Institute of Education
Child Development and Learning Difficulties Lab

UCL

Strategies for supporting educational success in students with SEND

Jo Van Herwegen

Centre for Educational Neuroscience

UCL IOE – Faculty of Education and Society

Child Development and Learning Difficulties Lab

1

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

Number of students with SEND currently in school in UK

2024 2023

18.4% ▲ 17.3%

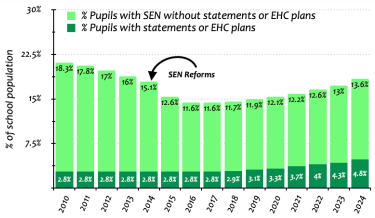
Of children in England had SEND

4.8% ▲ **4.3%**

Had an EHCP at end of Jan '22

13.6% ▲ **13%**

Of pupils were on SEN Support



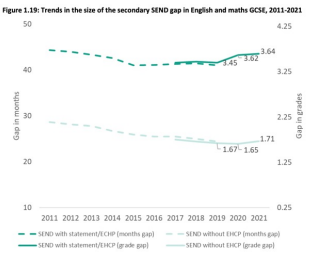
Special Needs Jungle July 2024

2

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

- Educational outcomes for those with SEND are often lower compared to those without SEND
- This gap has become larger as a result of the COVID-19 pandemic



(Tuckett et al., 2021, Education Policy Institute)

3

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

Early Years Foundation Stage Profile:

- KS1: teachers assessment expected standard met (%)

Percentage	2018/19		2021/22	
Teacher Assessment	SEN	No SEN	SEN	No SEN
Reading TA	30	83	26	75
Writing TA	22	78	17	66
Maths TA	33	84	29	75

DfE, June 2023

4

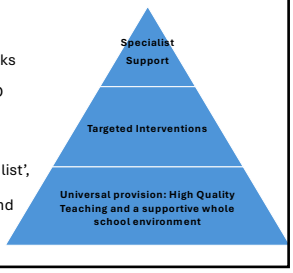
Child Development and Learning Difficulties Lab

UCL

Improving outcomes for SEND

Evidence-based resources and frameworks done by organisations (e.g. The Communication Trust, The Dyslexia-SpLD Trust, The Autism Education Trust, The Council for Disabled Children)

Organised by 'Universal, Targeted, Specialist', it covers strategies, identification and frameworks to assess school provision and staff knowledge

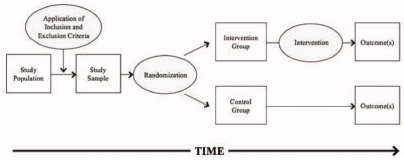


5

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

What works for SEND: RCT gold standard



Placebo effect

– involves the influencing of performance due to the subject's belief about the results.

Experimenter Bias

– The same way a person's beliefs can influence his or her perception, so can the belief of the experimenter.

6

Child Development and Learning Difficulties Lab

UCL

What works for SEND: diagnostic labels

Issues of diagnostic labels and needs

- Diagnoses are highly comorbid (20-80%)
- Many symptoms in common: problems in working memory, phonological processing, executive functions, inattention
- Symptom variability is very high for children with the same diagnosis
- Routes to diagnosis are haphazard
- CALM Study (Gathercole): treat individual behaviours, not disorder categories

Currently: many different suggestions/ interventions for different needs, many reviews are diagnosis based.

7

Child Development and Learning Difficulties Lab

UCL

MetaSENse

MetaSENse

Would certain interventions improve multiple educational outcomes?

Are there any targeted interventions that work for more than 1 SEND group?

What does the current evidence base look like?

8

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

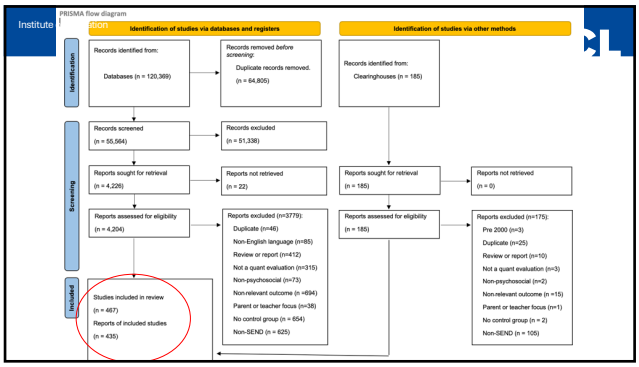
Methodology

- Phase 1: synthesise evidence of targeted interventions to raise educational outcomes (maths, reading, writing, attainment) for different pupils with SEND aged 4 to 25 in a systematic review followed by a meta-analysis
  - PRISMA guidelines
  - pre-registered on the Open Science Framework (currently embargoed)

  Van Herwegen et al (in press) Review of Education
- Phase 2: identify barriers that educational professionals face in implementing the most effective practices indicated by the evidence through in-depth interviews.

