A Meta-Analysis of Interventions to Reduce Disruptive Behaviour in Classroom Settings

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Abstract

I conducted a meta-analysis of 48 single-case and small-group experimental design studies from 1997 to 2024 that investigated interventions to reduce disruptive behaviour in classroom settings. I extracted data from graphs displaying behavioural data resulting from interventions to reduce disruptive behaviour and then I calculated Tau-*U* effect sizes. A total of 180 effect sizes from the 48 studies produced a total mean effect size of -0.82 indicating that 82% of students experienced a reduction in their disruptive behaviour. Interventions designed for individual students produced a very large mean effect size (*ES* = -0.85, *SD* = 0.31) compared to class-wide strategies (*ES* = -0.76, *SD* = 0.30). The most prevalent intervention was group contingencies included in 13 studies. The most utilised intervention within this group was the Good Behaviour Game. All interventions provided in the studies included in this meta-analysis resulted in a reduction in disruptive behaviour, however not all interventions had a strong representation across the studies and therefore have limitations. A small number of experiments trialling an intervention may produce a large effect size, however, due to the need for replication to evoke confidence in the efficacy of an intervention, these results are tentative at best. There is also a strong theme for more training for teachers in classroom management skills as many teachers are reporting that they are not equipped for managing disruptive behaviour in the classroom.

Keywords: classroom management, disruptive behaviour, effect sizes, individual and class-wide interventions, teacher-child interactions

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When there is disruption in the classroom it is more difficult for teachers to bring good quality learning experiences for their students due to time taken up with managing disruptive behaviour. Wills et al. (2019) reported that teachers rate managing problem behaviours as one of their highest barriers to teaching. Teachers with good classroom management skills are more likely to have higher engagement from their students, lower rates of disruptive behaviour and higher job satisfaction (Nanyele et al., 2018). Disruptive behaviour in the classroom is described as any behaviour that impedes the individual who is engaging in the behaviour and others from experiencing a quality education (Nanyele et al., 2018). There are many characteristics that describe disruptive behaviour in the classroom. They include speaking and eating out of turn, swearing and verbal abuse, crying, yelling, destruction of property, and assault of the teacher and other students (Floress et al., 2017; Nanyele et al., 2018). Disruptive behaviour affects both student and teacher wellbeing and performance (Ervin et al., 2018). Ervin et al. (2018) reported that an average of three to four students in a classroom will take part in problem behaviour that disrupts academic and social growth. Research shows that there is a growing number of young children exhibiting challenging behaviours (McKenna et al., 2021). Because of this increase, there is an urgent need for early intervention at a young age to reduce the risk of these behaviours developing into social and academic problems as the children age. McKenna et al. (2021) go on to report that challenging behaviours may be quickly dismissed and considered normal for a child's stage of development. This may delay the recognition of the early stages of behavioural disorders. These delays can also prevent access to interventions and services beneficial to a child. Prevention strategies ideally should be introduced early before disruptive behaviours become fully established making it more difficult to intervene (McKenna et al., 2021). Another potential reason for delay is the social stigma associated with having a disorder therefore preventing parents or caregivers from seeking early diagnosis. Disruptive behaviours are often established well before interventions are introduced and therefore can produce a strong resistance to change (Kulkarni & Sullivan, 2019). Prediction of the development

of disruptive behaviours means that implementing interventions early can reduce the likelihood of treatment resistance developing. Children engaging in undetected disruptive behaviour are more likely to be held back, drop out of school prematurely, and engage in substance abuse (Kulkarni & Sullivan, 2019). Kulkarni and Sullivan (2019) also identified that children who exhibit disruptive behaviour are more likely to be punished, and experience negative exchanges with their teachers. A propensity for teachers to *see* negative behaviours of the students who engage in disruptive behaviour can be exaggerated and therefore the child may experience excessive reprimands and punishments. This may lead to increased negative exchanges and increased disruptive behaviour.

Some of the latest studies indicate the importance of establishing positive teacher-child relationships due to their effectiveness at reducing disruptive behaviours (Claessens, 2017; Kulkarni & Sullivan, 2019; Wilkinson & Bartoli, 2020). Many teachers, who are experiencing high stress and burn-out, are choosing to leave the profession, reporting that inadequate training in classroom behaviour management is a major contribution (Lastrapes, 2018). Korpershoek et al. (2016) found that the difference between very proficient teachers and unsuccessful teachers is poorly managed classrooms. Teachers are compelled to manage disruptive behaviour while still providing a quality curriculum in the classroom, contributing to higher levels of stress and fatigue (Wilkinson & Bartoli, 2020). Skiba et al. (2016) reported, as determined by teachers, that training in classroom management is one of the most important areas of need. Classroom management is a preventative strategy to decrease the potential for disruptive behaviour. Without adequate training in preventative strategies, teachers are more likely to revert to reactive measures, such as sending the child to the principal (Korpershoek et al., 2016). Bulla and Freider (2018) determined that teachers who lack training in classroom management skills may struggle to maintain interventions that have been implemented in the classroom or successfully fade them out while maintaining a good, positive learning environment. Wilkinson and Bartoli (2020) concluded that treatment strategies for reducing behaviour problems need to include skills training in fostering strong relationships and exchanges between teacher and student. The quality of the teacher-student relationship is shown to contribute

to the behaviour of the child (Wilkinson & Bartoli, 2020). Negative relationships between teacher and child can impact the child's capacity to learn and can result in an increase in negative exchanges with students which in turn increase behaviour problems.

Meta-analyses are conducted by researchers for the purpose of collating results of multiple studies to strengthen evidence-based conclusions that cannot be supported by individual studies alone (Dowdy et al., 2021). This is particularly necessary for single-case experimental designs (SCEDs) that do not purport to being reliable or replicable on their own. Meta-analyses inform which types of interventions are deemed reliable as they can strengthen results through collating studies of the same type of intervention, and clearly define who and what settings the interventions are designed for. A meta-analysis is an invaluable tool for informing choices around formulating interventions that are most effective at altering target behaviours (Dowdy et al., 2021). I intended to update a meta-analysis conducted by Stage and Quiroz (1997) that collated and compared effect sizes of interventions implemented in classroom settings to decrease disruptive behaviour. Effect sizes are an indication of the impact an intervention has on a target behaviour in an experiment (Vannest & Ninci, 2015). Stage and Quiroz examined the effectiveness of both individual interventions and group or class-wide interventions with the intent to inform intervention practices for future implementation. I hoped that my update would inform professionals working with children who exhibit disruptive behaviour in classroom settings on evidence-based robust practices suitable for implementation in classroom settings. Additionally, I aimed to provide statistical evidence of the effectiveness of different intervention types, settings, grades, and standards.

Behavioural Interventions

Applied Behaviour Analysis is the study of human behaviour with scientific practices to improve human behaviour through environmental manipulations (Pennington, 2022). Applied Behaviour Analysis in the classroom is the science of analysing and applying behavioural principles to assist in classroom management. Students react to their environment in ways they have learned, and this can be inappropriate at times (Pennington, 2022), for example, yelling and calling out in class, or

playing and talking during independent work time. Behaviour Analysts seek to determine the function of targeted behaviours and then offer solutions to bring about meaningful change. Behavioural interventions that target disruptive behaviour in a classroom can be designed specific to an individual's needs for a specific behaviour, or for a group of students within a class-wide contingency plan to address a number of students at one time, or multiple behaviours exhibited within a classroom setting. Determining which plan is best for the situation can be complex as there are many factors, such as the cost, time, teacher training required, and resources available, that will contribute to the decision-making process. Plans designed for individuals target specific behaviours and concentrate on the individual's needs however they can be time consuming for the teacher to implement and may deprive the other students of teacher attention. Group designs focus on the overall behaviour of a group or whole class. Group strategies can be less costly, take less time, can be integrated into the teacher's classroom management plan, and address the needs of multiple students at the same time (Naylor et al., 2018), however may not meet the behavioural needs of some individuals within the group.

