



# Classroom interventions for children with ADHD

▶▶ In class, children with ADHD often struggle to sustain attention

RAWPIXEL.COM/SHUTTERSTOCK

**I**n a typical classroom, children are instructed to remain seated, perform independent seatwork and follow teachers' instructions. Children with attention deficit hyperactivity disorder (ADHD) may find these classroom demands particularly difficult to adhere to because, by definition, children with ADHD experience difficulty in paying attention, possess more motor restlessness and respond more impulsively to their environment compared with other children.<sup>1</sup> In class, children with ADHD often struggle to sustain attention when carrying out tasks or listening to instructions, frequently call out or talk to classmates at inappropriate times and regularly leave their seat without permission.<sup>2</sup> They commonly show behavioural problems and have difficulty in progressing with their schoolwork, which often results in

underachievement.<sup>3</sup> These factors may lead to poor academic outcomes for children with ADHD and contribute to teacher stress, as teachers often do not have the necessary skills to deal with the behavioural problems of these children.<sup>4</sup>

Given the approximate 5% prevalence of ADHD, elementary school classes contain on average one child with ADHD.<sup>5</sup> Most teachers may, therefore, need to teach one or more children with ADHD on a daily basis. Important factors to consider are that the personality and attitude of teachers can have a considerable impact on the achievement and behavioural outcomes of children with ADHD;<sup>6</sup> and that teachers often perceive children with ADHD as more stressful to teach than other children, irrespective of the teacher's age or length of teaching experience.<sup>4</sup> Many teachers use simple management techniques, which can be implemented across the class

## Yvonne Groen

PhD Associate Professor of Clinical Neuro/Biopsychology<sup>1</sup>

## Geraldina

PhD student in Clinical Neuro/Biopsychology<sup>1</sup>

## Lara I Tucha

PhD Associate Professor of Clinical Neuropsychology<sup>1</sup>

## Oliver Tucha

PhD Full Professor of Clinical Neuropsychology<sup>1</sup>

<sup>1</sup> Department of Clinical and Developmental Neuropsychology, University of Groningen, the Netherlands

### Box 1. Search terms used for the systematic literature review

#### Participant-related terms:

- ▶▶ ADHD
- ▶▶ ADD
- ▶▶ Attention deficit
- ▶▶ Hyperactivity
- ▶▶ Hyperkinetic

#### Intervention-related terms:

- ▶▶ Classroom, school, education or academic
- ▶▶ Treatment, intervention, training, strategies, therapy or program\*

#### Outcome measure-related terms:

- ▶▶ Classroom
- ▶▶ School
- ▶▶ Academic
- ▶▶ On-task
- ▶▶ Off-task
- ▶▶ Disruptive
- ▶▶ Functioning or behavior\*

\*US spellings were used in the search

and are less time-consuming than more complex techniques.<sup>7</sup> More advanced strategies, however, may be more effective at improving the behaviour of children with ADHD. Many such advanced psychosocial strategies exist, but it is unclear which are most effective.

We recently conducted a meta-analysis that compared the effectiveness of several types of psychosocial intervention that can be applied by teachers, in order to decrease off-task and disruptive classroom behaviour in children with symptoms of ADHD.<sup>8</sup> This article summarises our findings; interested readers can read the full article at <http://dx.doi.org/10.1371/journal.pone.0148841>.

## Methods

A systematic literature search of the PsycINFO (American Psychological Association), ERIC (Education Resources Information Center), and Web of Science databases was conducted to identify studies for inclusion in the meta-analysis. A combination of search terms was used relating to participants, interventions and outcome measures (see Box 1). A manual search of the reference lists of included literature reviews and studies was also performed to identify additional studies of interest. Records were screened for inclusion based on the titles and abstracts, with the full text of the remaining articles used to determine eligibility for inclusion.

The meta-analysis included studies of children attending school grades 1–12 (or age 6–17 if grade was not reported) with ADHD, attention deficit disorder, attention deficits or hyperactive-impulsive deficits. Interventions were required to be implemented in a classroom setting by a teacher with no parental involvement.

