIJ, and BAS-3 social scale. Teacher's report questionnaire was developed for this study.
2. Lohaus and Klein-Hessling (2000)	$N=826$; 7–14 years	Psychology students, five 10-min sessions/week	Three relaxation variants: sensory, imaginative, and combined	Two groups: neutral stories, no training	Stress experiences, coping, social support (subscales from SSK by Lohaus et al. 1996,) mood, somatic, pulse rate, ear-temperature, and questionnaires about child characteristics	SSK: Cronbach's α varied per subscale from .67 to .80 (for parents version from .67 to .83); test–retest varied per subscale from .52 to .84 (for parents version unknown)
3. McCraty, Atkinson, Tomasino, Goelitz, and Mayrovitz (1999)	$N=122$; 12–14 years	Phase 1: 16 h conducted over 2 weeks Phase 2: as a full-year elective course	Social–Emotional program	No training	The Achievement Inventory Measurement (AIM) and heart rate variability	AIM: normed and validated on 4.176 students from mixed demographic backgrounds
4. Lohaus et al. (1997)	$N=170$; 3rd and 4th graders	Psychologists	Combined program variants with different accents on: knowledge, relaxation, problem solving or the combination	Delayed training	SSK (Lohaus et al. 1996), and questions on stress-related knowledge of children. Questionnaires for parents: a subscale of the HAVEL questionnaire (Wagner, 1981) and questions on stress experiences and preferred coping strategies of the children, parents version.	

5. De Wolfe and Saunders (1995)	<i>N</i> =157; 6th graders	Mental health professional (social worker), eight 1-h sessions/week	Combined stress management program: stress knowledge, relaxation, role of emotions, problem solving, and rules for good health	Delayed	Children’s Self-Efficacy for Peer Interaction Scale (CSE; Wheeler and Ladd, 1982); Stress Assessment Scale for child and for teacher (SAS-C and SAS-T), Stress Education Questionnaire for Teachers (SEQ), and subscales of Harter’s Perceived Competence Scale for children: academic competence, acceptance by peers, athletic competence, physical appearance, behavior/conduct, and self-worth	SAS-C, SAS-T, and SEQ were developed for this study. Split-half reliabilities of all measures were reported.
6. Dirks, Klein-Hessling, and Lohaus (1994)	<i>N</i> =83; 4th graders	Experimenter, 4 double-lesson-hours/week	Combined program: knowledge, coping skills and relaxation	No training	Self-constructed questionnaire to measure stress awareness, coping strategies, school-related well-being, psychosomatic symptoms and program evaluation.	
7. Dubow et al. (1993)	<i>N</i> =92; 4th graders	Co-led by two clinical psychology graduate students, 13 sessions of 45 min	Social problem-solving: (I Can Do)	Delayed training	Measures specifically designed to evaluate the program: facts/attitudes, self-efficacy, problem solving, social support network size, process evaluation	Coefficient α values were reported at pre-post and follow up. For problem solving rater reliability is given. For social support test–retest reliability is given.

(continued on next page)

Table 1 (continued)

Authors	Participants, grade or age	Therapist and length of sessions	Type of training	Control group	Measurement instruments	Psychometric characteristics
8. Klingman and Hochdorf (1993)	<i>N</i> =237; 8th graders, 12–13 years	Experienced school counselor or psychologist, 12 sessions of 50 min/week	Social–emotional program	Placebo control group	Israel Index of potential suicide (IIPS), Loneliness scale (UCLA), index of empathy, story completion, semantic differential, knowledge assessment instrument, and a constructed program evaluation questionnaire	IIPS: Cronbach's α is .81 (varied per subscale from .71 to .86). Story completion was specially developed for this study. Interrater reliability is .95
9. Caplan et al. (1992)	<i>N</i> =282; 6th and 7th graders, 11–14 years	Classroom teacher together with Master's-level health educators, 20 sessions of two 50-min class periods/week over a period of 15 weeks	Social–emotional program (Positive Youth Development Program)	No training	Two skill assessment measures: Social and emotional adjustment (Allen, Weissberg, & Hawkins, 1989) and the Rand Well-being Scale (Veit & Ware, 1983); two subscales of the Self-Perception Profile for Children (Harter, 1985), the Decision-Making Confidence Scale, abridged 4-item version (Wills, 1986), Attitudes toward smoking and drinking (Botvin, Baker, Renick, Filazzola, & Botvin, 1984), adapted measure for substance use (Grady, Gersick, Snow, & Kessen, 1986; Kandel, Kessler, & Margulies, 1978)	Two skill assessment measures, with Interrater reliability. Rand Well-being Scale: Cronbach's α .82. Self-Perception Profile for Children (Harter): high reliability and validity established Decision-Making Confidence Scale, abridged 4-item version: Cronbach's α .57. Attitudes toward smoking and drinking (Botvin et al., 1984): Cronbach's α .74–.80
10. Battistich, Solomon, Watson, Solomon, and Schaps (1989)	<i>N</i> =642–342; Kindergarten–grade 4	Teacher; continuous	Social problem-solving program	No training	Several social problem-solving interviews based on e.g. Social Problem-Solving Analysis Measure (SPSAM) by Elias, Larcen, Zlotlow, and Chinsky (1978)	Reliability of coding and internal consistency was reported.

