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A Systematic Review of the Quality of Reporting in Mathematics Meta-Analyses for Students with or at Risk of Disabilities Coding Protocol

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To access the corresponding dataset for this protocol please see: https://doi.org/10.18122/sped_data.1.boisestate

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Abstract

The purpose of this document is to provide readers with the coding protocol that authors used to code 22 meta-analyses focused on mathematics interventions for students with or at-risk of disabilities. The purpose of the systematic review was to evaluate reporting quality in meta-analyses focused on mathematics interventions for students with or at risk of disabilities. To identify meta-analyses for inclusion, we considered peer-reviewed literature published between 2000 and 2020; we searched five education-focused electronic databases, scanned the table of contents of six special education journals, reviewed the curriculum vitae of researchers who frequently publish meta-analyses in mathematics and special education, and scanned the reference lists of meta-analyses that met inclusion criteria. To be included in this systematic review, meta-analyses must have reported on the effectiveness of mathematics-focused interventions, provided a summary effect for a mathematics outcome variable, and included school-aged participants with or at risk of having a disability. We identified 22 meta-analyses for inclusion. We coded each meta-analysis for 53 quality indicators (QIs) across eight categories based on recommendations from Talbott et al. (2018). Overall, the meta-analyses met 61% of QIs and results indicated that meta-analyses most frequently met QIs related to providing a clear purpose (95%) and data analysis plan (77%), whereas meta-analyses typically met fewer QIs related to describing participants (39%) and explaining the abstract screening process (48%). We discuss the variation in QI scores within and across the quality categories and provide recommendations for future researchers so that reporting in meta-analyses may be enhanced. Limitations of the current study are that grey literature was not considered for inclusion and that only meta-analyses were included; this limits the generalizability of the results to other research syntheses (e.g., narrative reviews, systematic reviews) and publication types (e.g., dissertations).

Keywords: meta-analysis, mathematics, intervention, disability

The dataset that accompanies this coding protocol can be found here: https//doi.org/10.18122/sped_data.1.boisestate

Math Meta-Analyses Quality Indicator Coding Manual

Publication Codes

Cell	Variable	Code	Explanation
A	Authors	Name	List all authors' last names
B	Year	Number	Record year of publication
C	Journal	Name	Record journal; Use full name, do not use acronyms

NOTE: For Quality Indicator codes; 0 = the quality indicator was not addressed at all in the meta-analysis; 1 = the quality indicator was somehow addressed in the manuscript.

Quality of Study Focus and Research Questions

Cell	Variable	Code	Explanation
D-I	Clear Research Questions and Conceptualization for the Study	Mark 0, 1 for all variables: • previous research summarized (D) • contribution to the field (E) • define key variables (F) • clearly stated purpose (G) • indicating the types of participants (H) • provide clearly stated research question (J)	Codes defined: D = previous research summarized: previous research is summarized providing a rationale for the current study. D = contribution to the field is specifically noted, such as the unique contribution or how the results will impact researchers or practitioners, or perhaps how the current study addresses the limitations of previous reviews. F = define key variables: key variables aligned with the study are defined (e.g., math difficulty, intervention, learning disability). This is a bit arbitrary depending on what the authors chose to define. Mark 1 if authors operationally defined at least 1 important construct related to either: disability or risk, or the definition of an intervention. G = clearly stated purpose for the review such as formulating new theory, examining the evidence base of an instructional practice or intervention program H = indicating the types of participants who are of interest in the studies and providing information about participants in the introduction (e.g., what is MLD). J = provide clearly stated research question.