Group Contingencies

Hirsch et al. (2016) describe three variations of group contingencies, they are dependent, independent, or interdependent. These types of interventions are used by teachers in the classroom to encourage student engagement and cooperation. Dependent group contingencies receipt of consequences is reliant on the behaviour of a few students in the group before the whole group can receive a reward, and has potential for pressure and coercion from peers toward the few students upon whom the reward is dependent (Hirsch et al., 2016). Independent group contingencies foster responsibility of one's own behaviour and rewards are earned independently from other students if the right criteria are met. An issue with independent group contingencies is the lack of consideration of reinforcement preferences of individual students. Interdependent group contingencies rely on the behaviour of the whole group to meet the set criteria before the whole group will receive the reward. The downside to interdependent group contingencies is the potential for one or more

students to intentionally refuse to participate, or to comply with the set criteria causing everyone to miss out (Groves et al., 2018). Group contingency interventions such as the Good Behaviour Game encourage the teacher's focus to be on reinforcing positive behaviours and is a practical opportunity to reinforce multiple students with one intervention rather than multiple, individually designed interventions across students (Hirsch et al., 2016). This intervention type can be integrated into classroom management strategies and is very helpful when a teacher wants to target an inappropriate behaviour such as students calling out answers instead of raising their hands and waiting for the teacher to select them before responding. The least desirable of the three contingencies, according to Hirsch et al. (2016), is the dependent group method because of the potential for pressure from peers and coercion that may be directed toward the individual target student if the whole group does not receive their reward. Groves et al. (2018) reported that teachers prefer to select independent contingencies because students do not rely on their peers compliance to secure their reinforcement. The Good Behaviour Game is a management strategy that has seen positive results at decreasing disruptive behaviour and increasing task engagement (Groves et al., 2018). Other group contingencies include Mystery Student and Mystery Motivators. They are management strategies that both have a surprise component. Mystery Student is when one or two students are secretly chosen for a set period to be monitored for their behaviour. Mystery Motivators offer a surprise reinforcer or surprise delivery of the reinforcer (Davis et al., 2024). Both strategies are designed to promote positive behaviours and compliance of all of the students in the group because no one knows who the mystery student is or what the mystery reward is once the allocated time has lapsed.

Group contingencies operate on a reward-based system such as token economies that offer tokens in exchange for desirable behaviours. Students can earn tokens for positive behaviours and once they have reached a predetermined level, can exchange them for a reward (Heiniger et al., 2022). For example, tokens can be in the form of points or ticks on a scoreboard, coupons or vouchers, or computer-generated point systems. This is a credit system that allows a student to gain

recognition for following the teacher's classroom directives. A punitive component, that is response-cost, is sometimes implemented where students can lose tokens when they are caught not complying with the teacher's expectations (Groves et al., 2018).

Punishment

Punishment-based intervention strategies in classroom settings involve applying a consequence to a problem behaviour that has already occurred with the aim to reduce the behaviour from occurring again in the future (Vargo et al., 2024). Applied Behaviour Analysts consider punishment procedures a last resort to be used only when all other positive reinforcement interventions have been exhausted or when a problem behaviour needs to be quickly subdued because of potential serious harm (Lerman & Vorndran, 2002). Vargo et al. (2024) reported that teachers do not necessarily follow these same guidelines and therefore may not understand the potential adverse effect punishment can have on their students. With punishing consequences, negative outcomes such as an increase in the student's behaviour, or reactive responses such as avoidance or escapism may develop (Vargo et al., 2024). Lerman and Vorndran (2002) asserted the importance of guided practice for punishment interventions. Consequences that are unplanned, such as reprimands and time-out, and changes of intermittent schedules to continuous schedules of punishment should be avoided, and a desensitisation to punishment stimulus can develop if overused (Lerman & Vorndran, 2002).

Function-based Interventions

Function-based interventions are designed specifically for the student engaging in disruptive behaviour. Firstly, to determine what the function of a behaviour might be, a functional analysis is conducted via a variety of functional behaviour assessments with the intention to confirm why a student exhibits disruptive behaviours. Lloyd et al. (2019) report that functional behaviour assessments are the strongest evidence base for dealing with acute or relentless disruptive behaviours. Once assessments are completed, a plan is devised to meet the needs of the student. For example, a child might engage in calling out during quiet reading times and, after conducting a

functional analysis, it is concluded that this behaviour is to gain attention. After determining the function, a plan is designed to meet the child's need for attention through reinforcement at appropriate times. Lloyd et al. (2019) identified potential challenges for function-based interventions in education settings. The number of staff to students in these settings can create an unstructured environment whereas a function-based intervention often requires control over antecedents that elicit problem behaviours of the student requiring mediation. The level of attention from staff to implement function-based interventions, usually one-to-one, is not always possible due to student numbers in general education classrooms. Lloyd et al. go on to note that teachers in general education settings have not had adequate training in behaviour management or in function-based intervention implementation.

Noncontingent Reinforcement

Noncontingent reinforcement intervention strategies are opportunities for reinforcement irrespective of the occurrence of disruptive behaviours (Moore et al., 2016). For example, break cards, class pass, or fixed-time procedures make reinforcement available without having to fulfil any criteria to gain access to them. The class pass is a strategy designed to teach students the skill of asking for breaks appropriately (Narozanick & Blair, 2019). Narozanick and Blair (2019) determined that the use of a physical card representing the opportunity for a break may operate as a reminder to request a break rather than engage in disruptive behaviour to escape a task. They go on to explain that having a choice over when to take a break can also deter disruptive behaviour because reinforcement is instantly available. When class passes are limited to a specific number, for example, three cards per session, the student must learn to manage when to use their opportunities for noncontingent breaks. Fixed-time schedules of reinforcement operate differently to the class pass. Moore et al. (2016) explain that break opportunities are set at fixed times, and reinforcement is available at these times with or without the occurrence of the target behaviour. Often noncontingent schedules of reinforcement are dense to start with to reduce opportunity for disruptive behaviour to occur and then gradually faded over time to a more realistic schedule. Cook et al (2014) investigated

whether students' disruptive behaviour in the classroom for the purpose of escaping or avoiding unfavourable tasks would decrease if they were given opportunities for noncontingent breaks. They found this intervention was effective at reducing the disruptive behaviour and both students and teachers strongly agreed it was acceptable and effective.

Peer Mediated

Peer mediated interventions are peer-led strategies to support social, academic, and behavioural development (Ryan et al., 2004). Peers who are already exhibiting desirable behaviours are trained to support, encourage, and teach appropriate classroom conduct. Ryan et al. (2004) noted that positive peer influence has produced effective results within general and special education settings. Tootling is a class-wide peer-mediated intervention that encourages students to focus on positive behaviours of their peers and report them to the teacher. Reinforcers are made available to the tootler and the person they are reporting on. Actively participating in tootling enables peers to report on positive behaviours that a teacher cannot observe (Wright et al., 2022). Tootling has shown to support positive social skills development and decrease problem behaviour (Wright et al., 2022).

Home-Based Contingencies

Home-based contingencies are used to support a child's education via communication between teaching staff and parents or caregivers. For example, Daily Behaviour Report Cards (DBRCs) are a valuable system that gives teachers opportunity to report on behavioural and academic activity within the classroom. DBRCs are a classroom management strategy shown to alter problem behaviours and encourage parent involvement in their child's education (Mires & Lee, 2017). Home-based contingencies connect parents with their child's development and keeps them informed of areas that may require extra support. Mires and Lee (2017) found that DBRCs work well across multiple age groups and effectively contribute to increasing academic engagement and decreasing disruptive behaviour.

Teacher Behaviour

Teacher-behaviour interventions are strategies used by teachers to improve engagement and behaviours within the classroom. For example, Behaviour-Specific Praise is praise offered by the teacher specific to the behaviour exhibited (Royer et al., 2019). The key is to be precise in labelling the behaviour the teacher is reinforcing. For example, “Good job for sitting and reading quietly” targets the behaviour not intellect or ability. If attention is reinforcing for the child then the behaviour resulting in attention is likely to happen again. Behaviour-Specific Praise is recognised as a preventative approach to behaviour management and considered simple to implement (Royer et al., 2019). Universal Teacher-Child Interaction Training is a teacher-behaviour intervention strategy developed to offer training to teachers to increase skills on building social-emotional competencies with their students, and strengthen classroom management competencies (Fawley et al., 2020). Because a child spends a lot of their time at school, the teacher-child relationship is a very important contributor to the child’s well-being (Fawley et al., 2020).

