

## Improving Algebra Readiness for Middle School Students: A Literature Review

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What is the effect of mathematics interventions for middle-school students with learning difficulties or disabilities?

- Published 1992-2017
- Published in English
- Participants in grades 6, 7, or 8
- Participants with learning difficulties or mathematics difficulties
- Mathematics intervention

Identified 1,965 studies with 51 meeting all inclusion criteria

nbke)								
Characteristic	<u>n</u>							
Publication year								
1990s	6							
2000s	15							
2010 - 2016	30							
Math content								
Operations	13							
Fractions	6							
Problem solving	28							
General skills	3							
Algebra	4							
Geometry	1							
Instructional group size								
<8	19							
8 or more	33							
Sample size								
<25	24							
25 to 50	10							
51 to 100	4							
>100	10							
Total sessions								
<10	5							
10 to 20	18							
21 to 30	7							
31 to 50	8							
>50	5							
Total hours								
<10	18							
10 to 20	12							
21 to 30	3							
31 to 50	4							
>50	5							

Study	Design	N	Grade	IEP	Math content	Interventionist	Description of conditions; Interventionist	Sessions	Hours 25
Barrett et al. (2011)	Group	15	6, 7, 8	15	Operations, problem	GEN Teacher	T1: chess intervention T2/C: BAU	30	25
(2011)					problem				
Bornfield	SCRD; group	9	7, 8	0	solving Operations, fractions, general skills	Researcher	T1: data-based instruction using CBA data: content derived from	6	2
(1992)	SCKD; group	9	7,8	U	Operations, fractions	Researcher	T1: data-based instruction using CBA data; content derived from error analysis of student work T2/C: CBA-probes only T1: contextualized math instruction	ь	2
(1332)					general skills		T2/C: CRA-prohes only		
Bottge (1999)	Group	36	8	5		GEN Teacher	T1: contextualized math instruction	10	5
bottge (xsss)	огоор				problem solving Operations, problem		T2/C: word problem instruction		
					solving				
Bottge et al. (2001)	Group	75	8	25	Operations,	GEN Teacher, SPED	T1: enhanced anchored instruction, explicit instruction, procedural	10	15
(2001)					problem	Teacher	computation		
							computation T2/C: BAU		
Bottge et al.	Group	335	6, 7, 8	159	Operations,	GEN Teacher	T1: enhanced anchored instruction, explicit instruction, procedural	94	82.25
(2014)					fractions,		computation		
					problem solving		T2/C: BAU		
					solving				
Bottge et al.	Group	471	6, 7, 8	134	Operations,	GEN Teacher	T1: explicit instruction T2/C: BAU	68.5	68.5
(2015)					fractions, problem		T2/C: BAU		
					problem				
Bouck et al.	SCRD	3	6	3	solving Operations	GEN Teacher	T1: computer instruction	16	2.7
(2009)	SCRD	3		3	Operations	GEN TEACHER	T2/C: BALL	16	2.7
Butler et al.	Group	115	6, 7, 8	42	Operations,	SPED Teacher	T1: computer instruction T2/C: BAU T1: CRA	10	7.5
(2003)	0.00p		4,,,0	-	fractions.	5. 65 .656.65	T2/C: BAU		
,,					problem				
					solving Fractions				
Butler (2014)	Group	47	7	26	Fractions	GEN Teacher	T1: enhanced anchored instruction, explicit instruction on	17	n/a
							procedural computation and problem solving		
Cade (2002)	SCRD	3	6, 7, 8	3	Operations,	GEN Teacher	procedural computation and problem solving T1: mnemonic instructional strategy	22	1.8
		57		32	general skills Operations, fractions,	GEN Teachers	T2/C: BAU	38	38
Choo (2017)	Group	57	7,8	32	Operations,	GEN Teachers	T1: enhanced anchored instruction	38	38
					fractions,		T2/C: BAU		
					problem				
Cleary et al.	Group	22	7		solving Operations	GEN Teacher	T1: self-monitoring	28	11.7
(2017)	Огоор	22	,		Operations	GEN TEACHER	T3/C- BALL	20	11.7
Cornelius	Group	45	7,8		Operations	GEN Teacher	T1: direct instruction T2/C: BAU	48	36
(2013)	огоор	45	,,0		Орегистопа	GEN TEMENET	T2/C: BALL	40	30
