

## **Case Study 1: An Evidence-Based Practice Review Report**

### **Theme: School/setting Based Interventions for Learning.**

#### ***How effective is an attribution retraining intervention in improving academic attainment in literacy and numeracy for school aged children?***

#### **Summary**

The purpose of this review is to evaluate the effectiveness of an attribution retraining intervention for improving academic attainment in literacy and numeracy for school aged children.

Attributions are the judgements we make as to why a particular outcome occurred. Weiner (1974;1985) argues that attribution theory can be used within an educational context to explain how students perceive their academic successes and failures, and to understand how these causal attributions influence subsequent learning behaviours. Attribution retraining aims to identify maladaptive attributions and replace these with more adaptive patterns of attribution.

Research suggests that attribution retraining may have a positive influence on academic outcomes (Perry & Hall, 2009), however there is a need to clarify the ideal context and potential outcomes of the intervention to maximise the effectiveness of its use in education. This review hopes to provide some clarity for the intervention's use in raising literacy and numeracy attainment.

A comprehensive search of the literature returned six studies meeting the inclusion criteria for the review. These studies were evaluated using Gough's (2007) 'Weight of Evidence' framework. An adapted version of Kratochwill's (2003) coding protocol was used to provide an objective assessment of the methodological quality for each study.

After detailed analysis of the six studies, the findings suggest that attribution retraining shows promising evidence for use as an intervention for raising attainment in reading, but not for maths or spelling. Strengths and limitations of each study are discussed throughout the review, but conclusions and recommendations are reported in the final section.

## **Introduction**

### ***Attribution Theory***

Attribution theory can be traced back to the ideas of Heider (1958), whose cognitive theory of motivation argues that individuals seek to identify and explain the root cause of observable behaviours and outcomes. An individual may perceive the cause to be due to either internal or external factors. These perceptions of causality are known as 'attributions' and are believed to affect our subsequent behaviour and motivations (Heider, 1958).

Weiner (1974;1985) is one of the key researchers to develop Heider's (1958) original theory of attribution, bringing the idea in to the context of achievement settings. Weiner's (1985) attribution theory of achievement motivation is outlined in Figure 1 below.

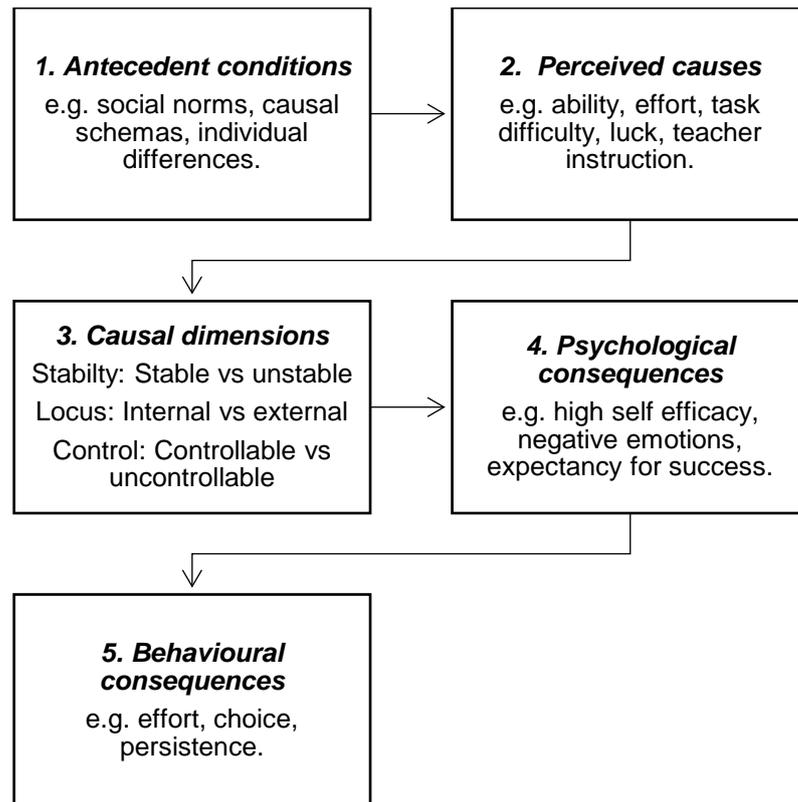


Figure 1. Overview of Weiner's (1985) attribution theory of achievement motivation

Attribution theory is used within an educational context to explain how students perceive their academic successes and failures, and to understand how these causal attributions influence subsequent learning behaviours. Research has consistently demonstrated that an individual's attributional style is an effective predictor of academic success (Kloosterman, 1984). Weiner (1985) argued that the optimal attributional profile would be one that attributes success to internal, stable factors such as high ability and effort, and failure to internal, controllable factors such as a lack of effort, rather than a lack of ability.

### **Attribution Retraining (AR)**

Attribution retraining (AR) is based on the premise that attributions can be altered to help students become more effective learners. The optimal attributional profile outlined by Weiner (1985) is often not displayed by students, so AR aims to identify

maladaptive causal attributions and replace these with more adaptive patterns of attribution.

AR has been researched in a wide range of achievement settings, including education (Robertson, 2000). The implementation of AR differs greatly in terms of the format of delivery, the content included and even the target group (Forsterling, 1985). In school settings AR has been implemented as a whole class intervention supporting female students who were 'gifted' in physics (Ziegler & Heller, 2000), while many others have used AR as targeted intervention to support small groups of students with learning difficulties (Chodkiewicz & Boyle, 2014). Perry and Hall (2009) found that content delivery ranged from using written materials to video simulations, strategies varied from changing causal dimensions to encouraging perceptions of effort over ability for failures, while techniques used included self-talk, modelling and persuasive feedback.

### ***Rationale and relevance***

Research suggests that AR may have a positive influence on academic outcomes (Perry & Hall, 2009) however much of the current evidence base comes from the late 1900's, highlighting the need to assess the effectiveness of AR in the modern classroom. Additionally, the term academic attainment is often used to describe a broad range of outcomes so the current review aims to synthesise findings focused on literacy and numeracy attainment.

Roome and Soan (2019) suggest that students are feeling increasing pressure to achieve high grades in their GCSE's due to the 'audit culture' of the UK education system. Giddens (1991) suggests that academic success and failure can contribute to an individual's sense of self and academic self-concept. Increased emphasis on exam results could threaten the wellbeing and self-esteem of students due to

lowering their expectations of future success and ability to cope with failure (Denscombe, 2000). There are a variety of ways in which educational psychologists may be able to contribute to supporting young people to manage the pressure of exams, including possible training for teachers and school staff to help cope with failure and success in a helpful way. AR is one possible tool that educational psychologists could use to help staff support students' appraisals of success and failure in the face of arduous examinations.

In the world of applied psychology there has been a concerted effort to encourage practitioners to identify the most effective and appropriate interventions by using evidence from research to inform decisions, and resources such as The What Works Clearing House have been introduced to enable educational psychologists to integrate scientific evidence into professional practice. With this emphasis on evidence based practice, it is important that educational psychologists acknowledge the dangers of looking at certain interventions as 'effective' and 'ineffective'. AR interventions, for example, have a strong evidence base, however there is a need to clarify the ideal context and potential outcomes of the intervention to maximise the effectiveness of its use in education.

***Review question***

*How effective is an AR intervention in improving academic attainment in literacy and numeracy for school-aged children?*

## Critical Review of the evidence base

### Literature search

The search terms outlined in Table 1 were used to carry out a systematic search of the literature across three online databases: ERIC, PsycINFO, and the Web of Science. Searches were carried out on 17<sup>th</sup> January 2020 and limited to peer reviewed journal articles.

Table 1  
*Search terms used in systematic literature review*

Search Term	Rationale
"Student*" OR "School" OR "Academic" OR "Child*"	This review is interested in the attribution retraining interventions for school-aged children, in school settings.
"Attribution* Retraining" OR "Attribution* Training"	This review is interested in studies using attribution retraining techniques.
"Achievement" OR "Attainment" OR "Performance" OR "Grade" OR "Level" OR "Numeracy" OR "Math*" OR "English" OR "Literacy" OR "Reading" OR "Writing" OR "Comprehension" OR "Success"	This review is interested in studies measuring outcomes of academic attainment in either literacy or numeracy.

### Screening of articles

The initial searches generated 225 results. After removing duplicates (n=75) and the addition of one study through ancestral searches, 151 studies were identified for 'title and abstract' screening. Using the inclusion and exclusion criteria presented in Table 2, 136 studies were removed and the remaining studies (n=15) were selected for 'full text' screening. The 'full text' screening resulted in nine studies being removed, with further explanations provided in Appendix A. The final six studies deemed eligible for review are listed in Table 3. This selection process is outlined in the flow diagram in Figure 2.