11. Nelson and Carson (1988)	<i>N</i> =101; 3rd and 4th graders	Classroom teacher, teacher's aide, the second author and six undergraduate students, 18 sessions of 1 h/week	Social problem-solving program	No training	Social skills knowledge test (SSKT), social skills role play test (SSRPT), Child behavior rating scale (CBRS), Children's self-efficacy for peer interaction (CSPI) and sociometric measures	CSPI: reliability on non-conflict scale for grade 4 is .84 Sociometric measures: test–retest is .69
12. Schinke, Schilling, and Snow (1987)	<i>N</i> =278; 6th graders	Group leader, 7th grade teacher and students, 8 sessions	Combined stress management program on school transition (information, problem-solving, self-instruction and communication skills)	No training	State-trait anxiety inventory, index of self-esteem, a subscale of the Interpersonal Problem Solving Test, Interpersonal Assertiveness Measure, Index of Peer Relations and Junior High Readiness Scales	Alpha reliability coefficients were reported for all, but the Junior High Readiness Scales (measuring individual's opinions).
13. Elias et al. (1986)	<i>N</i> =158; 5th graders	Teacher, two variants: 1) Instructional phase only: 20–40 min, twice a week. 2) Instructional phase and lessons once a week	Social problem-solving program (ISA–SPS)	Delayed control group	The Survey of Middle School Stressors, and the Group Social Problem-Solving Assessment (GSPSA).	The Survey of Middle School Stressors: internal consistency coefficient >.90 across different samples, and predictive of Piers–Harris Self-concept scores, school attendance, and AML (teachers version). GSPSA: coefficient α values were reported

(continued on next page)

Table 1 (continued)

Authors	Participants, grade or age	Therapist and length of sessions	Type of training	Control group	Measurement instruments	Psychometric characteristics
14. Olexa and Forman (1984)	<i>N</i> =64; 4th and 5th graders	School psychologist or school social worker, 8 sessions of 50 min/week	Social problem-solving program	No training	Devereux Elementary School Behavior rating The Schedule for Classroom Activity Norms, McKinney, Feagans, Ferguson, & Burnett, 1978. (SCAN), Preschool interpersonal problem-solving test, adapted version (PIPS)	Devereux Elementary School Behavior rating Scale: test–retest over 1 week varies from .85 to .91 SCAN: Interrater reliability on four subjects was 88%.
15. Zaichkowsky and Zaichkowsky (1984)	<i>N</i> =43; 4th graders	Experimenters, eighteen 10-min sessions: 3/week	Relaxation program (breathing, progressive muscular relaxation and mental imagery)	No training	Physiological outcomes (skin temperature, heart rate, respiration rate) and Spielberger's State and Trait Anxiety questionnaire	Spielberger's Trait and Anxiety Scale: Concurrent validity with other anxiety scales for children varied from .63 to .75; on the scales, α reliability ranged from .78 to .82 for males and from .81 to .87 for females.
16. Weissberg et al. (1981)	<i>N</i> =563; Grades 2–4	Teacher, assisted by two undergraduates. 42 sessions 3 times a week during 14 weeks	Social problem-solving	No training	Open Middle Test, Simulated Behavioral Problem-solving Test (Gesten, Flores de Apodaca, Rains, Weissberg, & Cowen, 1979), Problem-solving Interview (Gesten et al., 1979), Problem-Solving Abilities Scale, Child Behavior Rating Scale and Class sociometrics	Interrater reliability was reported for Open Middle Test, Simulated Behavioral Problem-solving Test and the Problem-solving Interview. Scale construction of the CBRS through factor analysis was described.

