SUPPLEMENTARY MATERIAL

Characteristics	Criteria	Studies	f
Publication year	2002-2008	S1, S5, S6, S9, S13, S20, S28, S30, S35, S42, S43, S46	12
	2009-2015	S10, S12, S16, S17, S19, S21, S25, S27, S29, S31, S33, S34, S36, S38, S41, S45, S47	17
	2016-2022	S2, S3, S4, S7, S8, S11, S14, S15, S18, S22-S24, S26, S32, S37, S39, S40, S44, S48-S50	21
Publication type	Article	S1, S3-S5, S8, S9, S11, S12, S14-S16, S18, S19, S21, S23-S25, S27-S31, S34, S38-S40, S42-S44, S47, S49, S50	32
	Dissertation	S2, S6, S7, S10, S13, S17, S20, S22, S32, S33, S35, S36, S41, S45, S46	15
	Proceedings	S26, S37, S48	3
Sample size	31-100	\$1-\$3, \$5-\$11, \$14-\$16, \$18, \$20-\$23, \$25, \$26, \$28-\$33, \$37, \$38, \$40-\$43, \$45-\$50	38
	101-400	\$4, \$12, \$13, \$17, \$19, \$24, \$27, \$34- \$36, \$39, \$44	12
Grade	K-8	S6, S21, S22, S32, S41, S46-S49	9
	High school	S1-S5, S7, S10-S15, S17, S18, S20, S23- S31, S34, S36-S40, S42, S44, S45, S50	34
	University	S8, S9, S16, S19, S33, S35, S43	7
Academic performance	Achievement	S1-S4, S6, S8-S10, S12-S17, S20-S29, S32, S34-S36, S38-S40, S42, S44, S45, S49, S50	36
	Understanding	S5, S7, S11, S18, S19, S30, S31, S33, S37, S41, S43, S46-S48	14
Type of intervention	Computer-assisted instruction	\$3, \$4, \$8, \$12, \$15, \$21, \$23, \$25, \$27, \$28, \$32, \$34, \$45	13
	Concept map	S2, S38	2
	Conceptual change	S20, S30, S33, S35, S47, S50	7
	Constructivist learning environment	S5, S24, S46	3
	Cooperative learning	S1, S9, S11	3

Table S1 Characteristics of the studies included in the meta-analysis

Enrich enviror differen	ed learning ment with nt techniques	S13, S19, S26, S29, S31, S41	6
Inquiry	-based learning	S14, S16, S18, S22, S40	5
Multip	le representation	S39, S48	2
Other	Context-based learning	S10	9
	Discovery learning model equipped re- lyric songs	\$37	_
	Drama-assisted instruction	S49	
	Enriched text	S44	
	Explain and integration ideas	S43	
	Learning styles	S17	-
	Modelling	S7	_
	Multiple intelligence	S6	
	Problem-based learning	S42	
	Remedial learning system	S36	

S1-Acar & Tarhan (2008); S2-Adane (2020); S3-Adherr et al. (2019); S4- Anekwe & Opara (2021); S5-Atasoy et al. (2003); S6-Bayrak (2005); S7-Chan (2016); S8-da Silva Júnior et al. (2020); S9-Doymuş (2008); S10-Ekinci (2010); S11-Eymur & Geban (2017); S12-Frailich et al. (2009); S13-Genel (2008); S14-Ginting & Juniar (2022); S15- Gongden et al. (2020); S16-Ikenna (2015); S17-İnal (2013); S18-Iryani et al. (2021); S19-Karacop & Doymus (2013); S20-Kılıç (2007); S21-Kırılmazkaya et al. (2014); S22-Korkman (2018); S23-Kuit & Osman (2021); S24-Mercy et al. (2019); S25-Mondal (2012); S26-Munawarah et al. (2020); S27-Okorie (2015); S28-Özmen (2008); S29-Özmen et al. (2009); S30-Pabuçcu & Geban (2006); S31-Pabuçcu & Geban (2012); S32-Pamuk (2018); S33-Sarı (2013); S34-Sentongo et al. (2013); S35-Sevim (2007); S36-Sharma (2015); S37-Side et al. (2020); S38-Singh & Moono (2015); S39-Sunyono & Meristin (2018); S40-Suyanti & Sormin (2016); S41-Şeker (2012); S42-Tarhan et al. (2008); S43-Teichert & Stacy (2002); S44-Tsaparlis et al. (2018); S45-Ulusoy (2011); S46-Uzuntiryaki (2003); S47-Ültay (2015); S48-Widarti & Marfu'ah (2019); S49-Yıldırım et al. (2018); S50-Zorluoğlu & Sözbilir (2016).