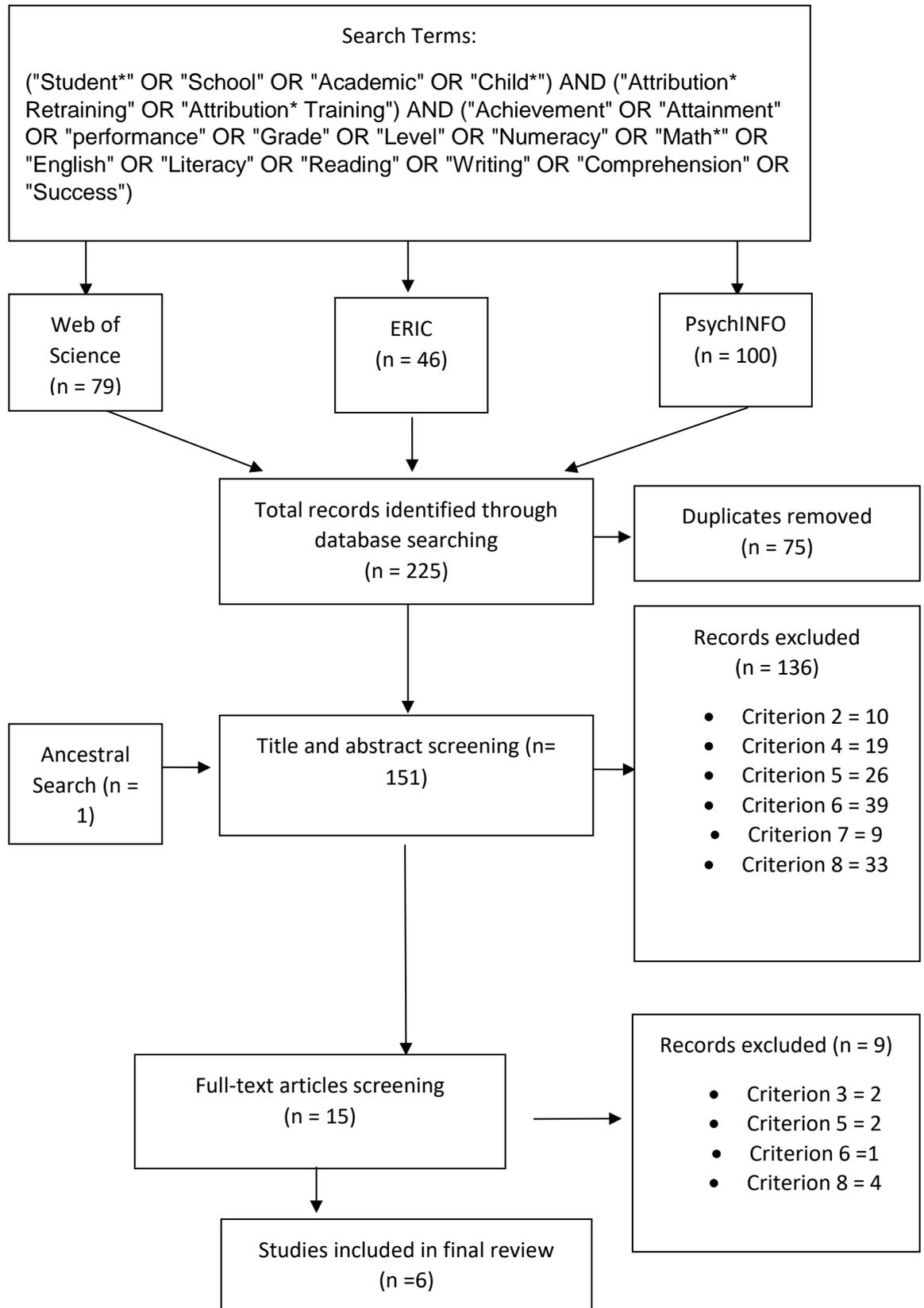


Figure 2. Flow diagram outlining the selection process of reviewed studies

Table 2

*Inclusion and Exclusion Criteria for Literature Search*

Criteria	Inclusion	Exclusion	Rationale
1. Type of publication.	The study has been peer reviewed.	The study has not been reviewed.	The methodological quality of peer reviewed articles have already been scrutinised, therefore are assumed to be of a higher overall quality.
2. Date of Publication.	The date of publication is between January 1st 2000 and January 1st 2020.	The date of publication is after January 1st 2020.	A systematic literature review was conducted in 2000 exploring attribution retraining in educational settings. This avoids duplication and allows the research relevant to a modern classroom setting to be investigated.
3. Language.	The article is written in English.	The article is not written in English.	This ensures that the article can be read by the researcher, allowing for full understanding and critical appraisal.
4. Type of studies.	The articles must use an experimental or quasi-experimental design as part of original, empirical study.	The article is reviewing findings of other studies and does not report original, empirical findings.	The review is evaluating the impact of Attribution Retraining on Academic Attainment by reviewing original findings.
5. Intervention.	The article includes Attribution Retraining in one or more of the intervention conditions.	The article does not include Attribution Retraining in one of the intervention conditions.	This review seeks to specifically explore the impact of Attribution Retraining as opposed the general motivation strategies.
6. Participants.	All participants are school aged (4-18 years).	The participants are not school aged (Over 18 years or under 4 years).	This review is specifically exploring the impact of Attribution Retraining on school aged pupils.

*Inclusion and Exclusion Criteria for Literature Search*

Criteria	Inclusion	Exclusion	Rationale
7. Setting.	The study is carried out in a school or alternative educational settings.	The study is not carried out in a school or alternative educational settings.	The review is interested in the effect of AR within a school/educational based setting.
8. Outcomes.	The study has at least one outcome measure assessing Academic Attainment in literacy and numeracy.	The study has no outcome measures assessing Academic Attainment in literacy and numeracy.	This review is specifically exploring the impact of Attribution Retraining on Academic Attainment in literacy and numeracy.

Table 3

*Full references of studies included in the review*

Reviewed studies	
1	Bosnjak, A., Boyle, C., & Chodkiewicz. (2017). An intervention to retrain attributions using CBT: A pilot study. <i>The Educational and Developmental Psychologist</i> , 34(1), 19–30. <a href="https://doi.org/http://dx.doi.org/10.1017/edp.2017.1">https://doi.org/http://dx.doi.org/10.1017/edp.2017.1</a>
2	Berkeley, S., Mastropieri, M. A., & Scruggs, T. E. (2011). Reading comprehension strategy instruction and attribution retraining for secondary students with learning and other mild disabilities. <i>Journal of Learning Disabilities</i> , 44(1), 18–32. <a href="http://dx.doi.org/10.1177/0022219410371677">http://dx.doi.org/10.1177/0022219410371677</a>
3	Chodkiewicz, A. R., & Boyle, C. A. I. (2016). Promoting positive learning in Australian students aged 10- to 12-years-old using attribution retraining and cognitive behavioral therapy: A pilot study. <i>School Psychology International</i> , 37(5), 519–535. <a href="http://dx.doi.org/10.1177/0143034316667114">http://dx.doi.org/10.1177/0143034316667114</a>
4	Sukariyah, M. B., & Assaad, G. (2015). The Effect of Attribution Retraining on the Academic Achievement of High School Students in Mathematics. In Ozcan, D (Ed.), <i>first global conference on contemporary issues in education (globe-edu 2014)</i> (pp. 345–351). <a href="https://doi.org/10.1016/j.sbspro.2015.02.356">https://doi.org/10.1016/j.sbspro.2015.02.356</a>
5	Horner, S. L., & Gaither, S. M. (2004). Attribution Retraining Instruction with a Second-Grade Class. <i>Early Childhood Education Journal</i> , 31(3), 165–170. <a href="http://dx.doi.org/10.1023/B:ECEJ.0000012134.58050.2a">http://dx.doi.org/10.1023/B:ECEJ.0000012134.58050.2a</a>
6	Toland, J., & Boyle, C. (2008). Applying Cognitive Behavioural Methods to Retrain Children’s Attributions for Success and Failure in Learning. <i>School Psychology International</i> , 29(3), 286–302. <a href="https://doi.org/10.1177/0143034308093674">https://doi.org/10.1177/0143034308093674</a>

***Mapping the field***

The reviewed studies all investigated the effectiveness of an AR intervention to improve literacy and numeracy attainment, however the authors varied in their approach to research design, participant selection, outcome measures and intervention delivery. The key features of each study are outlined in the summary table located in Appendix B.

***Weight of Evidence (WoE)***

Gough's (2007) Weight of Evidence (WoE) framework was used to evaluate both the quality and relevance of the selected studies. This framework considers the methodological quality (WoE A), methodological relevance (WoE B) and topic relevance (WoE C) of each study.

WoE A focuses on the quality of the research design and methodology. Kratochwill's (2003) coding protocol was used to provide an objective assessment of each study in relation to measurement techniques, comparison groups, intervention components, implementation fidelity and follow up assessments. WoE B evaluates the type of evidence and its appropriateness in relation to the literature review question, while WoE C seeks to evaluate how relevant the focus of the study is in relation to the review question.

The overall Weight of Evidence (WoE D) is the average rating of WoE A, B and C for each study and determines the strength of evidence in answering the review question. A summary of each study's WoE ratings is provided in Table 4.

Appendix C provides the detailed criteria used for WoE A, B and C, and the justification for their use. Adjustments to Kratochwill's (2003) coding protocol are also outlined in Appendix D, with a completed example of the WoE A coding protocol included in Appendix E.

Table 4  
*Summary of Weight of Evidence ratings for reviewed studies*

Authors	WoE A: Methodological quality	WoE B: Methodological relevance	WoE C: Topic relevance	WoE D: Overall weight of evidence
Bosnjak, Boyle & Chodkiewicz (2017)	1.2	2.6	2.6	2.1 (medium)
Berkeley, Mastropieri & Scruggs (2011)	2.4	2.8	2.0	2.4 (high)
Chodkiewicz & Boyle (2016)	2.0	2.8	2.6	2.5 (high)
Sukariyah & Assaad (2015)	0.6	2.0	2.4	1.6 (Low)
Horner & Gaither (2004)	0.6	2.0	2.4	1.6 (low)
Toland & Boyle (2008)	1.0	1.8	2.6	1.8 (medium)

*Low rating = 1 to 1.6                      Medium rating = 1.7 to 2.3                      High rating = 2.4 to 3*

**Participants**

There were a total of 227 participants included across the six studies. Each study varied greatly in sample size, ranging from just 16 participants (Bosnjak, Boyle & Chodkiewicz, 2017) to 59 participants (Berkeley, Mastropieri & Scruggs, 2011). Horner and Gaither’s (2004) study was the only one to include children under the age of ten, while the remaining studies included students ranging from ten to sixteen years of age. Frederickson (1998) suggests that it is challenging for younger children to distinguish between effort and ability in relation to attainment. Nicholls and Miller (1984) found that children only begin to distinguish effort and ability at around 10-11 years old, and at around age 12 this distinction is clearly understood; the effect of effort is limited by one’s ability. This suggests that it may be more

appropriate to investigate the effect of AR with students aged 10 and over due to their readiness for attributional change.