Active Student Responding

Active Student Responding is a technique used by teachers to increase student engagement and participation through repeatedly testing and fostering student recall of learned information (Keim et al., 2023). Opportunities to Respond intervention improved levels of engagement and increased the likelihood of on-task behaviour and reduces levels of disruptive behaviour (Sutherland et al., 2003). Increasing opportunities to respond to teacher instructions also increases opportunities for teachers to offer immediate reinforcement and enables teachers to gauge a student’s interest or understanding and adjust their lesson if necessary (Sutherland et al., 2003). Schulz et al. (2022) compared high-tech (clickers) versus low-tech (response cards and hand raising) as active response mechanisms and found that clickers and response cards were effective at increasing student responding and reducing disruptive behaviour.

Self-Management

Self-Management interventions in a classroom setting are self-empowering strategies where students are encouraged to be responsible for regulating and modifying their own behaviour through goal setting, self-monitoring, and self-evaluation (Kamps et al., 2015). The process involves firstly defining the target behaviour and then establishing a clear plan with the student. The student is then responsible for reflecting on and recording their own behaviour, whether they have fulfilled the goal in its allotted time. Positive reinforcement is available when their goals are met. Bulla and Frieder (2018) implemented a class-wide strategy called the Self & Match system that comprises of self-monitoring, goal setting, conditioned reinforcement, teacher matches, and differential reinforcement. This system uses a probe of reminders designed with specific behaviours unique to each student. For example, “Did I sit on the mat and keep my hands to myself?” Both teacher and student independently respond to the prompts with a yes or no. If there is an agreement between the teacher and student then the student earns points, 2 for complying or 1 for accuracy even if they do not comply with the probe. No points are gained when there is a discrepancy in the responses. Large numbers of students in a classroom may make this system difficult to implement, however a group contingency design where only selected number of students are monitored may make it more feasible for the teacher (Bulla & Frieder, 2018).

Multiple Treatments

Multiple-treatment designs combine two or more interventions at the same time. When multiple treatments are applied at the same time, it is difficult to ascertain which variable produced the behaviour change, however this process may be useful when it is not certain which treatment will work. Sometimes there are multiple underlying issues that require more than one approach. Some of the studies in this meta-analysis include an intervention on its own with a multiple-treatment design to compare the effectiveness of a single intervention versus combining two interventions. For example Lipscomb et al. (2018) compared a Dojo point system on its own with a combination intervention of Dojo and Tootling. Mottram et al. (2002) combined classroom rules,

token economy, response cost, and mystery motivators into a multi-component intervention design to implement across three students exhibiting disruptive behaviour. The results indicated that this intervention was successful at reducing disruptive behaviour however, because all components were implemented together, it is not clear which variable had produced the effect. The teacher participant in the implementation of this intervention reported that it was easy to incorporate into her classroom management plan and recommended it to others.

Summary of Original Study

Stage and Quiroz (1997) conducted a meta-analysis including studies from 1967 to 1996. The final total of studies included was 99 with a total extraction of 223 individual effect sizes and a total of 5057 participants. They incorporated the Interrupted Time Series Autocorrelation program (ITSACORR) to calculate effect sizes. A mean effect size of −0.78 (SD = 0.58) was capitulated across all effect sizes. This indicates that, of all students treated, 78% on average experienced a reduction in their disruptive behaviour. Stage and Quiroz determined that a dependent measure of appropriate or on-task behaviour did not necessarily correlate with a decrease in disruptive behaviour and therefore these measures were excluded from their meta-analysis. Mean effect sizes by intervention ranged from −0.31 to −1.02. Stage and Quiroz reported that any intervention including less than 10 effect sizes should be conservatively considered, that is, punishment (n = 3, ES = −0.58, SD = 0.13), token economies (n = 7, ES = −0.90, SD = 0.40), home-based contingencies (n = 6, ES = −0.55, SD = 0.47), individual counselling (n = 3, ES = −0.31, SD = 0.23), parent training (n = 3, ES = −0.60, SD = 0.23), and exercise programmes (n = 7, ES = −0.72, SD = 0.60). The largest effect size was calculated within group contingencies (n = 25, ES = −1.02, SD = 0.63).

Due to the age of Stage and Quiroz's (1997) meta-analysis and the concerns of teachers over a lack of training in classroom management strategies for reducing disruptive behaviour, I chose to update this very important analysis on classroom intervention strategies. I hoped this update would either support past research or reveal new evidence-based practices to inform teachers and professionals of quality interventions for robust classroom management. To make meaningful

comparisons, I replicated some key components such as using the same search terms and kept the focus of my meta-analysis on disruptive and inappropriate measures of behaviour. While Stage and Quiroz separated group contingencies and token economies into separate intervention groups, I combined these under group contingencies because all studies with a token economy from my search were also group contingency intervention methods. For example, with group contingencies such as The Good Behaviour Game or Caught Being Good game, the teacher or experimenter also incorporated a token economy system as part of the intervention's reinforcer. My search acquired studies from 1997 to 2024 and, after the extraction process, a total of 48 studies, including 180 effect sizes and 719 participants were finalised for analysis. Like Stage and Quiroz, I expected my results to produce a mean effect size below zero showing that interventions were successful at reducing of disruptive behaviour in the classroom overall. I also expected that there would be a variation of effect sizes between different interventions revealing levels of effectiveness amongst them.

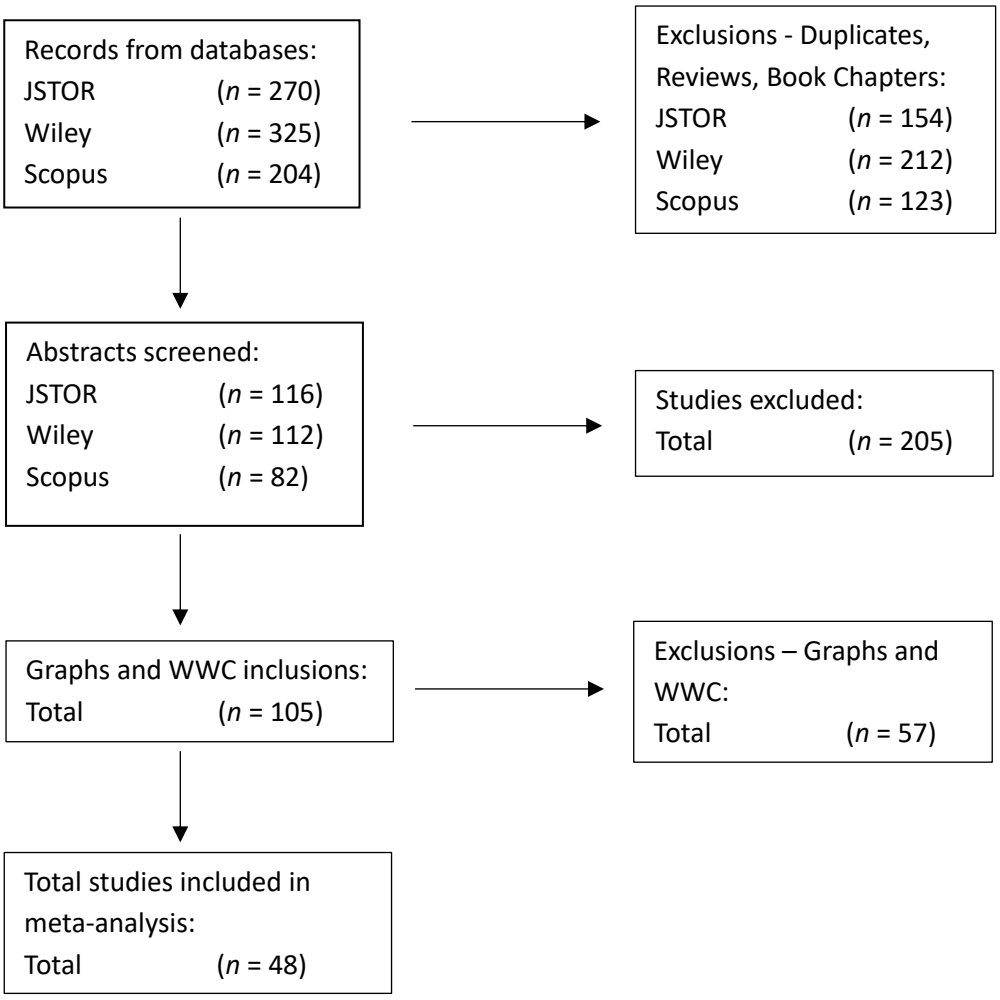
Method

Searches for this meta-analysis were included from three sources, JSTOR, Wiley, and Scopus. Specific search terms, also used in Stage and Quiroz's (1997) meta-analysis, were *classroom behaviour*, *disruptive behaviour*, and *aggression*. Articles published between 1997 and 2024 were gathered to search for studies pertaining to disruptive behaviour in classroom settings for this meta-analysis. Figure 1, a flow chart, is an overview of the inclusion and exclusion process. The initial search produced 799 studies. Duplicates, book chapters, and reviews were extracted leaving a total of 310 articles. Abstracts were screened and only studies including interventions for disruptive behaviour that were conducted in a classroom setting were selected. Studies conducted in other environments such as a clinic or laboratory, in the playground, in gym class, on a school bus, or in a home setting were excluded. Studies including a pharmacological intervention component were excluded to focus on behavioural interventions however students who were already taking medication before the study commenced were still considered viable. Studies measuring on-task,

compliance and engagement were also excluded (*n* = 205) leaving 105 studies for further consideration.