17. Michelson and Wood (1980)	N=80; 4th graders	Graduate students, 2 variants during 4 weeks: eight 1-h sessions, 2/week, or sixteen 1-h sessions, 4/week	Social–emotional program	Two control groups: 1 placebo and 1 no training group	Children’s Assertive Behavior Scale (CABS, by Wood & Michelson, 1978), Teacher Rating of Children’s Assertive Behavior with Other Children and Adults (TRCAB), Rathus Assertiveness Scale Revised for Children (D’Amico, 1976)	CABS: Test–retest reliability .88; KR20 internal consistency .78. TRAB: not mentioned. Rathus Assertiveness Scale: test–retest (8 weeks) is .78; KR 20 is .77 for the Rathus version of 1973.
18. McClure, Chinsky and Larcen (1978)	N=185; 3rd and 4th graders	Classroom teacher and undergraduate assistants	Social problem-solving program (several variances)	No training	Measures based on the behavior analytic method, (Goldfried & D’Zurilla, 1969), the Problem-Solving Measure (Larcen, 1973), constructed measures: the Dyad interaction, the Friendship Club interaction; the Norwicki–Strickland Locus of Control Scale for Children (1973) and the Lorge–Thorndike Intelligence Test (1964)	Interrater reliability was reported.
19. Houtz and Feldhusen (1976)	N=240; 4th graders	Classroom teacher, 15–30 min per day during 9 weeks	Social problem-solving program (several variances)	No training	Worksheets based on the Purdue Elementary Problem Solving Inventory, the inventory itself, Lorge–Thorndike IQ, and Iowa Achievement Test	Interrater reliability scores were reported for the worksheets.

Table 2
Quality criteria list

Quality items of research design	%		
	Yes	Partial	No
Theoretical framework described	95		5
Study question clearly formulated	85		15
Description of study population	60	40 ^a	
Inclusion criteria mentioned			100
Number of participants (power)	75	25 ^b	
(Quasi) randomization into groups	85		15
Baseline differences investigated	80		20
Description of the intervention, settings and the conductor	95		5 ^c
Compliance of the intervention ^d	15	1	84
Response rate on outcome measures is reported	80		20
Information about the validation, reliability and/or norms of the instrument	55	35	10
Information about blinding of the conductor or data-collector (e.g. observer) to the allocation of the participants	20		80
Statistical analysis (e.g. multiple comparisons taken into consideration, interactions)	100		
Biases and limitations taken into consideration	80		20
Follow-up data presented and number of participants on follow-up	10	25	65
Number of measurements reported ^e	5	60	35

^a No demographic background information.

^b Not specified per group.

^c Not mentioned or only by reference.

^d One article described two studies, of which one reported compliance of intervention.

^e One article described two studies, of which one also reported follow-up data; another article described a study that used three delayed intervention groups: a pretest and posttest group, a pretest group only and a posttest group only.

social problem solving and 8.75 (1.19) for programs based on combined techniques. Table 3 presents an overview per intervention category.

Post-hoc tests (Bonferroni corrected) with one-way ANOVA showed a significantly lower quality score $F_{(3,15)} = 7.97, p = .002$ for combined interventions compared to the other intervention types.

Change scores

Study results were coded and data extraction was possible in 14 articles. Of these 14 articles 9 presented mean differences between baseline and final measures for both experimental and control groups, and 5 articles presented only mean differences between

Table 3
Quality score per intervention category

Intervention category	N	Mean	S.D.	Range
1. Relaxation	2	11.75	1.06	11.0–12.5
2. Social/Emotional	5	11.50	.61	10.5–12.0
3. Social problem-solving	8	11.13	.99	10.0–13.0
4. Combined	4	8.75	1.19	8.0–10.5
Total	19	10.80	1.41	8.0–13.0

both groups on final measures. Table 4 gives an overview of outcomes per intervention type for the studies in which data extraction was possible. Overall result, results per outcome, and results per intervention type will be described.

Overall results and results per outcome category

A meta-analysis was performed with negative outcomes indicating positive effects. In some publications several variants of an intervention (using separate groups) were simultaneously compared with control group(s). In one study results were presented per gender only and in another study per grade only. These variants were treated as separate studies ($n=44$). The overall effect size for the mean difference in change scores between experimental and control groups was -1.51 (95% CI: $-2.29, -0.73$). However, heterogeneity was significant ($p<.001$). Meta-analyses were also performed separately for outcome specific categories reporting changes from baseline to final measures. Positive effects were found for stress symptoms [$n=14$ (SMD= -0.87 ; 95% CI: $-1.23, -0.50$)], and for coping [$n=12$ (SMD= -3.49 ; CI: $-6.71, -0.28$)]. No effect was found for (social) behavior [$n=14$ (SMD= -0.76 ; 95% CI: $-1.78, 0.26$)] and self-efficacy [$n=3$ (SMD= -0.70 ; 95% CI: $-3.65, 2.26$)]. Meta analyses showed significant heterogeneity for each outcome category (p values <0.001).