Figure S1. Forest plot of the papers included in the meta-analysis

Study name	Subgroup within study			Statistics fo	or each s	tudy			Hedges's g and 95% Cl
		Hedges's	Standard		Lower	Upper	-		
		9	error	Variance	limit	limit	Z-Value	p-Value	
Acar and Tarhan (2008)	1,000	2,698	0.364	0,132	1.985	3,410	7.422	0.000	
Adane (2020)	1,000	1,324	0,223	0,050	0,888	1,781	5,945	0,000	
Adherr et al. (2019)	1,000	1,051	0,310	0,096	0.443	1,658	3,388	0.001	
Anekwe and Opara (2021)	1,000	2,663	0,193	0.037	2,286	3,041	13,833	0,000	
Atasoy et al. (2003)	1,000	0.049	0,221	0.049	-0.384	0,481	0,220	0.826	
Bayrak (2005)	1,000	0,606	0,261	0,068	0,095	1,117	2,325	0,020	
Chan (2016)	1,000	0,021	0,323	0,104	-0,612	0,654	0,065	0,948	
da Silva et al. (2020)	1,000	0.031	0,218	0,047	-0.393	0,458	0,145	0,885	
Doymus (2008)	1,000	0,910	0,180	0,032	0,557	1,263	5,056	0,000	
Ekinci (2010)	1,000	1,180	0,190	0,036	0.808	1,552	6,211	0,000	
Eymur and Geban (2017)	1,000	2,817	0,331	0,110	2,168	3,485	8,512	0,000	
Frailich et al. (2009)	1,000	0,758	0,139	0,019	0,485	1,031	5,445	0,000	
Genel (2008)	1,000	1,686	0,147	0,022	1,398	1,974	11,474	0,000	
Ginting and Juniar (2022)	1,000	0,544	0,260	0,087	0,035	1,052	2,093	0,036	
Gongden et al. (2020)	1,000	2,787	0,320	0,105	2,148	3,427	8,045	0,000	
Ixenna (2014)	1,000	0,058	0,227	0,052	0,212	1,103	2,891	0,004	
inal (2013)	1,000	0,626	0,190	0,036	0,254	0,998	3,298	0,001	
inyani et al. (2021)	1,000	0,093	0,244	0,059	0,215	1,170	2,844	0,004	
Karacop and Doymus (2013)	1,000	0,782	0,231	0,053	0,310	1,215	3,301	0,001	
Karacop and Doymus (2013)	2,000	0,779	0,236	0,056	0,317	1,242	3,302	0,001	
Kilic (2007)	1,000	1,266	0,312	0,097	0,854	1,877	4,058	0,000	
Kirilmazkaya et al. (2014)	1,000	0.740	0,269	0,072	0,214	1,265	2,759	0.006	
Korkman (2018)	1,000	-0,077	0,247	0,061	-0,561	0,408	-0,311	0,756	
Korkman (2018)	2,000	0,600	0,180	0,032	0,247	0,953	3,333	0,001	
Kuit and Osman (2021)	1,000	0,515	0,233	0,054	0,058	0,972	2,207	0,027	
Mercy et al. (2019)	1,000	0,296	0.182	0.033	-0.062	0,653	1.621	0.105	
Mondal (2012)	1,000	0.817	0,231	0,053	0,365	1,270	3,544	0,000	
Munawarah et al. (2020)	1,000	4,189	0,458	0,208	3,298	5,082	9,190	0,000	
Okorie (2015)	1,000	0,277	0,114	0,013	0,054	0,500	2,437	0,015	
Ozmen (2008)	1,000	2,225	0,356	0,127	1,527	2,924	0,244	0,000	
Ozmen et al. (2009)	1,000	0.578	0,265	0,070	0.059	1,097	2,184	0,029	
Pabuccu and Geban (2006)	1,000	0,990	0,325	0,106	0,352	1,627	3,042	0,002	
Pabuccu and Geban (2012)	1,000	0,162	0.307	0.094	-0,439	0,764	0.529	0.597	
Pamuk (2018)	1,000	1,261	0,280	0,078	0,713	1,809	4,510	0,000	
Sari (2013)	1,000	1,774	0,271	0,073	1,244	2,305	0,003	0,000	
Sentongo et al. (2013)	1,000	1,751	0,218	0,048	1,323	2,179	8,021	0,000	
Sevim (2007)	1,000	1,700	0,160	0,028	1,386	2,014	10,625	0,000	
Sharma (2015)	1,000	0.379	0,147	0,022	0.091	0,007	2,0/9	0,010	
Side et al. (2020)	1,000	0,400	0,249	0,002	-0,089	0,889	1,005	0,108	
Singh and Moone (2015)	1,000	1,520	0,310	0,096	0,912	2,128	4,903	0,000	
Sunyono and Meristin (2018)	1,000	0,350	0,160	0,028	0,036	0,004	2,188	0,029	
Suyanti and Sormin (2016)	1,000	0,905	0,268	0,072	0,380	1,430	3,3/8	0,001	
Seker (2012)	1,000	1,947	0.340	0.115	1,281	2,613	5,732	0,000	
Taman et al. (2008)	1,000	1,000	0,238	0,007	0,534	1,467	4,201	0,000	
Teichert and Stady (2002)	1,000	0,103	0,295	0,087	-0,4/4	0,680	0,350	0,726	
Isapariis et al. (2018)	1,000	0,346	0,045	0.002	0,258	0,434	1,089	0,000	
000509 (2011)	2,000	0,929	0,208	0,043	0,521	1,337	4,400	0,000	
Ulusoy (2011)	2,000	0,960	0,208	0,043	0,552	1,368	4,615	0,000	
Ulter (2015)	1,000	1,001	0,321	0,103	0,403	1,030	3,311	0,001	
onay (2010)	1,000	0,374	0.295	0.058	-0,207	0,954	1,262	0,207	
Wildiam et al. (2019)	1,000	1,220	0,288	0,083	0,856	1,784	4,242	0,000	
Triginm et al. (2018)	1,000	0,779	0,298	0,089	0,194	1,304	2,610	0,009	
Zonuoglu and Sozbilir (2016)	1,000	1,020	0,252	0,064	0,526	1,015	9,042	0,000	
Random		1.007	0.094	0,009	0.822	1,192	10,660	0.000	
									-1,00 -0,50 0,00 0,50 1,00
									Favours A Favours B

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