Quality of Eligibility: Inclusion and Exclusion Information

Cell	Variable	Code	Explanation
J	Range of Publication	Select **one**: 0 = no 1 = yes	Codes Defined: • there was not a range of publication years provided in the search or inclusion criteria. • There was a range of publication years provided in the search or inclusion criteria.
K	Type of Literature Considered	Select **one**: 0 = authors did not specify 1 = peer-reviewed articles only 2 = peer-reviewed and grey literature	Codes defined: 0 = authors did not specify if they searched peer-reviewed or grey literature 1 = peer-reviewed articles only (also peer-refereed) 2 = peer-reviewed and grey literature (including dissertations, book chapters, conference proposals, technical reports, etc.)
L	Language Requirements	List Language of Publication Requirement	List the languages of publication that were considered, list NA if not mentioned.
M	Math Content Focus (Ind. Variable) is ***Identified in Inclusion/Exclusion Criteria***	Select **one**: 0 = NA; the Ind. Variable is not a math content area 1 = Yes there is a math content area that is the ind. variable BUT it is NOT specified in the inclusion/exclusion. 2 = yes, the independent variable was listed or identified as a math content area AND it is addressed in the inclusion/exclusion criteria.	This code refers to whether or not the author/study simply identified or mentioned the skill or intervention focus that is the independent variable. • NA = the variable of interest is not a math content area, but instead an instructional strategy (e.g., peer tutoring) • 1 = The article either did not specify the type of intervention that is the focus of the meta-analysis, or the meta-analysis was vague and it was not immediately clear what the independent variable was. • 2 = yes, the article makes statements about the focus of the meta-analysis and type of intervention that is the independent variable. For example, the article might state, “The intervention focused on ratio and unit rate concepts.” Or “The independent variable of the included studies was a numeracy intervention.”

N	Math Content Focus (Ind. Variable) is *Operationally Defined* (this could be included in the literature review, purpose, and Method)	Select **one**: 0 = NA; The Ind. Variable of interest in the meta-analysis is not a content focus; but an instructional strategy 1 = No, not reported (the author/article did not provide how their intervention defined the ind. variable) 2 = yes, the author/article provided how their intervention defined the ind. variable	This refers to whether or not the author or article provide how the research team envisioned the concept or skill (ind. Variable) in relation to their own intervention. The article does not have to read, "we **define** ratio as…" but there does need to be text provided for the reader to understand how the research team defined the concept. For a good example of how "broad mathematics intervention" focus is defined, see Stevens et al. (2019). Use NA when the variable of interest is a strategy instead of a content focus (e.g., schema-based instruction).
O	If Ind. Variable is an Instructional Strategy (e.g., SBI, peer tutoring) it is ***Identified in Inclusion/Exclusion Criteria***	Select **one**: 0 = NA; The Ind. Variable of interest in the meta-analysis is not an instructional variable focus; but a content focus 1 = No, the ind. Variable is an instructional feature but it is not identified in the inclusion/exclusion criteria 2 = yes, the author/article provided how their instructional features is identified in the inclusion/exclusion criteria	Similar to the math content focus variables above. If the authors specify that the main focus is on math interventions that use schema-based instruction, peer tutoring, cognitive strategy instruction, etc. the ind. Variable of interest is likely the instructional feature. It could also be a content area (e.g., peer tutoring within word problem solving interventions).
P	If Ind. Variable is an Instructional Strategy (e.g., SBI, peer tutoring) it is Operationally Defined	Select **one**: 0 = NA; no instructional feature as a variable 1 = No, the ind. Variable is an instructional feature but it is operationally defined	Similar to the math content focus variables above. If the authors specify that the main focus is on math interventions that use schema-based instruction, peer tutoring, cognitive strategy instruction, etc. the ind. Variable of interest is likely the instructional feature. It could also be a content area (e.g., peer tutoring within word problem solving interventions).

	this could be included in the literature review, purpose, and Method)	2 = yes, the author/article provided how their instructional features is operationally defined	
Q	***Math*** Outcome Measure (Dep Variable)	Selected **<u>one</u>**: 0 = No math academic outcome measure requirements 1 = Study listed math academic outcome measure requirements	Codes defined as: ● 0 = Study did not specify any outcome measure requirements for inclusion or exclusion specifically related to math academic outcomes (e.g., CBM, computation fluency, achievement, WPS) ● 1 = Study specified outcome measure requirements for inclusion or exclusion that were related to math academic outcomes (e.g., "study must include dependent measure of fraction computation")
R	Grade/Age Code	Selected **<u>one</u>**: 0 = No grade/age requirements 1 = Study listed grade/age requirements	Codes defined as: ● 0 = Study did not specify any grade/age ● 1 = Study specified grade/age requirements for inclusion or exclusion (e.g., 6-12th grade, kindergarten - 6th grade)