  Antalek et al (2025) Mind Brain and Education
- Phase 3: co-produce a database

9

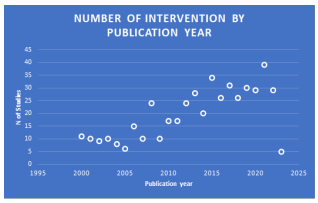


10

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

Main findings: Narrative review

- Number of studies has increased but is low
- Most studies from USA, only 21 studies from UK (Belgium = 2!)
- Most focus on primary school students (58%)
- The majority of the studies (84%) included a control group that had SEND

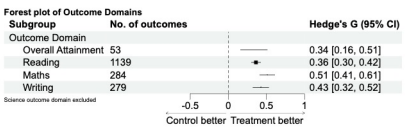


11

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

Main findings: Phase 1 – What Works?

- Overall effect: g= .44 (equivalent to 5 months progress)
- Higher effect size for maths than for reading



12

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

Main findings: Phase 1 – What Works?

Generally positive findings for different SEND groups:

- Interventions work for specific learning difficulties (reading & mathematical difficulties)
- Evidence in favour of ADHD, MLD, SEMH, SLCN.
- Other SEND groups have less available evidence.

Forest plot of All Outcome Moderators

Moderator	No. of outcomes	Hedge's G (95% CI)
Overall Effect Size Estimate	1758	0.44 [0.38, 0.50]
SEND Need		
ADHD	98	0.45 [0.24, 0.66]
Autism	36	0.14 [-0.17, 0.45]
Down Syndrome	24	0.20 [-0.23, 0.63]
Dyslexia/RD	879	0.34 [0.26, 0.42]
FASD	18	0.33 [-0.36, 1.03]
Hearing Impairment	26	0.19 [-0.14, 0.52]
Moderate LD	56	0.66 [0.50, 0.81]
Mathematical Difficulties	142	0.47 [0.33, 0.60]
Mixed SEND	216	0.32 [0.07, 0.58]
Severe LD	17	0.40 [-0.04, 0.85]
SEMH	26	0.57 [0.21,0.92]
SLCN	162	0.43 [0.24, 0.62]
Writing Difficulties	49	0.35 [-0.03, 0.74]

13

Institute of Education

UCL

Main findings: Aim 1 – What Works?

Impact of moderators varies by outcome domain:

- Phase of education matters for maths and writing but not for reading interventions (maths = primary > across phases; writing = secondary > primary)
- Educational setting - evidence for significant effect for mainstream but not specialist, clinical, or mixed settings for maths outcomes – not for others.
- Group and individual delivery method did not differ in reading, mathematics.

14

Institute of Education

UCL

Solution 1: Address the evidence gap

- Research on improving outcomes for SEND to date is skewed: most studies focus on reading interventions, very little known about particular SEND groups other than dyslexia/ reading difficulties.
- Very few studies focus on what works in secondary school.
- Some promising interventions but larger UK based trials needed (most have less than 50 participants).

15

Institute of Education

UCL

Phase 2

- Online interviews 35-45 minutes
- Interviewees were asked to reflect on:
  - The targeted intervention approaches they use to support for students with SEND
  - How they arrived at these approaches
  - What evidence they use to implement
  - How they monitored the effectiveness of the interventions, in terms of the assessment strategies they used but also when and how they reviewed which targeted approaches should be replaced.

Follow-up questions and probes were used to generate further explanation from participants.

Antalek et al (2025) Mind Brain and Education

16

Institute of Education

UCL

Interview with educational professionals

- 32 participants (6 males)
- aged between 30-49
- average of 8.76 years of experience but ranging from 1 to 29 years.

Phase/Type	*Teacher/ SENCO (N)*	*Headteacher/Deputy (N)*	*Specialists (N)*
Primary			
Mainstream	3	2	3
Special	1	2	0
Mainstream +SEND	0	1	1
Secondary			
Mainstream	4	1	1
Special	5	1	0
Mainstream +SEND	3	0	0
All Phases			
Mainstream	1	0	0
Special	2	1	0
Mainstream +SEND	0	0	0
Total	19	8	5

17

Institute of Education

UCL

Three Themes Identified

Theme 1: Exploring and Evaluating Evidence for Interventions	Theme 2: Balancing Fidelity and Adaptation in Implementing Interventions	Theme 3: Monitoring Effectiveness of Interventions
Defining 'evidence'	*Students' Individual Needs*	*Assessment Strategies*
Navigating Sources of Evidence	*Significance of Training*	*Reflection and Review*
Practical Considerations	*Structural and Financial Considerations*	