### ***Settings***

All six studies were carried out in a school setting as per the requirements of the exclusion and inclusion criteria outlined in Table 2. Sukariyah and Assaad (2015) were the only authors to deliver the intervention in typical classroom settings and subsequently received a higher WoE C rating than the remaining five studies that delivered the intervention in a separate location within the school. This is because embedding AR within classroom learning has wider scope for generalising the intervention to use within real school settings where it may not be practical or ethical to remove students from existing classroom learning. It is acknowledged that AR may be more suitable for use with smaller groups, thus it is not always possible for the intervention to take place within a natural classroom environment. The remaining five studies all received a 'medium' WoE C rating for the 'setting' component on the basis that many schools will deliver the intervention outside of regular classroom learning.

### ***Research design***

The research design used in each study was evaluated as part of the WoE A and WoE B ratings. It is widely considered that the most appropriate research design for an 'effectiveness' question is a randomised controlled trial (Petticrew & Roberts, 2003). Three studies (Berkeley, Mastropieri & Scruggs, 2011; Bosnjak, Boyle & Chodkiewicz, 2017; Chodkiewicz & Boyle, 2016) used a randomised controlled trial and received 'high' WoE B ratings. Two studies (Horner & Gaither, 2004; Sukariyah & Assaad, 2015) used a pretest-posttest non-equivalent control group design in which participants were not truly randomised to conditions but a comparison group was still present, resulting in 'medium' WoE B ratings. Toland and Boyle (2008) used a one group pretest-posttest design in which there was no comparison group

or random allocation, subsequently receiving the lowest WoE B rating of all six studies.

Of those studies using a randomised controlled design, only Berkeley, Mastropieri and Scruggs (2011) used an 'active' control condition in which participants received an existing 'Read Naturally' strategy. The use of an 'active' control condition helps identify the comparative benefit of an AR intervention over other commonly used strategies. This study was awarded the highest WoE A and WoE B ratings for the comparison group components, while the other four studies used a 'no-intervention' control group and received 'medium' WoE A and B ratings. Toland and Boyle (2008) did not use any type of comparison group, meaning we cannot be sure that any improvement in academic performance is due to the AR intervention. The lack of even a 'no-intervention' condition increases the likelihood that any positive effects observed may have occurred due to factors outside of experimental condition (Barker, Pistrang, & Elliott, 2015), therefore this study received 'low' WoE A and B ratings for the comparison group components.

The use of random allocation to conditions in three studies (Berkeley, Mastropieri & Scruggs, 2011; Bosnjak, Boyle & Chodkiewicz, 2017; Chodkiewicz & Boyle, 2016) reduces potential selection bias as a threat to internal validity, allows for a direct comparison between conditions and offers a more valid representation of how the wider population will respond to the intervention (Barker, Pistrang, & Elliott, 2015). Sukariyah and Assaad (2015) used a matched participants design, assigning participants to the control condition by matching the intervention condition based on maths achievement scores. Using non-random allocation means that participants in each group may differ systematically on unmeasured variables and characteristics, although analysis of the data revealed no significant difference on measured variables between groups. Horner and Gaither (2004) used a cluster randomised design, in which groups of participants, as opposed to individuals, are randomly

allocated to groups. Lorenz, Köpke, Pfaff, and Blettner (2018) suggest that this is an appropriate approach to investigate effectiveness at a group level, such as the embedding of an AR intervention as part of whole class teaching in Horner and Gaither's (2004) study. There were clear pitfalls in this design as the two groups demonstrated significant differences in maths achievement at baseline and over 40% of the students did not give consent for their data to be analysed. The researchers used maths achievement as a covariate in later ANCOVAs but there is much debate whether such an approach appropriately 'corrects' or 'controls' for real differences between groups (Miller & Chapman, 2001). Both studies received lower WoE B ratings as a result of using non-randomised approaches to the allocation of individual participants.

### ***Intervention content and delivery***

Studies varied in the duration and frequency of the intervention condition, ranging from just eight sessions over eight consecutive days (Horner & Gaither, 2004) to twelve fortnightly sessions over six months (Toland & Boyle, 2008). Sessions lasted up to 75 minutes (Bosnjak, Boyle & Chodkiewicz, 2017), while Berkeley, Mastropieri and Scruggs (2011) delivered just 10 minutes of explicit AR per session with implicit principles included in a further 20 minutes of the session. Most studies used small groups of between five and eight students while Horner and Gaither (2004) used a whole class of 30 students. Full details of duration, frequency and groupings can be found in Appendix B.

This significant variance across studies should be considered when comparing any variance in outcomes across studies, as it is possible that the duration and frequency of sessions may mediate the effectiveness of AR in raising academic achievement in literacy and numeracy. The reality of practical implications in delivering school based interventions means that duration and frequency will likely

also vary depending on school circumstances, therefore the conclusions of this review may be more widely generalizable to school settings.

Three studies (Bosnjak, Boyle & Chodkiewicz, 2017; Chodkiewicz & Boyle, 2016; Toland & Boyle, 2008) used similar approaches of delivery by combining traditional features of AR programs and key principles from Cognitive Behavioural Therapy (CBT). Chodkiewicz and Boyle (2016) and Bosnjak, Boyle and Chodkiewicz (2017) both followed the structure and guidelines from Toland and Boyle's (2008) study, along with the resources developed out of the study known as 'Believing you can is the first step to achieving' (Chodkiewicz & Boyle, 2015). The focus of this approach is to help students understand the link between thoughts, feelings and actions, and challenge unhelpful thoughts to restructure attributions used to explain success and failure situations.

Horner and Gaither (2004) did not adopt the CBT principles but similar to the three aforementioned studies, they included some form of the following components: teaching points, demonstration, discussion, practice and direct attributional feedback. These four studies all received higher WoE C ratings for the implementation of the intervention on the basis that the inclusion of these features would constitute a thorough AR intervention. Sukariyah and Assaad (2015) received a lower WoE C rating due to attributional feedback being the only significant component of the intervention.

Berkeley, Mastropieri and Scruggs (2011) received the lowest WoE C rating with AR only being explicitly referenced in the final ten minutes of the 30 minute 'reading comprehension strategy' session. The inclusion of a 'reading comprehension strategy' group without AR still allowed for the impact of the AR element of the intervention condition to be considered in isolation.

**Outcome measures**

Three studies used standardised measures of literacy and numeracy, including the reading, maths and spelling components of the Wechsler Individual Achievement Test–3rd Edition (WIAT–III; Wechsler, 2009a) (Bosnjak, Boyle & Chodkiewicz, 2017; Chodkiewicz & Boyle, 2016), and the spelling and reading components of the British Abilities Scale (Toland & Boyle, 2008). These studies all received a ‘high’ WoE C rating for the measurement components on the basis that these outcome measures demonstrate high levels of validity and reliability while being normed on the target population, however only Toland and Boyle (2008) received a ‘high’ WoE A rating due to using teacher and parent perceptions to triangulate their findings.

Berkeley, Mastropieri and Scruggs (2011) received a ‘medium’ WoE A and WoE C rating for measurement, using two measures of reading comprehension; a criterion-referenced comprehension summarisation test and a passage-specific content test, demonstrating reasonable level of internal consistency ( $\alpha = .77$ ). Two studies (Horner & Gaither, 2004; Sukariyah & Assaad, 2015) used teacher constructed tests of maths attainment, and received lower WoE A and WoE C ratings due to uncertainty around the validity, reliability and procedure making it difficult to interpret any improvements made from pre-test to post-test.

**Findings**

A summary of the effect sizes for each study can be found in Table 7. Tables 5 and 6 provide a guide for interpreting these values using on Cohen’s (1992) descriptors. Effect sizes were taken from the findings section of the papers.

Table 5  
*Effect size descriptors for Cohen’s d*

Cohen’s d	Descriptor
.8	Large
.5	Medium
.2	Small

Table 6  
*Effect size descriptors for  $\eta^2$  and  $\eta_p^2$*

$\eta_p^2$ or $\eta^2$	Descriptor
.14	Large
.06	Medium
.01	Small

All six studies measured literacy and/or numeracy outcomes pre- and post-assessment, however only two studies carried out follow up assessments; Berkeley, Mastropieri and Scruggs (2011) at six weeks and Chodkiewicz and Boyle (2016) at eight weeks. These two studies subsequently received 'high' WoE A ratings as this allows us to see whether any effects were maintained after termination of the intervention.

Table 7

Summary of effect sizes for reviewed studies

Authors	Design	Sample Size	Outcome Measure	ES estimate	Post-test outcomes			Follow-up outcomes			WoE D
					P	Effect Size	Descriptor	P	Effect Size	Descriptor	
Bosnjak, Boyle & Chodkiewicz (2017)	Randomised Controlled Trial	16	<b>Reading achievement</b> - (WIAT-II-A).	$\eta_p^2$	<.01	.63	Large*	N/A	N/A	N/A	2.1 (medium)
			<b>Maths achievement</b> - (WIAT-II-A).	$\eta_p^2$	.19	.12	Medium	N/A	N/A	N/A	
			<b>Spelling achievement</b> - (WIAT-II-A).	$\eta_p^2$	.81	.00	Small	N/A	N/A	N/A	
Berkeley, Mastropieri & Scruggs (2011)	Randomised Controlled Trial	59	<b>Reading Comprehension: Comprehension summarization test.</b>	Cohen's d	.000	1.44	Large*	.000	1.21	Large*	2.4 (high)
			<b>Reading Comprehension: Passage-specific content test.</b>	Cohen's d	.89	0.14	Small	.59	0.26	Small	