SMD was also computed for studies with final measures only (positive outcomes indicating positive effects). Again variants were treated as separate studies ($n=9$). In these studies only three outcome categories were reported: (social) behavior, coping and self-efficacy. Positive effects were found for behavior (0.80; 95% CI: 0.57, 1.04) and coping (1.72; 95% CI: 0.75, 2.68). No effect was found for self-efficacy (0.03; 95% CI: $-0.21, 0.27$).

Publication bias

Publication bias was significant for the overall effect size ($p=.015$) and the outcomes stress symptoms ($p=.006$) and self-efficacy ($p=.046$). More studies with positive effects on stress

Table 4
Outcome per intervention type

Outcome	Intervention category				Total
	A	B	C	D	
Symptoms ^a	4	3	3	4	14
Social behavior ^a	0	3	7	4	14
Coping ^a	0	1	7	4	12
Self-efficacy ^a	0	0	3	0	3
Social behavior ^b	0	0	0	1	1
Coping ^b	0	0	6	1	7
Self-efficacy ^b	0	0	0	1	1
Total	4	7	26	15	52

Intervention type is coded: A=relaxation, B=social-emotional, C=social problem solving, D=combined strategies.

^a Data from baseline and final measures.

^b Data from final measures only.

symptoms have been published and were more readily obtainable. As a result, the true effect of these programs on stress symptoms may be overestimated. Publication bias was also found for effects on self-efficacy; for this meta-analysis only two studies were obtainable.

Sensitivity analysis

Heterogeneity was evaluated by examining intervention type and study quality as potential effect modifiers. First intervention type was investigated as a possible source of heterogeneity. Some publications studied several variants of intervention type. So, although two publications were found with programs based on relaxation techniques, four variants compared to control groups were described in these publications. For the social–emotional interventions ($N=4$) six variants were described, while interventions based on social problem solving ($N=6$), described the results of 12 variants. Combined programs ($N=2$) described 6 variants. Self-efficacy was only assessed in two publications from the intervention category ‘social problem solving’, so sensitivity analysis was not possible for this outcome.

Type of intervention was as an important source of heterogeneity for the outcomes stress symptoms ($p<.05$) and (social) behavior ($p<.05$), see Table 5. The SMD of Social problem solving training programs deviated from the SMDs of other intervention types with regard to the outcome (social) behavior and heterogeneity was attributed to the category ‘social problem solving’. The SMD of combined programs deviated from the

Table 5
SMD for stress, behavior and coping classifications stratified by type of intervention and quality of studies

	Stress	Behavior	Coping
Intervention	0.002 ^a	0.034 ^a	0.366 ^a
Relaxation	-0.57 -1.04, -0.09 ($n=4$)	($n=0$)	($n=0$)
Social–Emotional programs	-0.44 -0.67, -0.21 ($n=3$)	-3.82 -7.71, 0.07 ($n=3$)	-2.25 -6.37, 1.87 ($n=1$)
Social problem-solving training	-0.47 -1.46, 0.52 ($n=3$)	0.25 -1.23, 1.73 ($n=7$)	-5.53 -11.85, 0.78 ($n=7$)
Combined programs	-1.82 -2.42, -1.22 ($n=4$)	-0.25 -0.55, 0.06 ($n=4$)	-0.24 -0.67, 0.19 ($n=4$)
Quality	0.012 ^a	0.549 ^a	0.177 ^a
Low (<11)	-1.36 -2.02, -0.69 ($n=6$)	-0.25 -0.55, 0.06 ($n=4$)	-0.24 -0.67, 0.19 ($n=4$)
High (≥ 11)	-0.48 -0.84, -0.13 ($n=8$)	-0.97 -2.32, 0.39 ($n=10$)	-5.12 -9.81, -0.44 ($n=8$)

Each cell presents SMD, 95% CI, and number of studies between parentheses.

^a p -value for interaction.

SMDs of other intervention types with regard to the outcome stress and heterogeneity was attributed to combined programs.