Figure 1

Flow Chart of Database Search With Inclusion/Exclusion Process



Note. WWC = What Works Clearinghouse standards.

For consistent results, raw data were extracted from graphed results of each study using a data extraction tool known as the WebPlotDigitizer (https://automeris.io/wpd/?v=5_2). I copied and pasted each graph into the extraction tool. The X and Y axis were calibrated, and each data point manually plotted before exporting the data into an Excel spreadsheet. I used Microsoft 365, Excel version 2412 to collate and graph the data for this meta-analysis. The raw data points collected from the graphs were then the basis for calculating effect sizes. To calculate effect sizes, the on-line Tau-*U*

calculator (https://singlecaseresearch.org/calculators/tau-u/) was employed. Tau-*U* effect sizes are considered small between 0 – 0.20, moderate between 0.20 – 0.60, large between 0.60 – 0.80 and very large above 0.80 (Vannest & Ninci, 2015). Studies that did not include graphed results were excluded (*n* = 31). All raw data were extracted from graphs using the WebPlotDigitiser before the Tau-*U* calculator was used to calculate results. This was to keep all results consistent across all studies. When determining which studies were to be included, raw data were analysed to ensure the design used reaches the What Works Clearinghouse (WWC) standards. Studies which met the standards with and without reservations were included. Standards, according to Maggin et al. (2013), have specific criteria to meet before reaching WWC standards. Independent variables must be manipulated and each dependent variable measured over time, interobserver agreement must result in 80% or greater, and the study has at least three attempts to show whether an effect has occurred. Single-case experimental designs, according to WWC, require at least four phases with a minimum of three points per phase to meet *with* reservations and five or more points per phase to meet *without* reservation standards (Maggin et al., 2013). All other studies below these standards were excluded (*n* = 26) to ensure this study contributes to robust, evidence-based results. A final total of 48 studies were included in the meta-analysis with a total of 180 effect sizes (see Table 1). I created bar graphs including standard error of the mean (SEM) for intervention types and grade on groups that included more than 10 effect sizes to indicate if there were any apparent differences. The threshold for number of effect sizes was in keeping with the same methodology as Stage and Quiroz (1997). Any groups resulting in less than 10 effect sizes were to be cautiously considered.

Table 1

Studies Included in the Meta-Analysis

Date	Authors	M	F	Mix	WWC	Intervention	Design	Education	Tau-*U*	*p* Value
2024	Alkahtani	2	1		Without	Caught Being Good Game	Multiple BL across students with embedded ABAB	Elementary General Ed	-1.00 -1.00 -1.00 -1.00	0.000 0.000 0.000 0.000
2024	Ford, Blair, Iovannone & Kwak	3			Without	Prevent-Teach-Reinforce	Multiple BL across students	Elementary General Ed	-1.00	0.000
2024	Ray, Panahon, Hilt-Panahon, Peterson-Brown & Filter	8	2		Without	Tootling	Multiple BL across classrooms	Elementary Special Ed	-0.81	0.000
2023	McKenna, Bray, Fitzmaurice, Choi, DeMaio, Bray & Bernstein	3	1		With	Self-monitoring with Goal Setting	Multiple BL across students with embedded ABAB	Elementary General Ed	-0.17 -0.37	0.337 0.048
2022	Canfield & Cividini-Motta	3			Without	Peer-mediated Daily Behaviour Report Cards	Multiple BL across students	Elementary General Ed	-0.89	0.000
2022	Peltier, Newell, Linton, Holmes & Donaldson	19	24		With Without	Good Behaviour Game	ABAC reversal with multielement	Elementary General Ed	-0.88 -0.60 -1.00 -1.00 -0.50 -0.70	0.004 0.142 0.021 0.000 0.143 0.040
2022	Schulz, Cividini-Motta, Blair & MacNaul	3	1		With	Comparison High Tech Vs Low Tech	ABAB reversal with alternating treatments	Elementary General Ed	-1.45 -1.45 -1.11 -1.00 -0.73 -0.54 -0.78 -0.83	0.000 0.000 0.000 0.001 0.011 0.060 0.007 0.004

Date	Authors	M	F	Mix	WWC	Intervention	Design	Education	Tau-*U*	*p* Value
2021	Donaldson, Lozy & Galijour	18	22		Without	Good Behaviour Game	Multiple BL across classrooms with embedded ABAB	Preschool	-0.88	0.000
								General Ed	-0.98	0.000
									-0.98	0.000
									-1.00	0.000
									-0.59	0.013
2021	Groves, May, Rees & Austin	3			With	Good Behaviour Game	ABAB reversal	Highschool	-0.93	0.001
								Special Ed	-1.31	0.000
									-0.93	0.001
									-1.35	0.000
									-1.11	0.000
									-0.72	0.014
2021	Pasqua, Dufrene, LaBrot, Radley, Dart & Lown			NR	Without	Mystery Student	ABAB reversal	Preschool	-1.00	0.000
								General Ed	-1.04	0.000
									-1.18	0.000
2021	Riden, Taylor, Scheeler, Lee & McCloskey	1	1		Without	Daily Behaviour Report Cards	ABAB reversal	Highschool	-1.00	0.000
								General Ed	-0.87	0.001
								Special Ed	-0.94	0.001
									-0.98	0.000
2020	Fawley, Strokes, Rainear, Rossi & Budd	22	17		Without	Teacher-Child Interactions	Multiple BL across classrooms	Elementary	0.05	0.760
								General Ed	-0.22	0.120
2020	O'Handley, Olmi, Dufrene, Tingstrom & Whipple	28	12		Without	Behaviour-specific Praise	Multiple BL across classrooms with embedded A-B-B+C	Middle	-0.93	0.000
								General Ed	-1.01	0.000
2020	Chaffee, Briesch, Volpe, Johnson & Dudley	23	18		Without	Tootling	ABAB reversal	Middle	-0.48	0.070
								General Ed	-0.84	0.280
									-0.15	0.580
									-0.92	0.020
2019	Joslyn, Vollmer & Kronfli			NR	Without	Good Behaviour Game	Multiple BL across classrooms with embedded ABAB	Highschool	-0.90	0.000
								General Ed	-0.89	0.000
2019	Fallon, Marcotte & Ferron	27	18		Without	Good Behaviour Game	Randomised Reversal design	Elementary	-1.71	0.000
								General Ed	-0.81	0.000