Table 7

Summary of effect sizes for reviewed studies

Authors	Design	Sample Size	Outcome Measure	ES estimate	Post-test outcomes			Follow-up outcomes			WoE D
					P	Effect Size	Descriptor	P	Effect Size	Descriptor	
Chodkiewicz & Boyle (2016)	Randomised Controlled Trial	50	<b>Reading achievement</b> - (WIAT-II-A).	$\eta^2$	.025	.075	Medium*	.012	.128	Large*	2.5 (high)
			<b>Maths achievement</b> - (WIAT-II-A).	$\eta^2$	.071	.010	Small	N/A	N/A	N/A	
			<b>Spelling achievement</b> - (WIAT-II-A).	$\eta^2$	.34	.021	Small	N/A	N/A	N/A	
Sukariyah & Assaad (2015)	Pretest-posttest non-equivalent control group design	44	<b>Maths achievement</b> Maths test. No details of the test were provided.	Cohen's d	.002	.65	Moderate*	N/A	N/A	N/A	1.6 (Low)
			<b>Maths Achievement</b> First term maths scores	Cohen's d	.003	1.12	Large*	N/A	N/A	N/A	

Table 7

Summary of effect sizes for reviewed studies

Authors	Design	Sample Size	Outcome Measure	ES estimate	Post-test outcomes			Follow-up outcomes			WoE D
					P	Effect Size	Descriptor	P	Effect Size	Descriptor	
vs third term maths scores											
Horner & Gaither (2004)	Pretest-posttest non-equivalent control group design	29	<b>Maths Achievement</b> 7 question curriculum unit review; pre- and posttests.	Cohen's d	.055	.52	Medium	N/A	N/A	N/A	1.6 (Low)
Toland & Boyle (2008)	One group pretest-posttest design	29	<b>Reading Attainment:</b> <i>British Abilities Scale</i>	Cohen's d	<.001	0.22	Small*	N/A	N/A	N/A	1.8 (medium)
			<b>Spelling Attainment:</b> <i>British Abilities Scale</i>	Cohen's d	0.069	0.12	Small	N/A	N/A	N/A	

Chodkiewicz and Boyle (2016) found no significant differences in spelling and maths attainment between the AR group and the control group. They did, however, find a medium, significant effect ( $\eta^2 = .075$ ,  $p = .025$ ) on reading attainment at post-test measurements. The effect on reading attainment actually increased at the two month follow up ( $\eta^2 = .128$ ,  $p = .012$ ), suggesting that the impact of the AR may have required more time to practise and internalise the learnt skills before the effect truly manifests. This study received a 'high' WoE D rating, suggesting it is both methodologically sound and relevant to the current review question, so should be given considerable weight when drawing conclusions about the impact of AR.

Bosnjak, Boyle and Chodkiewicz's (2017) findings tend to support those reported by Chodkiewicz and Boyle (2016), finding a large, significant effect of AR on reading attainment at post-test measurements ( $\eta^2 = .63$ ,  $p = .01$ ), while no significant effects were found for maths or spelling attainment. This study received a 'medium' WoE D rating, however it only received a 'low' WoE A rating due to the lack of a follow up assessment and an insufficient sample size to detect a large effect size for a power of .80. These methodological limitations must be taken into account, but 'high' WoE B and C ratings demonstrate it is still relevant to the current review question.

Berkeley, Mastropieri and Scruggs (2011) found a large, significant effect of the AR condition on reading comprehension ( $d = 1.44$ ,  $p = .000$ ) which was maintained at the six week follow up assessment ( $d = 1.21$ ,  $p = .000$ ). This effect was only found for one measure of reading comprehension, and there was no significant difference between the two intervention conditions with and without the AR element. This suggests that the improved reading comprehension cannot be conclusively ascribed to the impact of AR. This study received a 'high' WoE D rating so should be given due weight, however it 'received a lower 'WoE' C rating on the basis that AR was not the primary focus of either intervention condition.

Toland and Boyle (2008) found that children with learning difficulties in the intervention condition showed a significant increase in reading attainment, but only a small effect size was found ( $d = .22$ ,  $p = .001$ ). Similar to the other studies, there was no significant effect on spelling attainment. This study received a 'medium' WoE D rating but a 'low' WoE A rating was awarded due to the lack of a comparison group, which means that the increase in reading attainment may be due to factors outside of the intervention.

Horner and Gaither (2004) found no significant effect of the intervention condition on maths attainment. Interestingly, the children in the intervention condition did show a significant decrease in attribution to uncontrollable factors post-test. This suggests that the intervention was successful in altering attributions but not for improving maths attainment. This study received a 'low' WoE D rating, largely due to receiving the joint-lowest WoE A rating. These findings should be interpreted with caution and will not be heavily weighted when drawing conclusions in this review.

Sukariyah and Assaad (2015) found a large, significant effect of AR on maths attainment ( $d = 1.12$ ,  $p = .003$ ) as measured by termly maths scores. This study was the only one included in this review to find a significant effect on maths attainment, however it also received the lowest WoE A and WoE D of all included studies. The use of ambiguous outcome measures with no clear evidence of validity or reliability means that these findings may not be useful in evaluating whether AR is effective in raising literacy and numeracy attainment.

## **Conclusions and recommendations**

In summary, the current review supports the effectiveness of an AR intervention to improve reading attainment in school-aged children. The overall findings from the reviewed studies suggest that reading attainment significantly improved as the result

of an AR intervention, while spelling and maths attainment did not significantly improve compared to control conditions.

There are a number of possible explanations for these findings. It could be that the different outcomes achieved for reading, spelling and maths may be due to the specific learning requirements in each of these academic areas. Toland and Boyle (2008) suggest that performance in certain academic areas may be more easily influenced by attributional change and increased motivation. Over 90% of the studies in Lewis and Samuels' (2005) review found that an increased volume of reading led to an improvement in reading, suggesting that an increased motivation to engage in reading would likely impact reading attainment. This, of course, will largely depend on an individual's basic reading skills being at an appropriate level to access a text.

A key component of AR is to help students believe that effort will lead to success, however it is possible that before this newfound belief can impact maths and spelling attainment, students may also need to develop the necessary subject specific skills (Ziegler & Heller, 2010). Robertson (2000) also points out that both maths and spelling usually require some level of rote learning over an extended period of time, therefore the impact of an AR intervention may not be immediately noticeable for these areas at post-intervention assessments.

Only two studies performed follow up assessments (Berkeley, Mastropieri and Scruggs, 2011; Chodkiewicz and Boyle, 2016) and this remains an important area of consideration for future research. Both studies found that the effect was somewhat maintained after the termination of the intervention, but little is known regarding the long term maintenance and generalisation of the changes in reading attainment within everyday curriculum learning.

It is also important to note that only two studies were able to demonstrate significant changes in students' attributional profiles (Horner & Gaither, 2004; Sukariyah & Assaad, 2015). Therefore, it is not wise to assume that the improved reading attainment found in the four studies reviewed (Berkeley, Mastropieri & Scruggs, 2011; Bosnjak, Boyle & Chodkiewicz, 2017; Chodkiewicz & Boyle, 2016; Toland & Boyle, 2008) was caused by the participants' change in attributional style, but perhaps by other extraneous variables. These studies all combined the intervention with additional support, either in the form of reading comprehension strategy instruction or CBT techniques. It is possible that these aspects of the intervention may have had a greater influence on reading attainment than the AR components of the intervention. Future research should consider using a wider array of measures to investigate the potential mediating factors between AR and reading attainment.

Despite some uncertainty around the underlying mechanisms leading to improved reading attainment, there appears to be some potential educational significance for an AR intervention for this purpose. These interventions were implemented with relative ease, using minimal resources and with appropriate training, successfully delivered by existing teaching staff (Berkeley, Mastropieri & Scruggs, 2011). The availability of a manual (Boyle & Chodkiewicz, 2015) also increases the feasibility of school implementation. Additionally, the underlying principles of AR do not require constant, explicit instruction in order to be embedded in classroom learning, meaning after the initial phase of delivery, teachers could continue providing attributional feedback as part of their everyday teaching.

The current evidence suggests that AR may be an appropriate intervention for raising attainment in reading, but not for maths or spelling. The research demonstrates that it can be a flexible intervention, used with a range of age groups, a variety of group sizes, and differing durations and frequencies. There remains a

need for further, longitudinal research to investigate the influence of the intervention on other academic disciplines.

## References and appendices

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**Appendix A: Articles excluded at full text screening**

Excluded studies	Excluded by criteria
<p>Ashouri, M., Tajrishi, M. P. R., Abkenar, S. S. J., &amp; Ashouri, J. (2012). The effectiveness of learning strategies and attribution retraining instruction methods on mathematical problem solving in intellectually disabled students. <i>Developmental Psychology: Journal of Iranian Psychologists</i>, 8(31), 247–256.</p>	<p>3 - The article is not written in English.</p>
<p>Boese, G. D. B., Stewart, T. L., Perry, R. P., &amp; Hamm, J. M. (2013). Assisting failure-prone individuals to navigate achievement transitions using a cognitive motivation treatment (attributional retraining). <i>Journal of Applied Social Psychology</i>, 43(9), 1946–1955. <a href="http://dx.doi.org/10.1111/jasp.12139">http://dx.doi.org/10.1111/jasp.12139</a></p>	<p>6 - The participants are not school aged (Over 18)</p>
<p>Dresel, M., &amp; Ziegler, A. (2006). Long-term enhancement of academic self-concept and implicit ability theory through computer-based attribution feedback. <i>Langfristige Forderung von Fahigkeitsselbstkonzept Und Impliziter Fahigkeitstheorie Durch Computerbasiertes Attributionales Feedback.</i>, 20(1–2), 49–63. <a href="http://dx.doi.org/10.1024/1010-0652.20.12.49">http://dx.doi.org/10.1024/1010-0652.20.12.49</a></p>	<p>3 – The article is not written in English.</p>
<p>Kolic-Vehovec, S. (2002). Self-monitoring and attribution training with poor readers. <i>Studia Psychologica</i>, 44(1), 57–68.</p>	<p>5 – The article does not include Attribution Retraining in one of the intervention conditions.</p>
<p>Lavasani, M. G., Sharifian, M. S., Naghizadeh, S., &amp; Hematirad, G. (2012). The effect of attribution retraining on academic achievement. In Baskan, GA and Ozdamli, F and Kanbul, S and Ozcan, D (Ed.), <i>4th world conference on educational sciences (WCES-2012)</i> (Vol.</p>	<p>8 – The study has no outcome measures assessing Academic Attainment in literacy and numeracy.</p>