“  
In class,  
children  
with ADHD  
often  
struggle  
to sustain  
attention  
”

**Table 1.** Overview of the four intervention types encountered in the literature

Intervention type	Definition	Examples
Antecedent-based	An intervention that manipulates antecedent conditions, such as the environment, a task or an instruction	<ul style="list-style-type: none"> <li>• Seating arrangement</li> <li>• Background music</li> <li>• Peer tutoring</li> <li>• Choice-making</li> <li>• Computer-assisted instruction</li> </ul>
Consequence-based	An intervention that uses reinforcement and punishment to alter the frequency of target behaviour	<ul style="list-style-type: none"> <li>• Praise</li> <li>• Reprimands</li> <li>• Prizes</li> <li>• Privileges</li> <li>• Response-cost</li> </ul>
Self-regulation	An intervention aimed at the development of self-control and problem-solving skills to regulate cognition and behaviour	<ul style="list-style-type: none"> <li>• Self-instruction</li> <li>• Self-monitoring</li> <li>• Self-reinforcement</li> </ul>
Combined	A combination of two or more of the above interventions	<ul style="list-style-type: none"> <li>• Teacher training</li> <li>• Self-regulation and/or antecedent-based intervention combined with reinforcement</li> </ul>

The outcome measures were either teacher ratings or direct observations of off-task behaviour, disruptive behaviour or ADHD-related behaviour, such as an ADHD teacher rating scale, in the classroom. Measures of on-task behaviour and appropriate behaviour were also included.

## Results and discussion

The meta-analysis included 100 studies spanning 43 years (1970–2013) of research on classroom interventions for ADHD. All studies described interventions that teachers not trained in special education can apply without the requirement for excessive resources.

The majority of studies included in the meta-analysis (76%) adopted a single-subject design, describing only one to six children with ADHD who underwent a particular intervention; its effectiveness was investigated by comparing the behaviour of individual children during the intervention to their behaviour during a certain baseline period when the intervention was absent. The remaining 24% of studies adopted a group design and most often described the behaviour of a group of children with ADHD (ranging in size from six to 65 children) that underwent the intervention compared with their behaviour at baseline. Only 8% of all studies included an independent comparison group of children with ADHD who underwent no intervention.

For statistical reasons, separate meta-analyses were performed for the single-subject and group studies. In these two meta-analyses we compared effectiveness of four types of interventions – antecedent-based, consequence-based, self-regulation and combined interventions – for reducing off-task and disruptive behaviour (see Table 1).

We also looked for:

- Any potential effects of the classroom setting (special or general education)
- Type of measure (observations or teacher report)
- Student age
- Gender
- Intelligence
- Medication use.

All intervention types elicited a positive behaviour change in children with ADHD, in both the single-subject and group studies (see Figures 1 and 2). However, the most effective intervention was different in group studies, compared with single-subject design studies.

### Consequence-based interventions

The meta-analysis of group studies revealed that consequence-based interventions were significantly ( $p < .001$ ) more effective compared with antecedent-based, self-regulation and combined interventions (see Figure 1).

Consequence-based interventions make use of frequent and immediate rewards (including praise) for good behaviour and mild punishment (including reprimanding)

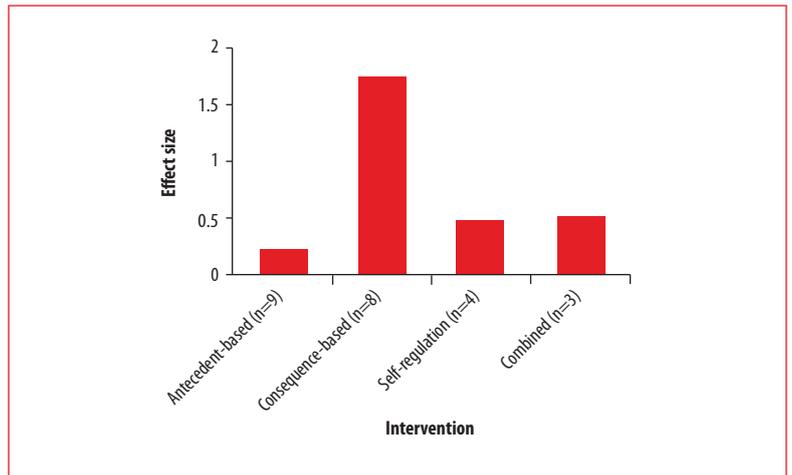
of bad behaviour. These interventions may be individually targeted to children with ADHD by using individualised reward/punishment schemes or daily report cards; they can also be used in a class-wide setting to directly benefit classmates without ADHD, as Hoff and Ervin report.<sup>9</sup> For example, a group competition can be held in which groups of students compete for a reward or privilege by showing good behaviour as a group. In practice this could mean that the children in each group earn ‘smileys’ for good, but not for bad, behaviour, and that the winning group with the most smileys earns a privilege, such as playing a game, acting silly or material rewards such as stickers, as discussed by Anhalt *et al.*<sup>10</sup> The behaviour changes following interventions that employed such reward-and-punishment schemes were large; in contrast, the effects of self-regulation and combined interventions were medium-sized and those of antecedent-based interventions only small.