Date	Authors	M	F	Mix	WWC	Intervention	Design	Education	Tau-*U*	*p* Value
2019	Slocum, Vollmer & Donaldson	2			With	Time-out with Delays	ABAB reversal with delay conditions	Preschool	-0.72	0.000
								General Ed	-0.55	0.120
									-0.48	0.142
									-0.58	0.104
									-0.70	0.048
									-0.55	0.120
									-1.44	0.000
									-1.04	0.008
									-1.21	0.002
									-1.13	0.004
									-1.04	0.008
									-1.21	0.002
2018	Bulla & Frieder	2			Without	Self-management Self & Match System	ABAB reversal	Middle	-0.01	0.980
								General Ed	-0.34	0.090
									-0.53	0.004
									-0.37	0.043
2018	Ervin, Wilson, Maynard & Bramblett	6			Without	Behaviour Skills Training	Multiple BL across students	Mid/High	-1.03	0.000
								Special Ed	-0.92	0.000
2018	Lastrapes, Fritz & Casper-Teague			NR	Without	Good Behaviour Game	Multiple BL across students	Elementary	-1.02	0.000
								General Ed	-0.73	0.000
									-0.63	0.000
									-1.24	0.000
									-0.74	0.000
									-0.91	0.000
									-0.87	0.000
2018	Lipscomb, Anderson & Gadke	7			With	Class Dojo & Tootling	A-A+B+C alternating treatment	Postsecondary	-1.30	0.002
								Special Ed	-1.30	0.002
									-1.00	0.014
									-0.87	0.053
									-1.35	0.001
									-1.30	0.002
									-0.70	0.086

Date	Authors	M	F	Mix	WWC	Intervention	Design	Education	Tau-*U*	*p* Value
									-0.40	0.327
									-0.20	0.624
									-0.20	0.624
									-1.20	0.003
									-1.05	0.010
									-0.60	0.142
									-0.30	0.462
									-0.60	0.142
									-0.20	0.624
2018	Narozanick & Blair	3			With	Class Pass	Multiple BL across students	Elementary Special Ed	-1.19 -1.00	0.000 0.000
2017	Floress, Rock & Hailemariam	12	9		With	The Caterpillar Game	Multiple BL across settings	Elementary General Ed	-0.93	0.000
2017	McDaniel, Bruhn & Troughton	5			With	Social Skills Instruction	Multiple BL across students	Elementary Special Ed	-0.86	0.000
2016	Bruhn, Vogelgesang, Fernando & Lugo	2			With	Self-monitoring	ABAB reversal	Middle Special Ed	-0.68 -0.90	0.006 0.000
2016	Hartman & Gresham			55	With	Good Behaviour Game	Alternating treatment across 3 classrooms	Elementary General Ed	-0.86 -0.79	0.001 0.002
2016	Moore, Robinson, Coleman, Cihak & Park	1			With	Escape Breaks	ABAB reversal	Elementary Special Ed	-1.19	0.000
2014	Kim, Blair & Lim	2	1		With	Social Stories	Multiple BL across students	Highschool Special Ed	-0.98	0.000
2014	Kowalewicz & Coffee	111	87		With	Mystery Motivator	ABAB changing criterion	Elementary General Ed	-0.08 -0.56	0.790 0.022
									-0.42	0.197
									0.06	0.833
									-0.34	0.219
									-0.67	0.018
									-0.21	0.452
									-0.56	0.030
									-0.03	0.922

Date	Authors	M	F	Mix	WWC	Intervention	Design	Education	Tau-*U*	*p* Value
									-0.64	0.028
									-0.76	0.006
									-0.64	0.014
									-0.78	0.004
									-0.83	0.001
									-0.65	0.014
									-0.73	0.004
									-0.74	0.004
									-0.65	0.019
									-0.92	0.000
									-0.66	0.010
									-0.84	0.000
									-0.75	0.004
2013	Cook, Collins, Dart, Vance, McIntosh, Grady & Decano	3			With	Class Pass	Multiple baseline with embedded ABAB reversal	Elementary	-1.00	0.002
								General Ed	-0.94	0.028
									-1.00	0.020
									-1.00	0.020
								Special Ed	-0.96	0.016
									-1.00	0.013
									-0.70	0.079
2012	Bruhn & Watt		2		With	Self-monitor	ABAB reversal	Middle	-0.98	0.002
								General Ed	-0.86	0.007
2012	Hoff & Ervin	3		64	Without	Self-management	Multiple BL across students and classrooms	Elementary	-0.51	0.012
								General Ed	-0.54	0.006
									-0.83	0.000
									-0.91	0.000
2011	Bilias-Iolis, Chafouleas, Kehle & Bray	2	1		Without	Self-modelling	Multiple BL across students	Highschool Special Ed	-0.91	0.000
2010	LeGray, Dufrene, Sterling-Turner, Olmi & Bellone	3			Without	DRA & DRO	Alternating treatment	Preschool	-1.00	0.014
								General Ed	-1.03	0.000
									-0.67	0.157
									-0.95	0.001

Date	Authors	M	F	Mix	WWC	Intervention	Design	Education	Tau-*U*	*p* Value
									0.00	1.00
									-1.00	0.001
2010	Waller & Higbee	2			With	Fixed-Time	ABAB reversal	Middle Special Ed	-0.90 -0.91	0.000 0.000
2009	Cihak	11	8		With	Tootling	ABAB reversal	Elementary General Ed	-1.17	0.000
2008	Trussell, Lewis & Stichter	3			With	Function-based	Multiple BL across students	Elementary Special Ed	-0.67 -0.87	0.000 0.000
2007	Dufrene, Doggett, Henington & Watson		1		With	Function-based	ABAB reversal	Preschool Special Ed	-1.16	0.001
2007	Sutherland & Snyder	1	3		Without	Peer Tutoring with Self-graphing	Multiple BL across students	Middle Special Ed	-0.36	0.001
2006	Blair, Liaupsin, Umbreit & Kweon	1	2		Without	Function-based	Multiple BL across students	Elementary General Ed	-0.99	0.000
2006	Murphy, Theodore, Aloiso, Alric-Edwards & Hughes	3	5		Without	Mystery Motivators	ABAB reversal	Preschool General Ed	-0.87 -1.17	0.001 0.000
									-0.73	0.001
									-0.59	0.009
									-0.98	0.000
									-0.73	0.001
									-0.76	0.001
									-1.00	0.000
2003	Sutherland, Alder & Gunter	8	1		With	Opportunities to Respond	ABAB reversal	Elementary Special Ed	-0.68	0.004
2003	Hawken & Horner	4			Without	Behaviour Education Program “check-in, check-out”	Multiple BL across students	Middle General Ed	-0.52	0.000
2002	Kern, Bambara & Fogt	6			With	Curricular Modification	ABAB reversal	Middle Special Ed	-0.64	0.014
2002	Mottram, Bray, Kehle, Broudy & Jenson	3			Without	Multi-component	Multiple BL across students	Elementary General Ed	-0.99	0.000

Date	Authors	M	F	Mix	WWC	Intervention	Design	Education	Tau-*U*	*p* Value
2000	Martini-Scully, Bray & Kehle		2		Without	Precision Request	Multiple BL across students with embedded ABAB	Elementary General Ed	-0.85	0.000
									-1.14	0.000
									-1.00	0.000
1999	Possell, Kehle, Mclouglin & Bray	4			Without	Self-modelling with Token Economy	Multiple BL across students	Elementary General Ed	-0.91	0.000
								Special Ed	-0.79	0.000
1997	Renolds & Kelley	4			With	Response Cost-based Treatment	Multiple BL across students with embedded ABAB	Preschool	-0.95	0.000
								General Ed	-0.70	0.003
									-0.82	0.000

Note. M = male participants, F = female participants, Mix = participant total combined as the study did not differentiate male from female participants. NR = Not Recorded. WWC = What Works Clearinghouse and With or Without indicate if the study meets standards with or without reservations.

Although this study is an update of Stage and Quiroz (1997) meta-analysis there are some differences to the areas of analysis. Stage and Quiroz used the Interrupted Time Series Autocorrelation program (ITSACORR) for calculating effect sizes. I found that there have been questions around its efficacy and therefore I chose to use the Tau-*U* method because it is designed for analysis of single-case experiential design (Parker, Vannest, Davis & Sauber, 2011). Huitema et al. (2007) expressed their concerns that the methodology of ITSACORR is potentially flawed. They found estimates calculated by this method significantly inconsistent with three other methods of analysis in level change, slope change, and autocorrelation results. Parker, Vannest, Davis, and Sauber (2011) explained that with the Tau-*U* method, all data points contribute to the analysis of an experiment, trends within the data can be accounted for and baseline trend corrected if required. This reduces the potential for Type I error, that is, the occurrence of a false positive. The Tau-*U* method enables a comparison of baseline with intervention phases to calculate what effect may be present between the two phases (Parker et al., 2011).