Excluded studies	Excluded by criteria
<p>46, pp. 5845–5848). Acad World Educ &amp; Res Ctr; Near E Univ; Bahcesehir Univ; Ankara Univ; Hacettepe Univ; Cyprus Educ Sci Assoc. <a href="https://doi.org/10.1016/j.sbspro.2012.06.526">https://doi.org/10.1016/j.sbspro.2012.06.526</a></p>	
<p>Mahmoodi, M. H., &amp; Doosti, M. (2018). Investigating the Effects of Attributional Retraining Procedures on High School Students' Foreign Language Causal Attributions and their Foreign Language Achievement. <i>Journal of language teaching and learning</i>, 8(2), 28–44.</p>	<p>8 - The study has no outcome measures assessing Academic Attainment in literacy and numeracy.</p>
<p>Yeager, D. S., Purdie-Vaughns, V., Garcia, J., Apfel, N., Brzustoski, P., Master, A., Hessert, W. T., Williams, M. E., &amp; Cohen, G. L. (2014). Breaking the cycle of mistrust: Wise interventions to provide critical feedback across the racial divide. <i>Journal of Experimental Psychology: General</i>, 143(2), 804–824. <a href="http://dx.doi.org/10.1037/a0033906">http://dx.doi.org/10.1037/a0033906</a></p>	<p>5 - The article does not include Attribution Retraining in one of the intervention conditions.</p>
<p>Ziegler, A., &amp; Heller, K. A. (2000). Effects of an attribution retraining with female students gifted in physics. <i>Journal for the Education of the Gifted</i>, 23(2), 217–243.</p>	<p>8 - The study has no outcome measures assessing Academic Attainment in literacy and numeracy.</p>
<p>Ziegler, A., &amp; Stoeger, H. (2004). Evaluation of an attributional retraining (modeling technique) to reduce gender differences in chemistry instruction. <i>High Ability Studies</i>, 15(1), 63–83.</p>	<p>8 - The study has no outcome measures assessing Academic Attainment in literacy and numeracy.</p>

**Appendix B: Summary of studies included in the review**

<b>Authors, date title and aim</b>	<b>Country and setting</b>	<b>Research Design</b>	<b>Participants</b>	<b>Intervention</b>	<b>Outcome Measures</b>	<b>Key Findings</b>
<p><b>Authors:</b> Bosnjak, Boyle &amp; Chodkiewicz (2017)</p> <p><b>Title:</b> An intervention to retrain attributions using CBT: A pilot study.</p> <p><b>Aim:</b> To investigate the effect of an AR program appended via CBT on academic achievement.</p>	<p><b>Country:</b> Australia</p> <p><b>Setting:</b> One 9<sup>th</sup> Grade cohort from a single school.</p>	<p><b>Design:</b> Randomised Controlled Trial.</p> <p><b>Data collection Points:</b></p> <ol style="list-style-type: none"> <li>1. Pre-test.</li> <li>2. Post-test</li> </ol> <p><b>Groups:</b> Random allocation.</p> <p>Intervention (n=8; 2 females, 6 males).</p> <p>Control (n = 8; 1 female, 7 males).</p>	<p><b>Sample size:</b> 16</p> <p><b>Age:</b> 14-16 Years Old</p> <p><b>Gender:</b> Female = 19% Male = 81%</p> <p><b>Ethnicity:</b> All spoke English without difficulty and belonged to a variety of backgrounds.</p> <p><b>Selection:</b> Students identified by support staff based on perceived difficulties with motivation and unjustified scholastic performance.</p>	<p><b>Interventionist:</b> Researcher.</p> <p><b>Intervention details:</b> An attribution retraining program, using CBT principles.</p> <p><b>Delivery:</b> Six 75 minute sessions, delivered weekly.</p> <p><b>Material and/or protocol:</b> Follows structure/guidelines from Chodkiewicz and Boyle (2015), and Toland and Boyle (2008), with some materials adapted from Stallard (2002).</p> <p>Delivered via presentations, group discussions, quizzes, worksheets and homework tasks.</p> <p><b>Control activity:</b> No-intervention.</p>	<p><b>Reading achievement - Wechsler Individual Achievement Test, 2nd Edition, Abbreviated (WIAT-II-A)</b></p> <p><b>Maths achievement - Wechsler Individual Achievement Test, 2nd Edition, Abbreviated (WIAT-II-A)</b></p> <p><b>Spelling achievement - Wechsler Individual Achievement Test, 2nd Edition, Abbreviated (WIAT-II-A)</b></p>	<p><b>Findings:</b> AR program resulted in significantly larger gains in reading achievement post-intervention, as compared to a control group, but not for spelling or maths.</p>

<b>Authors, date title and aim</b>	<b>Country and setting</b>	<b>Research Design</b>	<b>Participants</b>	<b>Intervention</b>	<b>Outcome Measures</b>	<b>Key Findings</b>
<p><b>Authors:</b> Berkeley, Mastropieri &amp; Scruggs (2011)</p> <p><b>Title:</b> Reading comprehension strategy instruction and attribution retraining for secondary students with learning and other mild disabilities.</p> <p><b>Aim:</b> To investigate the outcomes of RCS and RCS+AR compared to the repeated reading strategy.</p>	<p><b>Country:</b> USA</p> <p><b>Setting:</b> A diverse middle school and high school, each sanctioned for 'school improvement'.</p>	<p><b>Design:</b> Randomised Controlled Trial.</p> <p><b>Data collection Points:</b></p> <ol style="list-style-type: none"> <li>1. Pre-test.</li> <li>2. Post-test.</li> <li>3. 6-week delayed post-test.</li> </ol> <p><b>Groups:</b> Random allocation.</p> <p>Intervention; RCS+AR (n=20; 5 females, 15 males); RCS (n=19; 8 females, 11 males).</p> <p>Control; RN (n = 20; 6 female, 14 males).</p>	<p><b>Sample size:</b> 59</p> <p><b>Age:</b> Mean Age = 14.5 Years Old (Grades 7-9)</p> <p><b>Gender:</b> Female = 32% Male = 68 %</p> <p><b>Ethnicity:</b> African American = 49% Hispanic = 39% White = 12%</p> <p>English as a Second Language = 27%</p> <p><b>Selection:</b> Students with disabilities in each of seven existing English or accelerated reading classes were stratified by class and randomly assigned to one of three conditions.</p>	<p><b>Interventionist:</b> 7 randomly assigned instructors; 2 special education reading teachers, 2 trained researchers and a reading specialist.</p> <p><b>Intervention details:</b> An attribution retraining program, combined with reading comprehension strategy instruction.</p> <p><b>Delivery:</b> 12x 30 minute sessions over 4 weeks (20 minutes of RCS then 10 minutes of AR or read aloud).</p> <p><b>Material and/or protocol:</b> Lessons follow sequence of (a) teacher modelling, (b) guided practice, and (c) independent practice.</p> <p><b>Control activity:</b> 12x 30 minute sessions over 4 weeks (20 minutes of RN then</p>	<p><b>Comprehension summarization test.</b> Criterion-referenced comprehension summarization test including generic summary questions about a passage (adapted from Mastropieri et al., 2001)</p> <p><b>Passage-specific content test.</b> Developed by the researcher. Consisted of 10 production items and 10 identification items Used as an indicator of student ability to recall specific factual</p>	<p><b>Findings:</b> Both RCS groups led to significantly larger improvements in reading comprehension compared to a control.</p> <p>No significant difference between the RCS+AR condition and RCS condition.</p> <p>The effects for students who received AR persisted more strongly after instruction ended.</p>

<b>Authors, date title and aim</b>	<b>Country and setting</b>	<b>Research Design</b>	<b>Participants</b>	<b>Intervention</b>	<b>Outcome Measures</b>	<b>Key Findings</b>
		Total of 21 groups, 7 groups in each condition.		10 minutes of read aloud). RN used a repeated reading technique.	content information.	
<p><b>Authors:</b> Chodkiewicz &amp; Boyle (2016)</p> <p><b>Title:</b> Promoting positive learning in Australian students aged 10- to 12-years-old using attribution retraining and cognitive behavioral therapy: A pilot study.</p> <p><b>Aim:</b> To investigate how effective an intervention using AR and CBT techniques promote positive learning experiences and outcomes for students.</p>	<p><b>Country:</b> Australia</p> <p><b>Setting:</b> Six inner-city schools.</p>	<p><b>Design:</b> <i>Randomised Controlled Trial.</i></p> <p><b>Data collection Points:</b></p> <ol style="list-style-type: none"> <li>1. Pre-test.</li> <li>2. Post-test.</li> <li>3. 2 month follow up.</li> </ol> <p><b>Groups:</b> Random allocation.</p> <p>Intervention (n=31).</p> <p>Control (n =19).</p>	<p><b>Sample size:</b> 50</p> <p><b>Age:</b> 10-12 Years old; Mean age = 11:1 Years.</p> <p><b>Gender:</b> Female = 40% Male =60%</p> <p><b>Ethnicity:</b> No information provided.</p> <p><b>Selection:</b> 170 students completed the CASQ-R and participants were selected on basis of a 'maladaptive attributional profile'.</p>	<p><b>Interventionist:</b> Researcher.</p> <p><b>Intervention details:</b> An attribution retraining program, using CBT principles.</p> <p><b>Delivery:</b> 8 sessions delivered weekly.</p> <p><b>Material and/or protocol:</b> Using 'Believing you can is the first step to achieving'. Follows a student workbook and completion of home learning sheets.</p> <p><b>Control activity:</b> Remain in regular class.</p>	<p><b>Reading achievement - Wechsler Individual Achievement Test, 2nd Edition, Abbreviated (WIAT-II-A)</b></p> <p><b>Maths achievement - Wechsler Individual Achievement Test, 2nd Edition, Abbreviated (WIAT-II-A)</b></p> <p><b>Spelling achievement - Wechsler Individual Achievement Test, 2nd Edition, Abbreviated (WIAT-II-A)</b></p>	<p><b>Findings:</b> AR group showed significantly greater improvement in reading attainment at post-test, but not for spelling or maths.</p> <p>This effect increased at the two-month period follow up assessment.</p>