“  
The strongest effects were obtained by using [...] behavioural techniques”

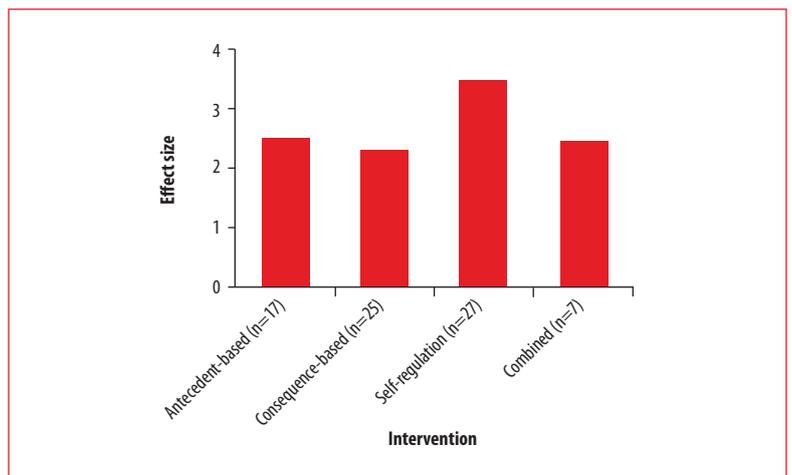
### Self-regulation interventions

The meta-analysis of single-subject studies revealed that self-regulation interventions had the strongest effect (see Figure 2). This result was obtained by calculating descriptive statistics (for statistical reasons it was not justified to perform a significance test).

The majority of self-regulation interventions used self-monitoring strategies, which instruct the child to observe their own behaviour while performing an academic assignment. At prompted times the child notes on a special recording sheet to what extent the good behaviour has been



►► Figure 1. Effect sizes (standardised mean differences) of antecedent-based, consequence-based, self-regulation and combined classroom interventions in group studies



►► Figure 2. Effect sizes (standardised mean differences) of antecedent-based, consequence-based, self-regulation and combined classroom interventions in single-subject studies

met during the past few minutes. This trains the child’s capacity to self-assess and evaluate their own behaviour. The ability to assess and evaluate your own behaviour is fundamental to the development of self-regulation; it thereby not only promotes on-task and appropriate behaviour but also increases academic accuracy and productivity.<sup>11</sup>

### Antecedent-based interventions

The relatively small effect sizes of antecedent-based interventions in the group studies indicate that simple adjustments to the environment alone are not sufficient, on their own, to improve the behaviour of children with ADHD. For example, giving extra time to complete an assignment, playing music in the background or providing instruction in a smaller group produced only small or negligible behaviour changes in children with ADHD. However, some more advanced environmental adjustments may have more powerful effects on behaviour. One example is class-wide peer tutoring, in which students pair up and alternate between the roles of tutor and tutee while working together on an assignment,<sup>12</sup> such as practising dictation or maths assignments together.

Personalised instruction can also be effective; for example, allowing the student to choose their own

assignments from a menu of several that involve practising the same skill, or carrying out computer assignments that involve choice-making.<sup>13</sup> Such assignments are likely to increase students' motivation to perform well at an assignment, which is exactly what children with ADHD need.

Sitting on stability balls while carrying out tasks also improves on-task behaviour in children with ADHD, as well as in their classmates.<sup>14</sup> This effect is most likely mediated by the increase in physical activity during seatwork, because physical activity has the potential to improve behavioural and cognitive functions.<sup>15</sup>

### ***Influence of setting and other factors***

Both meta-analyses showed larger intervention effects for general education classrooms than for other classroom settings, such as special education settings. This could be due to the inclusion of less severe cases (showing weaker ADHD symptoms and less comorbidity) in general education classes, in which the children may more easily respond positively to the applied interventions. Children in general education settings may also be relatively inexperienced with behavioural intervention programmes, potentially making them more responsive to change.

We could not draw reliable conclusions about the moderating effects of the type of measure or the children's age, gender, intelligence and medication use due to low statistical power. The interventions appeared to induce positive behavioural changes in children with ADHD regardless of these factors, but more research is necessary to find out whether these factors do influence the effectiveness of interventions.