To investigate study quality as a potential source of heterogeneity, studies were divided into two categories based on the median score. Studies with a score lower than 11 were categorized as low quality studies ($n=22$), studies with a score equal to or higher than 11 were categorized as high quality studies ($n=30$). For the outcome stress a significant difference was found between low and high quality studies for SMD, p -value for interaction was significant ($p=0.012$). Findings are summarized in Table 5.

Discussion

Findings indicate significant positive effects for the evaluated programs with an overall effect size of -1.51 (95% CI: $-2.29, -0.73$). Meta-analyses were also performed per outcome specific category and showed positive effects in reducing stress symptoms and enhancing coping skills (ESs $-.87$ and -3.49 , respectively). Effect on (social) behavior was not univocal, no effect was found for self-efficacy. This suggests that the positive overall effect could particularly be explained by the effects on stress symptoms and coping skills.

Although effect sizes can be considered large (Cohen, 1988), the study had some limitations. Heterogeneity was found for overall effects and for the effects per outcome category. A sensitivity analysis confirmed that effects differ for the various types of intervention and for the quality of the study. As 85 articles were not available for this meta-analysis, publication bias may have been induced (Deeks, Higgins, & Altman, 2004). Publication bias was indeed found to be significant for overall effect, stress symptoms and self-efficacy. Studies with positive effects have been published more frequently and were more readily obtainable. For self-efficacy only two studies were obtainable. Just a few studies reported (response) data and number of participants on follow-up. Analyses with follow-up data were not possible.

In evaluating the outcomes of this study, these limitations should be taken into account. Nevertheless, the positive effects especially for coping, but also for stress symptoms and (social) behavior are suggestive. Sensitivity analyses indicated that heterogeneity was caused by variation in study quality and type of intervention, while the latter could be explained by study quality and methodological diversity. For example heterogeneity for effects on stress symptoms was attributed to the much higher effects of the combined programs and may be related to the significant lower methodological quality score of these studies as found in the ANOVA analysis. Heterogeneity for effects on (social) behavior, is especially caused by the social problem solving type and may be associated with measurement bias and variation in outcome measures. More often observational measures were applied, the observer was not always blind to the intervention and participants, and a larger variation in outcome measures was found. Significant heterogeneity arising from methodological diversity or differences in outcome assessments suggests that the studies do not all estimate the same quantity, but does not necessarily suggest that the true treatment effect varies (Deeks et al., 2004). The positive findings of meta-analysis with final measures only on (social) behavior might be an indication that this could be the case.

In future program development, findings from sensitivity analysis should be kept in mind and studies should pay special attention to methodological quality criteria. Future research should also strive to diminish methodological variety and variety in outcome assessment in

studies. Blinding of administrators/observers in future research is strongly recommended. The development of instruments to measure stress, coping, and behavior change among children and adolescents should be promoted and carefully monitored. Differences in outcome assessment may decrease if standardized measurement instruments are used more frequently or if instruments adapted for this specific population become standardized. Longitudinal design studies with complete follow-up data should be preferred.

However, the positive effect sizes are impressive since participants are functioning in the normal range and thus should not be expected to change remarkably. Sensitivity analysis to investigate sources of heterogeneity showed that heterogeneity was caused by methodological aspects like study quality and differences in outcome assessments. This means that based on the sensitivity analyses no superior intervention type can (yet) be distinguished. The findings do implicate that primary prevention programs targeting stress management in schools are most likely effective.

Conclusion

Primary prevention programs targeting stress and coping in schools should be promoted, as in controlled studies a positive overall effect was found and positive effects for coping and stress symptoms. Also positive effects for (social) behavior were found, although the related studies had some methodological weaknesses.

Sensitivity analysis showed that the heterogeneity in effect was caused by methodological diversity in quality and outcome assessment. Study quality only differed significantly for one outcome category (stress). The differences in outcome assessments suggest that the studies do not all estimate the same quantity, but does not necessarily suggest that the true treatment effect varies. Bearing these limitations in mind, it can be concluded that primary prevention programs for schools (i.e. interventions designed specifically to promote mental health and reduce the incidence of adjustment problems in currently normal child and adolescent populations) show promising results. Findings indicate that although several issues have to be resolved, primary prevention programs focusing on promoting mental health through school-based stress management training are most likely effective. It provides empirical support for further research and practice in primary prevention.

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¹ References marked with an asterisk indicate studies included in the meta-analysis.

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