S	Participant Disability or Risk Requirements Code	Selected **<u>one</u>**: 0 = Participant Disability or Risk requirement was not specified in the Inclusion Criteria 1 = Disability only required 2 = Risk or low achievement only required 3 = Mix of disability and risk 4 = Mix of disability, risk, or a threshold of disability/risk with typically achieving (this does not refer to mixing different types of disability such as ADHD and LD, it refers to mixing disability OR risk WITH typically achieving or a threshold).	Codes defined as: ● 0 = The inclusion criteria for the meta-analysis did not address disability or risk, but the authors did provide disaggregated results for one of these risk populations. ● 1 = Study specified that only studies with students with disabilities (or a specific type of disability) were included ● 2 = Study specified that only studies with students who were at-risk of disabilities (e.g., reading difficulty) were included ● 3 = Study specified that studies with students with disabilities or who were at-risk of disabilities (e.g., reading difficulty) were included (Note: this may include other categories such as low achieving, struggling learning, or behavior challenge) ● 4 = Study specified that either students with disabilities or at-risk for disabilities were included, as well as typically achieving students
T	Participant **Disability** Criteria	Note **<u>all</u>** that apply related to disability requirement: 0 = Not Applicable 1 = percentile cutoff 2 = school, district, or state criteria 3 = documented 4 = IEP goal 5 = Services in special education setting 6 = Other 7 = Not described	Codes defined as: ● Not applicable = The authors did not include participants with disabilities in their meta-analysis, or the authors did not include disability as inclusion criteria and therefore, it was not addressed. ● Percentile = authors used a percentile to state students had LD, such as performing below the 10th percentile on a measure of math achievement. ● School, district, or state criteria = Authors stated that participants had LD according to criteria ● Documented = Authors stated that the participants had a *documented* disability (e.g., authors confirmed ASD through documentation; generally, not coded with any other category).

		Separate responses using a semi-colon (e.g., "1; 3; 4")	• IEP = Authors stated that the participants that had IEPs goals • Special education setting = Authors stated that students who received special education services or related services in a specific setting (e.g., self-contained, co-taught or inclusive settings, residential school) • Other = Authors used other criteria and specified what criteria were • Not described = Authors stated that students with disabilities were a focus of their study, but the authors did not provide difficulty criteria they used (authors of the meta-analysis may also state that students were identified with MLD, MD, etc. with methods 'as described by the author' although, the specific criteria are still not described).
U	Participant **Difficulty or Risk** Criteria (note: This may also be referred to as "struggling learner" "behavior challenges" or "poor academic skills")	Note **all** that apply: 0 = Not applicable 1 = percentile cut off on a screening test or measure 2 = teacher or parent referral or identification 3 = state test scores/benchmark 4 = Receiving Intervention for outcomes related to risk/difficulty 5 = Other 6 = Not Described Separate responses using a semi-colon (e.g., "1; 3; 4")	Codes defined as: • Not applicable = The authors did not include participants with disabilities in their meta-analysis, or the authors did not include disability as inclusion criteria and therefore, it was not addressed. • Percentile = authors used a percentile to state students had difficulty/risk, such as performing below the 25th percentile on a measure of reading achievement. • Referral = parents or teachers referred students for difficulty in an academic or social/behavior area • State or district criteria = Authors stated that participants had difficulty according to state or district criteria • Receiving Intervention = Authors stated that students were included as at-risk or difficulty due to receiving targeted services • Other = Authors used other criteria and specified what criteria were

			● Not described = Authors stated that students with difficulty or risk were a focus of their study, but the authors did not provide difficulty criteria they used (authors of the meta-analysis may also state that students were identified with MLD, MD, etc. with methods 'as described by the author' although, the specific criteria are still not described).
V	Design Requirements Code	Selected **one**: 0 = No design requirements (must mark 0 for the next code) 1 = Study listed design requirements	Codes defined as: ● 0 = Study did not specify any design requirements for inclusion or exclusion ● 1 = Study specified design requirements for inclusion or exclusion (e.g., group design, randomized control trial, regression discontinuity, single case)

Quality of Search Procedures

Cell	Variable	Code	Explanation
W	Stated Electronic Databases that were searched	Select **one**: 0 = no 1 = yes	Authors stated which electronic library data-bases were searched.
X	Provided the Search Terms	Select **one**: 0 = no 1 = yes	Authors specified which combination of search terms were used for the electronic search.
Y	Search Methods used	Select **all that apply**: 0 = Search not clearly detailed enough to select at least one of the options below. 1 = reference lists of relevant reviews 2 = reference lists of included studies 3 = contact authors or experts in the field	Select as many that apply. Only select "0" if no information about the search methods are provided. Separate responses using a semi-colon (e.g., "1; 3; 4")

		4 = table of contents of relevant journals (maybe referred to as hand search) 5 = forward citation search 6 = other (List other methods)	
Z	Credentials of Searchers	Select **one**: 0 = no 1 = yes	The credentials of the person(s) conducting the search were specified. Note: If the article states something along the lines of "the first author conducted the search" that is not the equivalent of specifying the credentials.
AA	Number of Searchers	Select **one**: 0 = no 1 = yes	The number of people conducting that search was specified.