### **Practical implications**

Many advanced and effective classroom interventions for children with ADHD are available for use by teachers – for a more narrative overview, see DuPaul *et al.*<sup>16</sup> Some may be used in a class-wide setting and also have direct, positive effects on classmates. All four types of interventions considered in the meta-analyses appeared to be effective, but the strongest effects were obtained by using interventions that employ behavioural techniques:

consequence-based and self-regulation interventions. Teachers should, therefore, give particular consideration to these types of interventions. However, a practical difficulty with them is that their effectiveness depends on how good and bad behaviours are defined for a specific child in a specific context, as well as how consistently the procedures are implemented.

Teachers who have not been trained to use psychosocial interventions may need to receive training from a behaviour specialist, such as a psychologist, in how to analyse and define good and bad behaviour in children. Behaviour specialists can also work with teachers to develop effective intervention plans for individual children with ADHD.<sup>16</sup> Empowering teachers with the right tools and help from behaviour specialists may lead to better outcomes for children with ADHD, their classmates and their teachers ■

#### **Declaration of interest**

The authors declare that there is no conflict of interest.

#### **References**

1. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders*, 5th edn. Arlington: American Psychiatric Publishing, 2013.
2. DuPaul GJ, Stoner G. *ADHD in the schools: Assessment and intervention strategies*, 3rd edn. New York: Guilford Press, 2014.
3. Loe IM, Feldman HM. Academic and educational outcomes of children with ADHD. *J Pediatr Psychol* 2007; **32**: 643–654.
4. Greene R, Beszterczey S, Katzenstein T, Park K, Goring J. Are students with ADHD more stressful to teach? Patterns of teacher stress in an elementary school sample. *J Emot Behav Disord* 2002; **10**: 79–89.
5. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The worldwide prevalence of ADHD: A systematic review and meta-regression analysis. *Am J Psychiatry* 2007; **164**: 942–948.
6. Sherman J, Rasmussen C, Baydala L. The impact of teacher factors on achievement and behavioural outcomes of children with attention deficit/hyperactivity disorder (ADHD): a review of the literature. *Educ Res* 2008; **50**: 347–360.
7. Murray DW, Rabiner DL, Hardy KK. Teacher management practices for first graders with attention problems. *J Atten Disord* 2011; **15**: 638–645.
8. Gaastra GF, Groen Y, Tucha L, Tucha O. The effects of classroom interventions on off-task and disruptive classroom behavior in children with symptoms of attention-deficit/hyperactivity disorder: a meta-analytic review. *PLoS One* 2016; **11**: e0148841.
9. Hoff KE, Ervin RA. Extending self-management strategies: the use of a classwide approach. *Psychol Sch* 2013; **50**: 151–164.
10. Anhalt K, McNeil C, Bahl A. The ADHD Classroom Kit: a whole-classroom approach for managing disruptive behavior. *Psychol Sch* 1998; **35**: 67–79.
11. Reid R, Trout A, Schartz M. Self-regulation interventions for children with attention deficit/hyperactivity disorder. *Except Child* 2005; **71**: 361–377.
12. DuPaul G, Ervin R, Hook C, McGoey K. Peer tutoring for children with attention deficit hyperactivity disorder: effects on classroom behavior and academic performance. *J Appl Behav Anal* 1998; **31**: 579–592.
13. Powell S, Nelson B. Effects of choosing academic assignments on a student with attention deficit hyperactivity disorder. *J Appl Behav Anal* 1997; **30**: 181–183.
14. Fedewa AL, Erwin HE. Stability balls and students with attention and hyperactivity concerns: implications for on-task and in-seat behavior. *Am J Occup Ther* 2011; **65**: 393–399.
15. Den Heijer AE, Groen Y, Tucha L *et al.* Sweat it out? The effects of physical exercise on cognition and behaviour in children and adults with ADHD: a systematic literature review. *J Neural Transm* (Vienna) 2016; [Epub ahead of print]
16. DuPaul GJ, Weyandt LL, Janusis GM. ADHD in the classroom: effective intervention strategies. *Theory Pract* 2011; **50**: 35–42.

## **Key points**

- ▶▶ Children with ADHD often struggle to sustain attention when carrying out tasks or listening to instructions in classroom settings, leading to behavioural problems and academic underachievement.
- ▶▶ A meta-analysis of research on classroom interventions for ADHD showed that such interventions are effective in reducing off-task and disruptive behaviour.
- ▶▶ Consequence-based and self-regulation interventions were shown to be the most effective interventions, with antecedent-based, and combined interventions demonstrating smaller effect sizes.
- ▶▶ The effects of classroom interventions were found to be larger in general classrooms compared with other settings, such as special education.
- ▶▶ In practice, collaboration between teachers and behaviour specialists may be necessary to develop individualised intervention plans.