Crawford et	Group	51	4, 5, 6	22	Operations	Computer	T2/C: BAU T1: computer-based instruction T2/C: BAU	18	12
al. (2016)					-,		T2/C: BAU		
Cuenca Carillo	SCRD	6	6, 7, 8	6	Operations	SPED Teacher		48	13.5
et al. (2015)							T2/C: BAU		
Daniel (2003)	Group	18	6, 7, 8	18	Operations	Researcher	T1: word problem solving	16	8
Darmer (2003)	Group	10	0, 7, 0	10	Operations	Nesearcher	T2/C: BAU	10	
Elissa et al.	Group	31	6	31	Problem	GEN Teacher	T1: differentiated instruction scripted lessons	3	2.1
(2013)	Group	31		31	solving	OLIV reaction	T2/C: BAU	,	4.4
Fletcher et al.	SCRD	3	6, 7, 8	3	Operations	SPED Teacher	T1: explicit instruction on TouchMath	16	2.7
(2010)	50115		0, 1, 0		operations	or co reserver	T2/C: BAU	10	2.17
Flores et al.	Group	30	7		Operations,	GEN Teacher	T1: direct instruction	14	7
(2007)					fractions		T2/C: BAU		
Franklin	Group	189	8		Operations	GEN Teacher	T1: direct instruction with MathConnection	45	41.25
(2016)							T2: BAU with AIMSweb T1: explicit instruction with mnemonics SOLVE strategy		
Freeman-	SCRD	6	8	6	Operations	Researcher	T1: explicit instruction with mnemonics SOLVE strategy	28	17.5
Green et al.									
(2015)									
Harris (2009)	Multiple	43	6, 7	43	Algebra	Researcher	T1: direct instruction, PALS, self-monitoring T2: direct instruction	10	15
	treatment						T2: direct instruction		
Haynes (2011)	SCRD	4	7	4	General skills	Researcher	Phase 1: test-taking strategy instruction	n/a	0.5-
									1.5/sessi
Hunt (2014)	SCRD	3	6, 7, 8		Fractions	Researcher	T1: abstract ration equivalency instruction	45	18.8
		6	8	6	Problem	SPED Teacher	T2/C: BAU T1: schema-based strategy instruction	8	5
Jitendra et al. (2002)	Group	ь	8	ь	solving	SPED Teacher	T2/C: BAU	8	5
(2002) litendra	Group	149	7	15	Problem	GEN Teacher	T1: schema-based instruction	10	6.7
(2009)	огоор	143	,	13	solving	OLIV TEUCHEI	T2/C: BAU	10	0.7
Jitendra	Group	148	7	15	Operations,	GEN Teacher	T1: schema-based instruction with self-monitoring	10	6.7
(2016)					fractions		T2/C: BAU		
(coze)					problem solving Operations,		140.010		
					solving				
Jitendra	Group	399	7		Operations,	GEN Teacher	T1: schema-based instruction	30	23.8
(2017)					tractions,		T1: schema-based instruction T2/C: BAU		
					problem				
					solving Fractions,				
Joseph (2001)	SCRD	3	8	3	Fractions,	SPED Teacher	T1: Self-monitoring cue cards	27	9
					problem		T1: Self-monitoring cue cards T2/C: BAU		
					solving				
Krawec (2013)	Group	77	7,8		Problem	GEN Teacher	T1: Solve It!	31	16.8
					solving		T2/C: BAU		
Maccini	SCRD	3	8		solving Operations,	Researcher	T1: CSA instruction, problem solving strategies with self-monitoring	31	16.8
(2000)					problem		strategies		
		25			solving	GEN Teacher	T2/C: BAU	180	165
Mills (2012)	Group	25	8	25	Operations, fractions,	GEN Teacher	T1: problem solving instruction T2/C: BAU	180	165
					fractions,		TZ/C: BAU		
					problem solving				
					sorving				
Montague	SCRD	6	6, 7, 8	6	Problem	Researcher	T1: cognitive strategy instruction T2: metacognitive strategy instruction	3	2.75
(1992)	SCHO		0, 1, 0		solving	Nescarcher	T2: metacognitive strategy instruction	,	2.75
Montague	Group	72	7,9	24	Operations,	Researcher	T1: direct instruction on problem solving	12	10
(1993)					problem solving		T2: explicit instruction on problem solving T3: combined T1 and T2		
					solving		T3: combined T1 and T2		
Montague	Group	319	8	32	Problem	GEN Teacher	T1: Solve It1	140	128.33
(2011) Montanuo	Group	644	7, 8		solving Problem	GEN Teacher	T2/C: BAU	160	146.67
(2014)	Group	644	7,8		Problem	GEN Teacher	T1: Solve ItI T2/C: BAU	160	146.67
(2014) Monye (2016)	Group	106	7		solving	GEN Teacher	T1: direct instruction	18	13.5
Morrye (2016)	Group	100	,		Operations, problem	GEN reacher	T1: direct instruction T2/C: BAU	18	13.5
					solving				