Results

Participants

Of the 48 studies in this meta-analysis, a total of 791 participants were recorded. There were 403 male participants, 269 female participants, and 119 for whom participants' gender was not disclosed. Three class-wide studies did not include the number of participants. The spread of these statistics across all the included studies can be seen in Table 1.

Reliability

The interrater reliability method, percentage of agreement, was conducted at Stage 2 of the screening process by an independent person with clear instructions that studies must be conducted in a classroom setting and have a measure of disruptive behaviour. Of the 310 studies that were included in the abstract screening phase, 63 were randomly selected and then analysed. The number of agreements were divided by the number of agreements plus disagreements to calculate the overall percentage of agreement. With 55 agreements and 6 disagreements a result of 87% was

agreed upon. At the next screening phase of What Works Clearinghouse standards and graph inclusion, an interrater reliability analysis was performed between two raters and a Cohen's Kappa strong agreement rate of 0.86 was calculated.

Effect Size Summary

A list of individual studies and their effect sizes is in Table 1, along with study design and type of intervention, and whether the study met WWC standards with or without reservation. The number of effect sizes per intervention span from 6 to 74. Effect sizes varied across the different studies, ranging from 0.06 to −1.71. The 48 studies, including 180 effect sizes, produced an overall mean effect size of −0.81 and a standard deviation of 0.31. Negative values indicate a reduction in disruptive behaviour. Any interventions that produced an effect size of 0 indicates that the intervention had no effect on changing the target behaviour. Any positive effect sizes indicated that the disruptive behaviour had increased. All studies resulted in a reduction of disruptive behaviour with three exceptions. Fawley et al. (2020) had one positive effect size of 0.05, $p = 0.760$, Kowalewicz and Coffee (2014) also had a positive effect size of 0.06, $p = 0.833$ when implementing a class-wide intervention, and LeGray et al. (2010) had an effect size of 0, $p = 1.00$ for one of their participants. Home-based contingencies produced the highest effect size of -0.97 ($SD = 0.05$), however, with the lowest number of effect sizes ($n = 6$) from a single study, this result should be viewed with caution before making definitive decisions on the efficacy of this intervention. The lowest effect size produced was for the self-management intervention. With a result of -0.67, it is still considered a large effect according to tau-*U* levels of effect. The forest plot, in Figure 2, is a visual representation of the individual studies grouped into their intervention type. These results include 90% confidence intervals to show the potential range of which interventions implemented may have an effect. A line set at 0 on the *x* axis represents the point at which no effect occurs. Visually, all intervention mean effect sizes sit below the point of no effect, indicating that all studies resulted in a decrease in disruptive behaviour. Two studies, Fawley et al. (2020, teacher behaviour) and McKenna et al. (2023, self-management) had upper confidence intervals above 0 indicating that there is a possibility that

these interventions could produce an increase in disruptive behaviour when implemented. Bulla and Frieder (2018, self-management) had an upper confidence interval sitting on 0 indicating that this intervention could produce no effect on reducing disruptive behaviour when implemented. A comparison of mean effect sizes between this current meta-analysis and Stage and Quiroz's can be viewed in Table 2. Interventions that were implemented in Stage and Quiroz's meta-analysis vary for this current study. Variations between the two meta-analyses could be due to changes that have occurred over time. Settings, design, and grades have some variations in how the effect sizes were distributed.

Effect Size by Intervention

Tau-*U* calculations resulted in very large means by intervention type in home contingencies, active student responding, noncontingent reinforcement, punishment, function-based, and group contingencies (see Table 2). Teacher behaviour, peer mediated, multiple treatments, and self-management interventions produced large mean effect sizes. Group contingencies were most frequently utilised across the studies making up over two-thirds of all effect sizes. The Good Behaviour Game was the intervention utilised the most across the studies (n = 7), and Tootling was implemented by four studies. The most utilised method for conducting an intervention experiment was the multiple baseline design (n = 21), followed by ABAB reversal design (n = 15). Multiple baseline with ABAB embedded designs included six studies. A bar graph including standard error of the mean (Figure 3) shows a visual representation of intervention mean effect sizes. According to the results shown in Figure 3, self-management appears to be less effective than all interventions except for teacher behaviour and multiple treatment designs. It also indicates that multiple treatment interventions were more likely less effective than noncontingent interventions. Only intervention groups with more than 10 effect sizes were represented in this bar graph. This is in keeping with Stage and Quiroz (1997) who indicated that less than 10 effect sizes should be tentatively considered.

Table 2

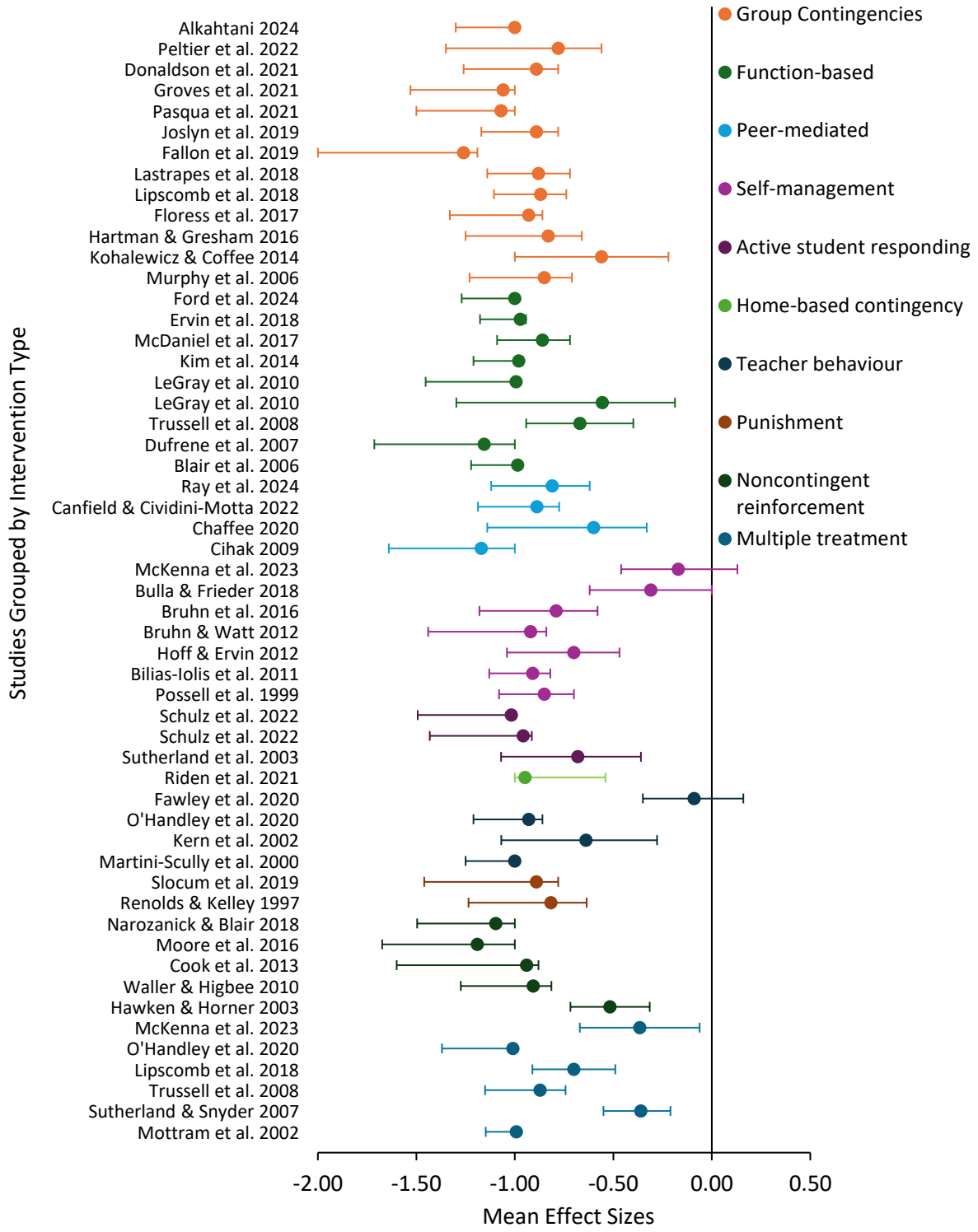
Comparison of Mean Effect Sizes Between the Current Meta-Analysis and Stage & Quiroz