Quality of Screening Procedures

Cell	Variable	Code	Explanation
AB - AH	Methods to Screening studies for inclusion and exclusion from the review.	Mark 0, 1 for all variables: • number retrieved (AL) • number screened out (AM) • reasons for exclusion (AN) • total eligible studies (AO) • training for screening (AP) • details for reliability of screening process (AQ) • reliability of **screening** process (AR)	Codes defined as: AL = states the number of studies successfully retrieved AM = states the number of studies screened out because they did not meet eligibility criteria AN = provides the reasons the excluded studies were excluded AO = states the total number of studies eligible (included) in the review AP = describes the training and expertise of those who conducted the **screening** process AQ = provides details **for the method** used to resolve any disagreements between screeners (e.g., discussed articles we did not agree on to determine inclusion) AR = reliability or interobserver agreement statistics used to evaluate the consistency of the **screening process** (e.g., provides the agreement % for the screening process)

Quality of Coding Procedures

Cell	Variable	Code	Explanation
AI – AO	Quality of the Coding Scheme	Mark 0, 1 for all variables: • expertise (AS) • training (AT) • double-coded (AU) • the reliability statistics for IRR/IOA (AV) • how/if disagreements were resolved (AW) • description of the coding scheme (AX) • what the coding scheme looked like (AY)	Codes Defined AS = the expertise of researchers who coded studies; Note: If the article states something along the lines of "the first author conducted all coding" that is not the equivalent of specifying the credentials. AT = the training procedures for using the coding scheme AU = the number/% and percent of studies that were double-coded for reliability AV = the reliability statistics used to evaluate the consistency of each domain/category of the coding scheme AW = the procedures used to resolve disagreements; often, this will just be a statement saying that disagreements were resolved via discussion between coders. AX = the authors provided a **brief review** of the variables they coded for (e.g., such as categories or titles of codes) AY = the response categories available for coders to select from (providing a coding sheet might be an example); specific information about how variables of interest were coded such as by providing examples in text (Stevens et al., 2018 is a good example of in text description to this level)

Quality of Reporting Study Quality

Cell	Variable	Code	Explanation
AP; AQ	Study Quality (Did the meta-analysis code the studies for quality?)	Select **one**: 0 = nothing related to quality was reported. 1 = yes, quality was coded for but there were not results presented related to quality 2 = yes, quality was coded for and results were reported	• 0 = Nothing related to study quality was reported. • 1 = study quality was coded for the meta-analysis, but results for quality were not presented. • 2= yes, quality was coded for and results (such as an average quality score or moderator analysis) were reported.

			Note: Quality might be referred to as quality indicators, CEC guidelines, WWC guidelines, evidence-based practice review, and methodological rigor. Methodological rigor means that studies may have been excluded for high attrition, for example, or not being able to appropriately gather results from the study.

Student Participant Demographic Information

Cell	Variable	Code	Explanation
AR	Total *N* Reported	Select **one**: 1 = yes 0 = no	● Yes = the meta-analysis provided the total number of students ● No = the meta-analysis did not provide any information on the total number of students
AS	Grade Range Reported	Select **one**: 1 = yes 0 = no	● Yes = the meta-analysis provided some information on grade or age of participants ● No = the meta-analysis did not provide any information on age or grade of participants
AT	Gender Reported	Select **one**: 1 = yes 0 = no	● Yes = the meta-analysis provided some information on gender of children ● No = the meta-analysis did not provide any information on gender of children
AU	Race Reported	Select **one**: 1 = yes 0 = no	● Yes = the meta-analysis provided some information on race/ethnicity of children ● No = the meta-analysis did not provide any information on race/ethnicity of children
AV	ELL/ESL Reported	Select **one**: 1 = yes 0 = no	● Yes = the meta-analysis provided some information on ELL status of children ● No = the meta-analysis did not provide any information on ELL status of children
AW	SES or FRL Reported	Select **one**: 1 = yes 0 = no	● Yes = the meta-analysis provided some information on SES or FRL status of children ● No = the meta-analysis did not provide any information on SES or FRL status of children