<b>Authors, date title and aim</b>	<b>Country and setting</b>	<b>Research Design</b>	<b>Participants</b>	<b>Intervention</b>	<b>Outcome Measures</b>	<b>Key Findings</b>
<p><b>Authors:</b> Sukariyah &amp; Assaad (2015)</p> <p><b>Title:</b> The Effect of Attribution Retraining on the Academic Achievement of High School Students in Mathematics.</p> <p><b>Aim:</b> To investigate the effect of attribution retraining on high school students' academic performance in mathematics.</p>	<p><b>Country:</b> Lebanon</p> <p><b>Setting:</b> A private school.</p>	<p><b>Design:</b> Pretest-posttest nonequivalent control group design.</p> <p><b>Data collection Points:</b></p> <ol style="list-style-type: none"> <li>1. Pre-test.</li> <li>2. Post-test.</li> </ol> <p><b>Groups:</b> Matched Participant design.</p> <p>Intervention (n=22)</p> <p>Control (n =22)</p>	<p><b>Sample size:</b> 44</p> <p><b>Age:</b> 15-16 Years Old</p> <p><b>Gender:</b> Female = 43% Male = 57%</p> <p><b>Ethnicity:</b> No information provided.</p> <p><b>Selection:</b> 67 students from grades 10 and 11 completed an attribution questionnaire. Participants were assigned to the intervention condition based on their maladaptive attributional profile. The control group was chosen by selectecting an equal number of students matched on math achievement scores.</p>	<p><b>Interventionist:</b> Teachers.</p> <p><b>Intervention details:</b> An attribution retraining program.</p> <p><b>Delivery:</b> Carried out over 4 weeks. Maths teachers asked to provide constructive feedback during intervention period.</p> <p><b>Material and/or protocol:</b> Three phases: 1.Target behaviour in which failure was likely to be attributed to internal and stable causes is identified. 2. Students trained to make more favourable attributions. 3. Efficiency of the training is evaluated by a post-test.</p> <p><b>Control activity:</b> No-intervention.</p>	<p><b>Maths achievement</b></p> <p>Maths test: No details of the test provided.</p> <p>First term maths scores (pre-test) vs third term maths scores (obtained one month after the closure of the training program).</p>	<p><b>Findings:</b> Maths post-test scores and third term maths scores were significantly higher than both pre-test maths scores and first terms maths scores for the AR group.</p> <p>The control group showed no significant improvement in either post-test score.</p>

<b>Authors, date title and aim</b>	<b>Country and setting</b>	<b>Research Design</b>	<b>Participants</b>	<b>Intervention</b>	<b>Outcome Measures</b>	<b>Key Findings</b>
<p><b>Authors:</b> Horner &amp; Gaither (2004)</p> <p><b>Title:</b> Attribution Retraining Instruction with a Second-Grade Class.</p> <p><b>Aim:</b> To investigate the effect of AR embedded in second-grade maths lessons on students' attributional styles and maths scores.</p>	<p><b>Country:</b> USA</p> <p><b>Setting:</b> The classroom setting of one second grade class from a single school.</p>	<p><b>Design:</b> Pretest-posttest nonequivalent control group design.</p> <p><b>Data collection Points:</b></p> <ol style="list-style-type: none"> <li>1. Pre-test.</li> <li>2. Post-test.</li> </ol> <p><b>Groups:</b></p> <p>Intervention (n= 18; 6 females, 12 males).</p> <p>Control (n = 11; 6 female, 5 males).</p>	<p><b>Sample size:</b> 29</p> <p><b>Age:</b> Mean age = 8.0 years (SD = .43).</p> <p><b>Gender:</b> Female = 41% Male = 59%</p> <p><b>Ethnicity:</b> Predominantly African American and lower SES.</p> <p><b>Selection:</b> The whole class participated but were only included in the study if they consented.</p>	<p><b>Interventionist:</b> Researcher.</p> <p><b>Intervention details:</b> An attribution retraining program, embedded in regular maths lessons.</p> <p><b>Delivery:</b> A 45 minute session each day for 8 consecutive days.</p> <p><b>Material and/or protocol:</b> Each session involves four components; 1. Specific strategy review. 2. Modelling and guided discussion (including self-talk). 3. Individual practice using the specific strategy modelled and the self-talk, 4. Effort feedback.</p> <p><b>Control activity:</b> Received 'Maths Only Instruction' (MOI) in their regular lessons, delivered by their regular classroom teacher.</p>	<p><b>Maths Achievement</b></p> <p>The curriculum unit review. A 7 question test in a whole class setting. Standardized procedure by the author introducing the test.</p>	<p><b>Findings:</b> There was no significant change in maths scores from pre-test to post-test.</p>

<b>Authors, date title and aim</b>	<b>Country and setting</b>	<b>Research Design</b>	<b>Participants</b>	<b>Intervention</b>	<b>Outcome Measures</b>	<b>Key Findings</b>
<p><b>Authors:</b> Toland &amp; Boyle (2008)</p> <p><b>Title:</b> Applying Cognitive Behavioural Methods to Retrain Children’s Attributions for Success and Failure in Learning.</p> <p><b>Aim:</b> To investigate the effect of a program aiming to change the ways in which students think about success and failure on motivation and attainment.</p>	<p><b>Country:</b> Scotland</p> <p><b>Setting:</b> 4 Scottish Schools.</p>	<p><b>Design:</b> One group pretest-posttest design.</p> <p><b>Data collection Points:</b></p> <ol style="list-style-type: none"> <li>1. Pre-test.</li> <li>2. Post-test.</li> </ol> <p><b>Groups:</b> Intervention (n=29)</p> <p>No control group.</p>	<p><b>Sample size:</b> 29</p> <p><b>Age:</b> 10-12 Years Old</p> <p><b>Gender:</b> No details provided.</p> <p><b>Ethnicity:</b> No Details provided.</p> <p><b>Selection:</b> Children with learning difficulties and/or motivational and self-esteem difficulties identified and nominated by their schools.</p>	<p><b>Interventionist:</b> Researchers.</p> <p><b>Intervention details:</b> An attribution retraining program, using CBT principles.</p> <p><b>Delivery:</b> Twelve 30-minute group sessions with an educational psychologist (groups of 5, every fortnight over a 6 month period).</p> <p><b>Material and/or protocol:</b> Children were taught the link between thoughts, feelings and actions using discussion, modelling, role play and work sheets. Sessions used a review, application and homework structure. Methods based on three main sources: 1. Techniques suggested by Seligman (1995) on changing childrens’ explanatory styles. 2. The structure suggested by Squires (2001) 3. Material adapted from Stallard (2002).</p>	<p><b>Reading Attainment:</b> British Abilities Scale</p> <p><b>Spelling Attainment:</b> British Abilities Scale</p>	<p><b>Findings:</b> Children in the intervention showed a significant increase in reading attainment, but it was found to have a small effect size.</p> <p>There was no significant effect on spelling attainment.</p>

**Appendix C: Criteria and rationale for all WoE Ratings**

**Weight of Evidence A: Methodological Quality**

Weight of Evidence A (WoE A) provides a judgement of the methodological quality of each study included in the review (Gough, 2007). An adapted version of Kratochwill’s (2003) ‘Group based-design coding protocol’ was used. These adaptations were made by removing individual components of the protocol that were not deemed relevant to the studies included in the current review question.

Each study was critically assessed for its methodological quality using this protocol and were given a rating of ‘no evidence’ (0), ‘low’ (1), ‘medium’ (2), or ‘high’ (3). The components assessed in the protocol included: measurement, comparison group, identifiable intervention components, implementation fidelity and follow up assessments. An average of each score was calculated to achieve an overall WoE A score.

*Criteria for Weight of Evidence A*

Criteria	No Evidence - 0	Weak Evidence - 1	Promising Evidence - 2	Strong Evidence - 3
A. Measurement	- Outcome measures demonstrate a reliability coefficient of $\leq .50$ . - Data collected using a single method and source.	- Outcome measures (at least 50%) demonstrate a reliability coefficient of $\geq .50$ . - Data collected using a single method and source.	- Outcome measures (at least 75%) demonstrate a reliability coefficient $\geq .70$ . - Data collected using multiple methods and/or multiple sources.	- Outcome measures demonstrate a reliability coefficient of $\geq .85$ . - Data collected using multiple methods and from multiple sources.
B. Comparison Group	- No steps taken to establish group equivalence.	- At least one comparison group. At least one of the following: - Counterbalancing of change agents. - Group equivalence established. - Equivalent mortality with low attrition.	- At least one ‘no intervention’ group. At least two of the following: - Counterbalancing of change agents. - Group equivalence established. - Equivalent mortality with low attrition.	- At least one ‘active’ comparison group must be used. - Initial group equivalency must be established (ideally random assignment of participants). - Counterbalancing of

Criteria	No Evidence - 0	Weak Evidence - 1	Promising Evidence - 2	Strong Evidence - 3
				change agents. - Less than 20% attrition.
E.	- There was no evidence of which components were necessary to produce change.	- Demonstrate weak evidence for significant primary outcomes - Use a design that allows for an analysis which identifies specific components - The analysis must provide evidence that at least 25% of the identified intervention components were necessary to produce change in the primary outcomes.	- Demonstrate promising evidence for significant primary outcomes - Use a design that allows for an analysis which identifies specific components - The analysis must provide evidence that at least 50% of the identified intervention components were necessary to produce change in the primary outcomes.	- Demonstrate strong evidence for significant primary outcomes - Use a design that allows for an analysis that identifies specific components - The analysis must provide evidence that all identified intervention components were necessary to produce change in the primary outcomes.
F. Implementation Fidelity	- No evidence of acceptable implementation fidelity or evidence of unacceptable implementation	- Study must demonstrate evidence of acceptable adherence. - Evidence of acceptable adherence requires either a training	- Study demonstrates evidence of acceptable adherence. - Evidence of acceptable adherence requires a training session in	- Study demonstrates strong evidence of acceptable adherence. - Evidence of acceptable adherence requires a training session in

Criteria	No Evidence - 0	Weak Evidence - 1	Promising Evidence - 2	Strong Evidence - 3
	tation fidelity.	session or one of the following: - Supervision, coding intervention sessions, or audio/video tapes, and use of a manual.	addition to at least one of the following: - Supervision, coding intervention sessions, or audio/video tapes, and use of a manual.	addition to at least two of the following: - Supervision, coding intervention sessions, or audio/video tapes, and use of a manual.
I.	Follo w-up	- No follow up assessm ent was built into the study.	- The study conducted follow up assessmen ts at least once (e.g., 6 months), with some participants from the original sample.	- The study conducted follow up assessmen ts at least once (e.g., 6 months), with the majority of participants that were included in the original sample, using similar measures used to analyse data from primary or secondary outcomes.