Moore (2014)	Group	146	6, 7, 8		Operations	GEN Teacher	T1: direct instruction	36	47.9
1410016 (2024)	Group	140	0, 1, 0		Operations	OLIV TEBUTET	T1: direct instruction T2/C: BAU	30	47.3
Murthy (2016)	Group	69	6		Operations,	GEN Teacher	T1: self-monitoring	30	23
, (2020)	аговр				Problem		T2/C: additional instruction		
					solving Problem				
Na (2009)	SCRD	4	6, 7	4	Problem	n/a	Phase 1: problem schemata instruction	4	2.67
					solving		Phase 2: problem solution instruction Phase 1: facilitating students' planning		
Naglieri &	SCRD	19	6, 7, 8	19	Operations,	School	Phase 1: facilitating students' planning	n/a	0.5/sessi
Johnson					fractions	psychologist/teacher			
(2000) O'Melia &									
O'Melia &	Multiple	171	6, 7, 8	68	n/a	Teachers	T1: cooperative homework teams	n/a	n/a
Rosenberg	treatment						T2/C: no cooperative homework teams, all other conditions being		
(1994)	SCRD	_		_	Problem	Researcher	similar		
Root (2016)	SCRD	3	6, 7	3	rroblem	Researcher	Phase 1: modified schema-based instruction	n/a	n/a
r	ccan	_		_	Solving Problem	FOED T	Marie Arramata bandanda arramata arramata		0.771
Sheriff & Boon	SCRD	3	6, 7, 8	3	Problem	SPED Teacher	Phase 1: computer-based word problem solving	n/a	0.33/sess
(2014)	SCRD	3	6, 7, 8		Solving Problem	Researcher	Obere 1: committee explored laster with the district of		0.5/sessi
Shin & Bryant	SCKD	3	6, 7, 8	3	rroblem	Kesearcher	Phase 1: computer-assisted instruction (modeling, guided practice, cognitive, and metacognitive strategies) Phase 1: culturally responsive instruction	n/a	U.5/sessi
(2017) Shumate et al.	SCRD	5	8	5	Solving Algebra;	Teacher	Operative, and metacognitive strategies)	n/a	0.5-
	SCKD	5	8	5	rageora;	reacher	Phase 2: culturally responsive instruction	n/a	
(2012)					geometry		Phase 2: modified culturally responsive instruction (e.g., manipulatives, puzzles, increased number of culturally relevant		0.58/sess
							manipulatives, puzzies, increased number of culturally relevant		
Talbot (2016)	Multiple	27	8	25	Algebra	Teacher	examples) T1: online algebra intervention with virtual manipulatives	15	7.5
. anov. (2016)	Multiple treatment	21		43	regeura	reacher	T2/C: online algebra intervention	15	7.5
van Garderen	SCRD	3	8	3	General skills:	Researcher	T2/C: online algebra intervention Phase 1: explicit instruction about how to generate diagrams	n/a	0.58/sessi
(2007)		,	,	,	Droblom		Phase 2: strategy instruction (one-step word problems)	240	0.50/3633
					solving		Phase 3: strategy instruction (two-step word problems)		
Watt &	Treatment	NR	6	NR	Fractions	Interventionist	T1: pre-teaching and CRA	10	5
Therrien	comparison						Phase 2: strategy instruction (one-step word problems) Phase 8: strategy instruction (one-step word problems) Phase 8: strategy instruction (two-step word problems) T1: pre-teaching and CRA T2/C: supplemental reading group		
(2016)									
Witzel (2005)	Treatment	182	6, 7	49	Algebra	Gen Ed Teacher	T1: CRA	19	15.83
	comparison						T1: CRA T2: direct instruction using abstract equations		

Combination of interventions researched with group and single case design

Majority of interventions used explicit instruction, CRA, self-monitoring, or schema instruction (Gersten et al., 2009)

Majority of interventions focused on operations or problem solving

Need more interventions focused on fractions given importance of fraction knowledge for algebra

Majority of interventions included fewer than 20 sessions and less than 20 hours of additional support

Need more time spent in intervention as middle school students exhibit large gaps in mathematics knowledge

Majority of implementers were general education teachers

Need to ensure that all educators are adequately prepared to teach students with learning difficulties

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