	Current Study			Stage and Quiroz		
Group	*n*	*M*	*SD*	*n*	*M*	*SD*
Overall Effect Size	180	-0.82	0.31	223	-0.78	0.58
Effect Size by Intervention						
Group Contingencies	74	-0.81	0.29	25	-1.02	0.63
Function-Based	15	-0.86	0.30	11	-0.51	0.36
Peer Mediated	7	-0.75	0.33	16	-0.79	0.43
Self-Management	14	-0.67	0.31	30	-0.97	0.64
Active Student Responding	9	-0.95	0.33			
Home-based Contingencies	6	-0.97	0.05	6	-0.55	0.47
Teacher Behaviour	11	-0.77	0.37	24	-0.77	0.46
Punishment	15	-0.87	0.29	3	-0.58	0.13
Noncontingent Reinforcement	12	-0.94	0.18			
Multiple Treatment	17	-0.73	0.43	20	-0.82	0.79
Token Economies				7	-0.90	0.40
Differential Reinforcement				26	-0.95	0.52
Response Cost				15	-0.53	0.67
Stimulus Cue				11	-0.83	0.48
Cognitive-Behavioural				16	-0.36	0.41
Individual Counselling				3	-0.31	0.23
Parent Training				3	-0.60	0.23
Exercise Program				7	-0.72	0.60
Effect Size by Setting						
General Education	133	-0.80	0.31	122	-0.65	0.51
Special Education	47	-0.87	0.31	68	-.97	0.63
Resource Room				33	-0.86	0.59
Effect Size by Grade						
Preschool	38	-0.88	0.27			
Elementary	80	-0.77	0.32	76	-0.91	0.57
Middle School	21	-0.74	0.31	85	-0.64	0.60
High School	25	-0.96	0.14	19	-0.82	0.56
Postsecondary	16	-0.79	0.44	17	-0.86	0.56
Several Grade Levels Combined				22	-0.85	0.47
Effect Size by Design						
Class-wide	71	-0.76	0.30	34	-0.71	0.68
Individual	108	-0.85	0.31	58	-0.84	0.59
Group Time Series				114	-0.75	0.50
Follow-Up				17	-0.90	0.77
Effect Size by WWC Standard						
Without Reservation	80	-0.84	0.27			
With Reservation	99	-0.80	0.34			

Note. Gaps in the results reveal differences in areas of inclusion. A reduction in disruptive behaviour is represented by negative numbers.

Figure 2

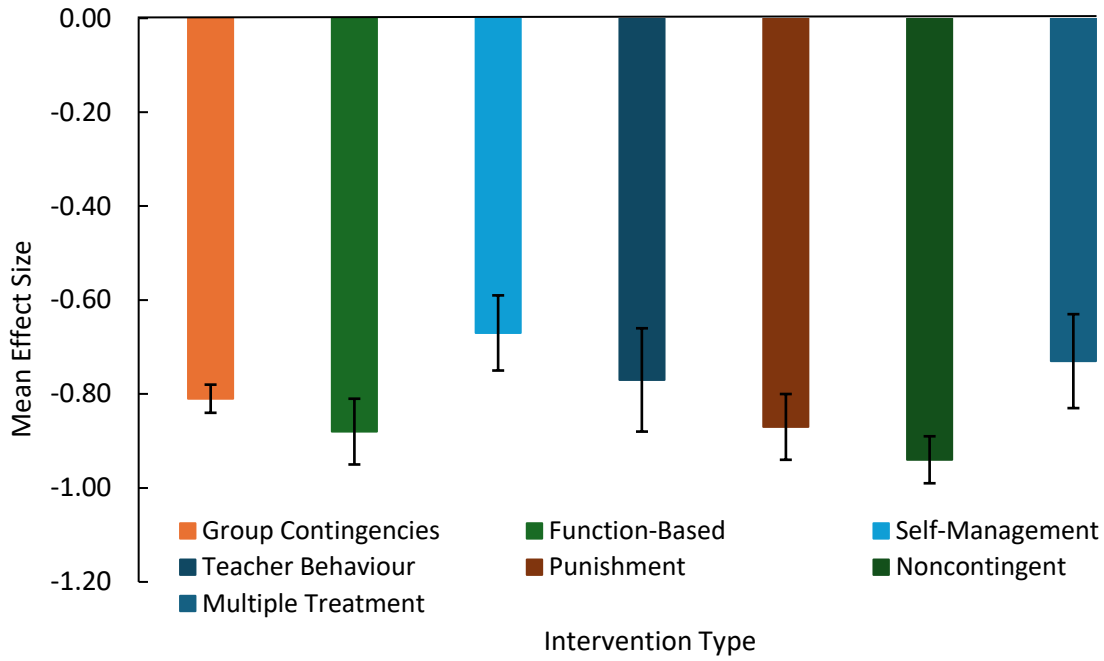
Mean Effect Sizes Across Intervention Types Including 90% Confidence Intervals



Note. Confidence intervals were set at 90% due to small sample sizes.

Figure 3

Intervention Mean Effect Sizes Including Standard Error of the Mean



Effect Size by Setting

General education classrooms, with a total of 678 participants, made up the majority of the studies (*n* = 133) compared to special education settings with 115 participants (*n* = 47). General education settings produced a large mean effect of −0.80 (*SE* = 0.05) and special education settings a very large mean effect size of −0.87 (*SE* = 0.03). The higher responsiveness of reducing disruptive behaviour with students in special education settings may be because there is usually higher number of teachers to students in these settings. It may also be that confounding variables can be better controlled for when there are more staff available (Lloyd et al. (2019). Stage and Quiroz (1997) also reported a higher mean effect size (−0.97) in special education settings.

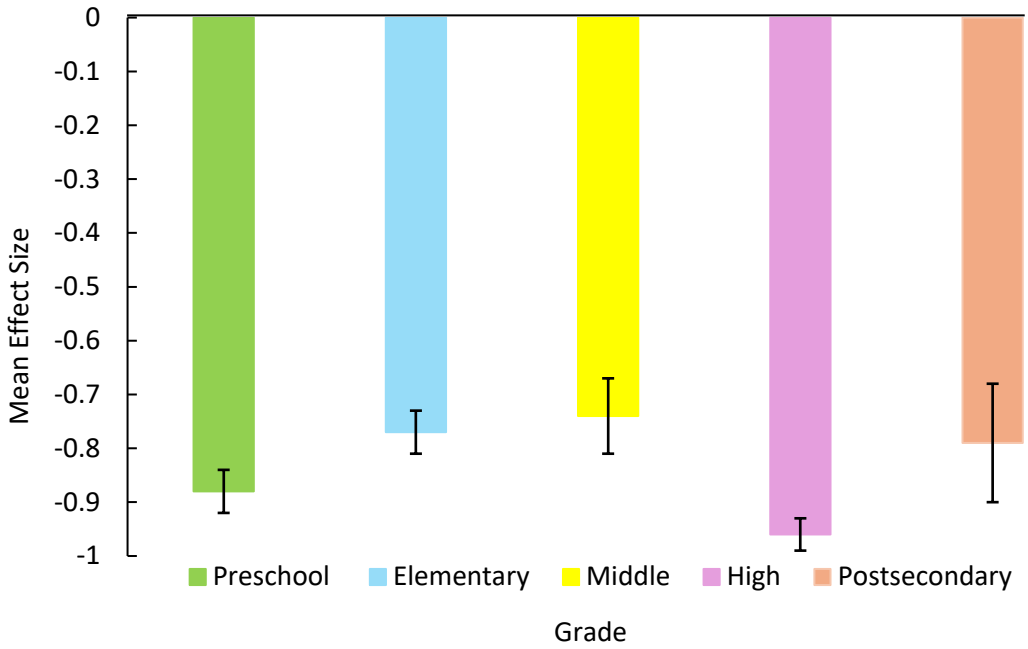
Effect Size by Grade

Figure 4 is a visual representation of grades from preschool to postsecondary. Nonoverlapping of standard error of the means revealed that high school appears to have had the most effective outcomes in reducing disruptive behaviour. It also appears that interventions

conducted in preschools were more effective than in elementary and middle school groups. This may support Kulkarni and Sullivan's (2019) theory that interventions applied at a young age may avoid the challenge of strong resistance that can develop as a child gets older. The majority of the studies (*n* = 80) included in this meta-analysis were conducted in the elementary age group and included 557 participants. This could indicate that elementary schools experience the greatest need for intervention support to reduce disruptive behaviour in classrooms.