*Summary of Weight of Evidence A ratings for included studies*

Study	A Measurement	B Comparison group	E Identifiable Components	F Impleme- ntation Fidelity	I. Follow Up	Wo E A
Bosnjak, Boyle & Chodkiewi cz (2017)	2	2	1	1	0	1.2
Berkeley, Mastropier i & Scruggs (2011)	2	3	1	3	3	2.4
Chodkiewi cz & Boyle (2016)	2	2	1	2	3	2.0
Sukariyah & Assaad (2015)	1	2	0	1	0	0.6
Horner & Gaither (2004)	1	2	0	1	0	0.6
Toland & Boyle (2008)	3	0	1	1	0	1.0

**Weight of Evidence B: Methodological Relevance**

WoE B seeks to determine the methodological relevance of the reviewed studies, by evaluating the type of evidence and its appropriateness in relation to the literature review question. The criteria for making these judgements was based on Petticrew and Roberts (2003) findings on the type of studies most suited for ‘effectiveness’ questions. The criteria for ‘low’ (1), ‘medium’ (2) and ‘high’ (3) are outlined in the table below:

*Criteria for Weight of Evidence B ratings*

Criteria	Low - 1	Medium - 2	High - 3
A. Design	Non-experimental design	Non-equivalent groups design	Random allocation to conditions
B. Control/comparison group	One group only design	At least one 'no-intervention' control or comparison group	At least one 'active' control or comparison group, receiving an alternative intervention
C. Data collection points	Outcomes are measured post intervention only	Outcomes measured at pre- and post-intervention for only one group	Outcomes measured at pre- and post-intervention for both/all groups
D. Outcome measures	Outcomes measures are existing assessments of literacy and numeracy or have not been clearly described	Outcomes measures are non-standardised assessments of literacy and numeracy, but have been clearly described	Outcomes measures are standardised assessments of literacy and numeracy
E. Details of intervention	Neither the intervention procedure or control activity has been clearly described	Intervention procedure is described in detail, but the comparison activity has not been clearly described	Intervention procedure and comparison group activity has been described in detail

*Summary of Weight of Evidence B ratings for included studies*

Authors	Criteria Rating					WoE B
	A	B	C	D	E	
Bosnjak, Boyle & Chodkiewicz (2017)	3	2	3	3	2	2.6

*Summary of Weight of Evidence B ratings for included studies*

Authors	Criteria Rating					WoE B
	A	B	C	D	E	
Berkeley, Mastropieri & Scruggs (2011)	3	3	3	2	3	2.8
Chodkiewicz & Boyle (2016)	3	2	3	3	3	2.8
Sukariyah & Assaad (2015)	2	2	3	1	2	2.0
Horner & Gaither (2004)	2	2	3	1	2	2.0
Toland & Boyle (2008)	1	1	2	3	2	1.8

**Weight of Evidence C: Topic Relevance**

Weight of Evidence C (WoE C) is a review-specific evaluation. It seeks to evaluate how relevant the focus of the study is in relation to the review question. Studies were rated on five areas: intervention, outcomes, setting, implementation and instructors.

*Criteria for Weight of Evidence C ratings*

Criteria	Ratings	Rationale
A. Intervention	3- Attribution retraining is the primary intervention or the core feature of the main intervention condition. 2- Attribution retraining is combined with another intervention. 1- Attribution retraining is the secondary or tertiary intervention.	As many studies combine attribution retraining with other interventions, it is important to understand how significant of a feature attribution retraining was in the intervention condition.
B. Outcomes	3- Outcomes have been measured using a standardised assessment of literacy or numeracy. 2- Outcomes have been measured using a teacher/instructor constructed assessment of literacy and numeracy. 1- Outcomes have been measured using an assessment that indirectly measures literacy and numeracy.	This questions focuses on the effect of attribution retraining on literacy and numeracy attainment, so outcome measures must be relevant to attainment in these two disciplines. Standardised and/or validated measures will produce a more accurate portrayal of literacy and numeracy attainment.
C. Setting	3- The intervention was conducted in a classroom setting. 2- The intervention was carried out in a separate location within a school. 1- The intervention was carried out in a non-school setting such as a psychology lab or office.	As the intervention is intended to be used in school, the study should also take place in a realistic school setting in order for results to be generalised.
D. Implementation	3- The intervention involves direct attributional feedback, instruction, practice and consolidation. 2- The intervention involves direct attributional feedback. 1- The intervention involves indirect attributional feedback through modelling, face-to-face or via video.	Attribution retraining does not have clear implementation guidelines but it does contain some key elements that should be included. The level of which these features are included will impact how closely the study reflects how attribution

*Criteria for Weight of Evidence C ratings*

Criteria	Ratings	Rationale
		retraining will be implemented in practice.
E. Instructor	3- The intervention is delivered by a member of the teaching staff who has been trained in Attribution Retraining. 2- The intervention is delivered by a researcher who has been trained in Attribution Retraining. 1- The intervention is delivered by an individual who has received minimal training in attribution retraining.	The intervention is intended to be delivered in schools and by trained school staff, so if the study does so it will more closely reflect the how attribution retraining will be implemented in practice. If the instructor has not been trained then the intervention is unlikely to be effective in retraining attributions.

*Summary of Weight of Evidence C ratings for included studies*

Authors	Criteria Rating					WoE C
	A Intervention	B Outcomes	C Setting	D Implement-ation	E instructor	
Bosnjak, Boyle & Chodkiewicz (2017)	3	3	2	3	2	2.6
Berkeley, Mastropieri & Scruggs (2011)	1	2	2	2	3	2
Chodkiewicz & Boyle (2016)	3	3	2	3	2	2.6
Sukariyah & Assaad (2015)	3	1	3	2	3	2.4
Horner & Gaither (2004)	3	2	2	3	2	2.4

*Summary of Weight of Evidence C ratings for included studies*

Authors	Criteria Rating					WoE C
	A Intervention	B Outcomes	C Setting	D Implement- ation	E instructor	
Toland & Boyle (2008)	3	3	2	3	2	2.6

**Weight of Evidence D: Overall Weight of Evidence**

Weight of Evidence D (WoE D) is determined by calculating the average rating of WoE A, B and C for each study and provides a judgement of the overall weight of evidence. The WoE D rating determines the extent to which a study contributes evidence to answering the review question. A rating of 1-1.6 is considered 'low', a rating of 1.7-2.3 is considered 'medium', while a rating of 2.4-3 is considered high.

*Overall Weight of Evidence for included studies*

Authors	WoE A: Methodological quality	WoE B: Methodological relevance	WoE C: Topic relevance	WoE D: Overall weight of evidence
Bosnjak, Boyle & Chodkiewicz (2017)	1.2	2.6	2.6	2.1 (medium)
Berkeley, Mastropieri & Scruggs (2011)	2.4	2.8	2.0	2.4 (high)
Chodkiewicz & Boyle (2016)	2.0	2.8	2.6	2.5 (high)
Sukariyah & Assaad (2015)	0.6	2.0	2.4	1.6 (Low)
Horner & Gaither (2004)	0.6	2.0	2.4	1.6 (low)
Toland & Boyle (2008)	1.0	1.8	2.6	1.8 (medium)

**Appendix D: Amendments to the Kratochwill (2003) coding protocol**

Section	Rationale
<b>Removed from coding protocol</b>	
I. B7 & B8	All the studies in this review are quantitative. The removed sections are only relevant for studies analysing qualitative data.
II. C Measures support primary and secondary outcomes	This review is interested in only the primary outcomes of the study.
II. D Educational and clinical significance	This is discussed in the main body of the review.
II. G Replication	This section was not seen as necessary due to the focus of the current review.
II. H Site of Implication	Only school settings were included in this review.
III. D Dosage	The use of dosage was not relevant to this review question.
III. H Cost analysis	Cost analysis was outside the scope of this review. In addition, none of the studies did not provide cost analysis details

## Appendix E: Coding Protocols for WoE A

### Coding Protocol for Group-Based Design

Adapted from Kratochwill, T. R. (2003). Task Force on Evidence Based Interventions in School Psychology. American Psychological Association.