Quality of Data Analysis Plan and Methodological Information

Cell	Variable	Description	Explanation
AX	Quality of Procedures for Data Analysis Plan	Select **one**: 0 = no 1 = yes	The method for aggregating the results (e.g., aggregating effect sizes) in order to describe patterns within the literature was described.
AY	Type of Effect Size	Select **all** that apply: 0 = Not Reported 1 = Cohen's d ES 2 = Hedges g ES 3 = Eta-squared ES 4 = Tau U 5 = PND (percent of non-overlapping data) 6 = PAND (percentage of all non-overlapping data) 7 = SMD (standard mean difference) 8 = IRD (Improvement Rate Difference) 9 = LLR = log response ratio 10 = Phi 11 = PEM (percentage of data points exceeding the median) 12 = Other Separate responses using a semi-colon (e.g., "1; 3; 4")	What type of effect size(s) researchers reported in the meta-analysis, for example, hedges' g Note: codes 1-3 are common for group design studies; codes 4-11 are common for SCD.
AZ	Type of Meta Analytic Method	Select **all** that apply: 0 = Not Reported 1 = fixed effect meta-analysis 2 = random effect meta-analysis 3 = meta regression analysis 4 = moderator analysis 5 = mixed effect analysis	Note. This code refers to whether researchers provide description of analytic methods. In other words, the code refers to which type of meta-analysis analytic method researchers used in the meta-analysis. In order to identify analytic models, look into the meta-analytic model section. For example,

		6 = sensitivity analysis 7 = meta-analysis of single-case design 8 = other Separate responses using a semi-colon (e.g., "1; 3; 4")	"We used a **random-effects meta-regression** model" will be coded as 2 and 3, or "Additional moderator analysis was conducted" will be coded as 4. Another way to identify analytic models is look into the title of tables. For example, "Table 2. Parameter Estimates From RVE **Random-Effects** Model and **Meta-Regression** Correction Methods" will be coded as 2 and 3.
BA	Type of Meta-analysis software	Select **one** code: 0 = Not Reported 1 = R software 2 = Comprehensive Meta-Analysis Software (CMA) 3 = Review Manager (RevMan) 4 = Stata 5 = SAS 6 = JASP 7 = Jamovi 8 = Meta-Essentials 9 = MetaXL 10 = MetaEasy 11 = Other	Note. This code refers to whether researchers provide descriptions of analysis software. To identify software, look into the description of meta-analysis or at the end of the method section. Another way to identify software is to search "software" in search terms in the article. For example, "We calculated ESs using **R software** (version 3.3.0; R Core Team, 2016) for each treatment and comparison contrast on all mathematics- related outcomes" will be coded as 1, and "We used the **Comprehensive Meta-Analysis software** (Borenstein, Hedges, Higgins, & Rothstein, 2006) for data analysis" will be coded as 2.

Quality of the Results

Cell	Variable	Code	Explanation
BB	Publication Bias	Select **one**: 0 = no 1 = yes	This code refers to whether or not authors provided results for publication bias analysis such as the *Classic Fail N* test, a funnel plot, etc. This may be reported in the Method, or in a Supplementary Figure.

BC	Long-term Effectiveness	Select **one**: 0 = no 1 = yes, summary effect (or other analysis) for delayed post-test	This code refers to whether or not authors evaluated summary effects beyond post-test, such as with a delayed post-test analysis.
BD – BF	Interpretation of the Results	Select **all** that apply: 0 = generalizability of the results is discussed 1 = limitations 2 = recommendations or implications Separate codes with a ;	Codes Defined: 0 = authors described the generalizability of the conclusions of the results of the meta-analysis including the relevant student and teacher populations as well as the appropriate contexts and variables of the results. This may also be achieved with authors discussing how their results apply to specific populations or do not generalize; perhaps also by making connections with previous research. 1 = authors directly acknowledged **limitations** of the current study 2 = authors recommended next steps or provided implications of the review for relevant domains such as research, practice, policy, and theory as applicable.