Figure 4

Grade Mean Effect Sizes Including Standard Error of the Mean



Effect Size by Design

Mean effect sizes by design included class-wide and individual intervention groups. Table 2 clearly shows a difference in these two approaches for reducing disruptive behaviour in the classroom. Class-wide strategies resulted in a mean effect size of −0.76 (*SE* = 0.03) and individual plans resulted in a mean effect size of −0.85 (*SE* = 0.04). Stage and Quiroz also reported similar mean results of −0.71 and −0.84 respectively. I would anticipate that the differences are due in part to the

ability to target specific behavioural needs and reinforcers in individuals where class-wide approaches may not meet the needs of all students in the group.

Effect Size by What Works Clearinghouse Standard

What Works Clearinghouse standards met without reservation produced a mean effect size of −0.84 (*n* = 80, *SE* = 0.03), and standards met with reservation resulted in a mean effect size of −0.80 (*n* = 99, *SE* = 0.03). Both results fit in the range of very large mean effects. There is no apparent difference between these two groups.

Summary of Results

Nearly 30 years have passed since Stange and Quiroz (1997) conducted their meta-analysis and, due to the evolution of science and understanding, I expected to see some differences across intervention types (Table 2). Looking at similarities, teacher behaviour strategies produced the same mean effect of −0.77. Stage and Quiroz calculated their result from 24 effect sizes while I had 11 effect sizes in this category. Peer-mediated mean effect sizes were comparable. My result was −0.75, and Stage and Quiroz had a mean effect size of −0.79. Stage and Quiroz had more than double the effect sizes for this calculation. Interventions that share very large mean effect sizes are group contingencies and function-based strategies. Stage and Quiroz's mean effect sizes were larger at −1.02 and −0.95 respectively compared with my results of −0.81 and −0.86. There was a big difference between home-based contingencies, with the same number of effect sizes (*n* = 6) where my study produced an effect size of −0.97 compared to Stage and Quiroz's moderate mean effect of −0.55. Another clear difference in mean effect sizes was in self-management strategies. My meta-analysis resulted in a mean effect size of −0.67 compared with −0.97 for Stage and Quiroz. There was a difference in the number of effect sizes of 14 to 30 respectively. Punishment also resulted in clear differences between both studies. My result revealed a very large mean effect size of −0.87 compared to Stage and Quiroz with a moderate result of −0.58. Additions to the types of interventions that came up in my search were active student responding, and noncontingent reinforcement. Both mean results were very large (−0.95 and −0.94 respectively). Intervention

categories included in Stage and Quiroz's study but did not come up in my search were, stimulus cue, exercise programmes, cognitive behaviour, individual counselling, and parent training. A visualisation of the heterogeneity across all 48 studies from this meta-analysis can be seen in Figure 2. The forest plot reveals how much variation of effect occurred across different studies testing a specific type of intervention. The results of this meta-analysis, although varied in magnitude, support the findings of Stage and Quiroz (1997) that provided strong evidence for the efficacy of behavioural interventions.

Discussion

My meta-analysis focused on the efficacy of interventions designed to decrease disruptive behaviour in classroom settings. With a total sample size of 48 studies conducted in general education and special education settings, and 180 effect sizes, I was able to gather a representation across multiple intervention types for the benefit of professionals and teachers contending with students exhibiting problem behaviours. The total mean effect size of -0.82 indicates a very large reduction in disruptive behaviours overall, however some results varied with individual intervention types. Stage and Quiroz (1997) reported a large mean effect size of −0.78, based on a greater number of effect sizes (*n* = 223) from a greater number of studies (*n* = 99). Stage and Quiroz found that self-management was the most studied intervention, however in this study group contingencies were most popular. A strong reason for this could be the ability for a teacher to target multiple behaviours, and multiple students engaging in disruptive behaviours, at the same time. Class-wide strategies often take less time and resources to implement and therefore more favourable with teachers (Naylor et al., 2018). Of the group contingency strategies, the Good Behaviour Game was the most represented in this meta-analysis. Even though all contingencies; dependent, interdependent, and independent, reduced disruptive behaviour, the overall preference of teachers was for the independent variation (Grove et al., 2018). This was because of the potential for peer animosity with dependent or interdependent contingencies when the reward is contingent upon a few or everyone meeting the set criteria. Group contingencies for Stage and Quiroz produced their strongest effect size (−1.02, *SD* = 0.63). Two notable additions to this study were interventions, noncontingent

reinforcement, in which a reinforcer is available independent of behaviour (e.g. a break from task demand) (Moore et al., 2016) and active student responding that implements strategies to increase student academic engagement and decreasing disruptive behaviour (Schulz et al., 2020). Both of these strategies are considered relatively low cost and easy to implement. Home-based contingencies produced the largest effect size of −0.97 (*SD* = 0.05), however, with the lowest number of effect sizes (*n* = 6) from a single study, this result should be viewed with caution before making definitive decisions on the efficacy of this intervention. The lowest effect size produced was for self-management with a result of −0.67. This result is considered a large effect according to tau-U levels. When there is a lot of variability across the results for individual or class-wide interventions within a study it shows that the intervention may not have had the same effect on everyone. Replication is challenged when results greatly vary. If an intervention is applied and results show a small to nil effect on the target behaviour this could reveal a number of issues. It could be that students do not have the skills to undertake the new behaviour expected of them, or the implementation is inconsistent. Clear, decisive objectives from the teacher, and ensuring students have the right skills to satisfy the requirements to access the reinforcers are important considerations. The reason an intervention may not be working as anticipated is that the reinforcers on offer may not appeal to the students.

Limitations

Interpretations of my findings should be made cautiously due to some limitations. The use of two different calculation methods, ITSACORR and Tau-*U*, could mean that results produced were different with each meta-analysis. The number of studies included in some of the intervention types was small. This means that, although some interventions resulted in large-to-very-large mean effect sizes, the replicability of studies to confirm the findings is limited. Demonstration that the same effect has been repeated across studies increases confidence in the efficacy of an intervention. Over half of the studies put through the WWC standards met with reservation. This means that these studies have limitations and therefore do not meet the highest standards of WWC. A cautious regard

for the findings of these studies is necessary. Reasons for studies meeting with reservations is potential design weakness, which could put into question their reliability. Due to single-case experimental designs focused on individuals or small group sizes, it is not always possible to conclude that these results will transfer to a greater population therefore replicability going forward will evidence the efficacy and generalisation of behavioural interventions.

Conclusion

Although the results of this meta-analysis are strong, interventions that only had a small representation should be considered with caution. Standardisation of evidence-based intervention practices is important because studies that are often conducted within classroom settings are small, focus on individual students or a small group of participants and therefore results from these need to be interpreted tentatively on their own. McKenna et al. (2021) emphasised the importance of evidence-based practices when implementing interventions to improve student behaviours. This means being certain that the interventions chosen for each situation are scrutinised for their effectiveness. Replication of studies following stringent guidelines is essential to confirm the efficacy of interventions. Encouraging researchers to conduct single-case-design experiments that adhere to the rigorous standards of What Works Clearinghouse guidelines will produce more robust evidence-based studies for practitioners to have confidence in their efficacy (Maggin et al., 2013). Bulla and Freider (2018) emphasised that the lack of training in classroom management may make intervention strategies difficult to maintain or successfully fade out, while sustaining a good positive learning environment. With many teachers reporting that they feel undertrained and ill-prepared to manage disruptive behaviour, professional development in classroom management should be considered a necessity due to the recent statistics that reveal an increase in disruptive behaviour within classrooms and on average three to four students per classroom are likely to engage in regular disruptive behaviour (Ervin et al., 2018). When disruptive behaviour dominates a learning environment, academic and social opportunities are negatively impacted for both staff and students (Ervin et al., 2018). Korpershoek et al. (2016) encourages classroom management strategies that a

teacher implements should be designed to foster a strong academic and social-emotional environment for student development. This includes building strong teacher-student relationships, creating opportunities for building positive peer relationships, organisation of optimal learning opportunities for their students, encouraging academic engagement through the use of group management strategies, and giving students opportunities to develop personal responsibility for their own behaviour.

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

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