- Domain:
- School and community based intervention programs for social and behavioural problems
  - Academic intervention programs
  - Family and parent intervention programs
  - School-wide and classroom-based programs
  - Comprehensive and coordinated school health services

Name of coder(s): ██████████

Date: 31/01/2020

Full study reference in APA format: **Berkeley, S., Mastropieri, M. A., & Scruggs, T. E. (2011). Reading comprehension strategy instruction and attribution retraining for secondary students with learning and other mild disabilities. *Journal of Learning Disabilities, 44*(1), 18–32. <http://dx.doi.org/10.1177/0022219410371677>**

Study ID Number (Unique Identifier):

- Type of Publication:
- Book/Monograph
  - Journal Article
  - Book Chapter
  - Other (specify):

### I. General Characteristics

#### A. General Design Characteristics

A1. Random assignment designs (if random assignment design, select one of the following)

- A1.1  Completely randomized design
- A1.2  Randomized block design (between-subjects variation)
- A1.3  Randomized block design (within-subjects variation)
- A1.4  Randomized hierarchical design

A2. Nonrandomized designs (if nonrandom assignment design, select one of the following)

- A2.1  Nonrandomized design
- A2.2  Nonrandomized block design (between-participants variation)

A2.3  Nonrandomized block design (within-participants variation)

A2.4  Nonrandomized hierarchical design

A2.5  Optional coding of Quasi-experimental designs

A3. Overall confidence of judgment on how participants were assigned (select one of the following)

A3.1  Very low (little basis)

A3.2  Low (guess)

A3.3  Moderate (weak inference)

A3.4  High (strong inference)

A3.5  Very high (explicitly stated)

A3.6  N/A

A3.7  Unknown/unable to code

**B. Statistical Treatment/Data Analysis (answer B1 through B6)**

B1. Appropriate unit of analysis  yes  no

B2. Familywise error rate controlled  yes  no  N/A Bonferonni adjustment for multiple comparisons

B3. Sufficiently large N  yes  no

Statistical Test: ANOVA

Level: .05

ES: Large

N required: 21

B4. Total size of sample (start of the study): 59

B5. Intervention group sample size: 20+19

B6: Control group sample size: 20

**C. Type of Program (select one)**

C1.  Universal prevention program

C2.  Selective prevention program

C3.  Targeted prevention program

C4.  Intervention/Treatment

C5. Unknown

**D. Stage of the Program (select one)**

D1. Model/demonstration programs

D2. Early stage programs

D3. Established/institutionalized programs

D4. Unknown

**E. Concurrent or Historical Intervention Exposure (select one)**

E1. Current exposure

E2. Prior exposure

E3. Unknown

**II. Key Features for Coding Studies and Rating Level of Evidence**

**(3=Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence)**

**A. Measurement (answer A1 through A4)**

A1. Use of outcome measures that produce reliable scores for the majority of primary outcomes. The table for Primary/Secondary Outcomes Statistically Significant allows for listing separate outcomes and will facilitate decision making regarding measurement (select one of the following)

A1.1  Yes

A1.2  No

A1.3 Unknown/unable to code

A2. Multi-method (select one of the following)

A2.1 Yes

A2.2 No

A2.3 N/A

A2.4 Unknown/unable to code

A3. Multi-source (select one of the following)

A3.1 Yes

A3.2  No

A3.3  N/A

A3.4  Unknown/unable to code

A4. Validity of measures reported (select one of the following)

A4.1  Yes

A4.2  No

A4.3  Unknown/unable to code

**Rating for Measurement (select 0, 1, 2, or 3):**

0  1  2  3

## **B. Comparison Group**

B1. Type of Comparison Group (select one of the following)

B1.1  Typical contact

B1.2  Typical contact (other) specify:

B1.3  Attention placebo

B1.4  Intervention elements placebo

B1.5  Alternative intervention

B1.6  Pharmacotherapy B1.1

B1.7  No intervention

B1.8  Wait list/delayed intervention

B1.9  Minimal contact B1.10  Unable to identify comparison group

**Rating for Comparison Group (select 0, 1, 2, or 3):**  3  2  1  0

B2. Overall confidence rating in judgment of type of comparison group  
(select one of the following)

B2.1  Very low (little basis)

B2.2  Low (guess)

B2.3  Moderate (weak inference)

B2.4  High (strong inference)

B2.5  Very high (explicitly stated)

B2.6  Unknown/Unable to code

B3. Counterbalancing of Change Agents (answer B3.1 to B3.3)

B3.1  By change agent

B3.2  Statistical

B3.3  Other

B4. Group Equivalence Established (select one of the following)

B4.1  Random assignment

B4.2  Posthoc matched set

B4.3  Statistical matching

B4.4  Post hoc test for group equivalence

B5. Equivalent Mortality (answer B5.1 through B5.3)

B5.1  Low Attrition (less than 20% for Post)

B5.2  Low Attrition (less than 30% for follow-up)

B5.3  Intent to intervene analysis carried out Findings

### E. Identifiable Components (answer E1 through E7)

E1. Evidence for primary outcomes (rate from previous code): 3 2 1 0

E2. Design allows for analysis of identifiable components (select one) yes no

E3. Total number of components: n/a

E4. Number of components linked to primary outcomes: n/a

E5. Clear documentation of essential components (select one) yes no

E6. Procedures for adapting the intervention are described in detail (select one)  
yes no

E7. Contextual features of the intervention are documented (select one) yes no

**Rating for Identifiable Components (select 0, 1, 2, or 3): 3 2 1 0**

### F. Implementation Fidelity

F1. Evidence of Acceptable Adherence (answer F1.1 through F1.3)

F1.1  Ongoing supervision/consultation

F1.2  Coding intervention sessions/lessons or procedures

F1.3  Audio/video tape implementation (select F1.3.1 or F1.3.2):

F1.3.1  Entire intervention

F1.3.2  Part of intervention

F2. Manualization (select all that apply)

F2.1  Written material involving a detailed account of the exact procedures and the sequence in which they are to be used

F2.2  Formal training session that includes a detailed account of the exact procedures and the sequence in which they are to be used

F2.3  Written material involving an overview of broad principles and a description of the intervention phases

F2.4  Formal or informal training session involving an overview of broad principles and a description of the intervention phase

F3. Adaptation procedures are specified (select one)  yes  no  unknown

**Rating for Fidelity (select 0, 1, 2, or 3):**  3  2  1  0

### I Follow Up Assessment

Timing of follow up assessment: 6 weeks

Number of participants included in the follow up assessment: 59

Consistency of assessment method used: same

**Rating for Follow Up Assessment (select 0, 1, 2, or 3):**  3  2  1  0

### III. Other Descriptive or Supplemental Criteria to Consider

#### A. External Validity Indicators

A1. Sampling procedures described in detail  yes  no

A1.1 Inclusion/exclusion criteria specified  yes  no

A1.2 Inclusion/exclusion criteria similar to school practice  yes  no

A1.3 Specified criteria related to concern  yes  no

A2. Participant Characteristics Specified for Treatment and Control Group (modified)

Age / school year

Gender

- SEN diagnostic label
- Ethnicity
- Home language
- Socio-economic background
- Levels of general cognitive abilities (e.g. IQ) WISC-IV
- Levels of maths achievement

A3. Details are provided regarding variables that:

A3.1 Have differential relevance for intended outcomes yes no Specify:

A3.2 Have relevance to inclusion criteria yes no Specify:

**A4. Receptivity/acceptance by target participant population (treatment group)**

Participants from treatment group	Results (what person reported to have gained from participation in the programme)	General rating
<input type="checkbox"/> Child <input type="checkbox"/> Parent <input type="checkbox"/> Teacher <input type="checkbox"/> Other		<input type="checkbox"/> Participants reported benefitted overall from the intervention  <input type="checkbox"/> Participants reported did not benefit overall from the intervention  <input type="checkbox"/> Participants did not report receptivity/acceptance

**A5. Generalization of Effects:**

A5.1 Generalization over time

A5.1.1 Evidence is provided regarding the sustainability of outcomes after intervention is terminated  yes no Specify: 6 week follow up

A5.1.2 Procedures for maintaining outcomes are specified yes no Specify:

A5.2 Generalization across settings

A5.2.1 Evidence is provided regarding the extent to which outcomes are manifested in contexts that are different from the intervention context  yes no Specify:

A5.2.2 Documentation of efforts to ensure application of intervention to other settings yes no Specify:

A5.2.3 Impact on implementers or context is sustained yes no Specify:

**A5.3 Generalization across persons**

Evidence is provided regarding the degree to which outcomes are manifested with participants who are different than the original group of participants for with the intervention was evaluated yes no Specify:

**B Length of Intervention (select B1 or B2)**

B1 Unknown/insufficient information provided

B2 Information provided (if information is provided, specify one of the following:)

B2.1 weeks: 4

B2.2 months: \_\_\_\_

B2.3 years: \_\_\_\_

B2.4 other: \_\_\_\_

**C. Intensity/dosage of Intervention (select C1 or C2)**

C1. Unknown/insufficient information provided

C2. Information provided (if information is provided,  specify both of the following:)

C2.1 length of intervention session 30

C2.2 frequency of intervention session 12 sessions over 4 weeks

**E. Program Implementer (select all that apply)**

E1. Research Staff

E2 School Specialty Staff

E3 Teachers

E4 Educational Assistants

E5 Parents

E6 College Students

E7 Peers

E8 Other

E9 Unknown/insufficient information provided

**F. Characteristics of the Intervener**

- F1  Highly similar to target participants on key variables (e.g., race, gender, SES)
- F2.  Somewhat similar to target participants on key variables
- F3  Different from target participants on key variables

**G. Intervention Style or Orientation (select all that apply)**

- G1  Behavioural
- G2.  Cognitive-behavioural
- G3.  Experiential
- G4  Humanistic/interpersonal
- G5  Psychodynamic/insight oriented
- G6  Other (specify)
- G7  Unknown/insufficient information provided

**Summary of Evidence for Group-Based Design Studies**

Indicator	Overall Evidence NNR= No numerical rating  OR  1-3	Description of Evidence Strong Promising Weak No/limited evidence  Or  Descriptive rating
<b>Key areas of judgement for weight of evidence A</b>		
Measurement	<b>2</b>	<b>Promising</b>
Comparison group	<b>3</b>	<b>Strong</b>
Identifiable Component	<b>1</b>	<b>Weak</b>
Implementation Fidelity	<b>3</b>	<b>Strong</b>
Follow up assessment conducted	<b>3</b>	<b>Strong</b>

<b>Average Quality of Evidence across the Included Judgement Areas</b>	
<b>Σ of X =</b>	<b>2+3+1+3+3/5</b>
<hr style="width: 10%; margin-left: 0;"/>	
<b>N</b>	
X= Individual quality of evidence for each judgement area N= Number of judgement areas	
<b>Overall Rating for Weight of Evidence A: 2.4</b>	