18

Institute of Education

UCL

Conclusions: interviews

- **Research evidence**: Barriers included access to research but also training to understand this evidence. All practitioners mentioned the need for a trusted source of research evidence (Like EEF but for SEND").
- **Intervention approaches**: they welcomed approaches that could be implemented flexibly and adapted to the needs of the individual students, as well as those that require less training. What is being evaluated in research is not what is being used in practice
- **Measuring impact**: lots of data being collected but not systematic or analysed, no systematic review of interventions being used in schools

19

Institute of Education

UCL

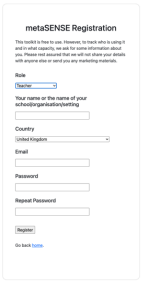
Solution 2: Give teachers access

http://www.educationalneuroscience.org.uk/metasense/

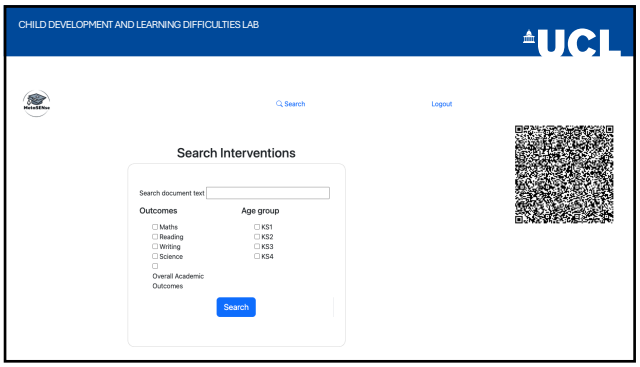
20

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

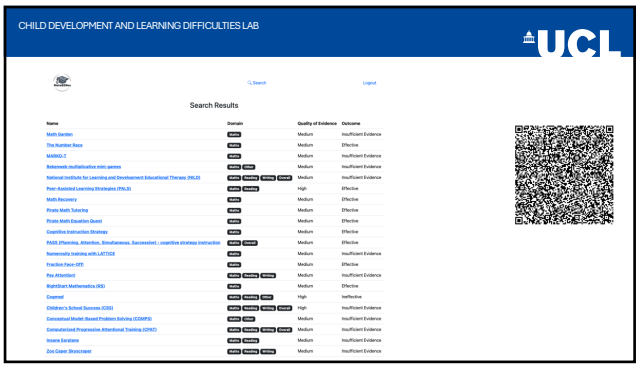
UCL



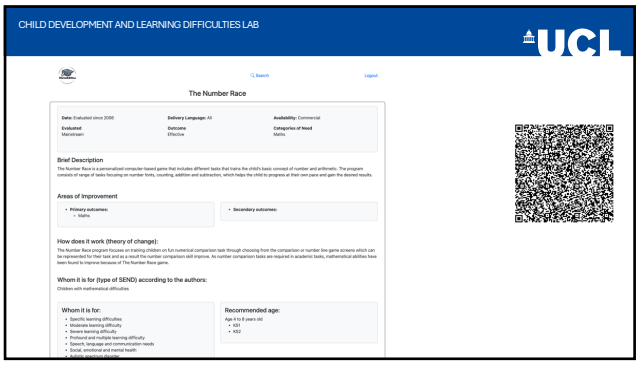
21


CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB
UCL
Search
Logout
Search Interventions
Search document text
Outcomes
Maths
Reading
Writing
Science
Overall Academic Outcomes
Age group
KS1
KS2
KS3
KS4
Search

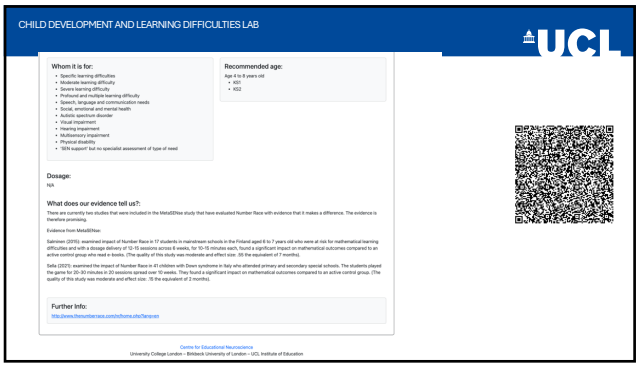
22


CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB
UCL
Search
Logout
Search Results
Name
Domain
Quality of Evidence
Outcome

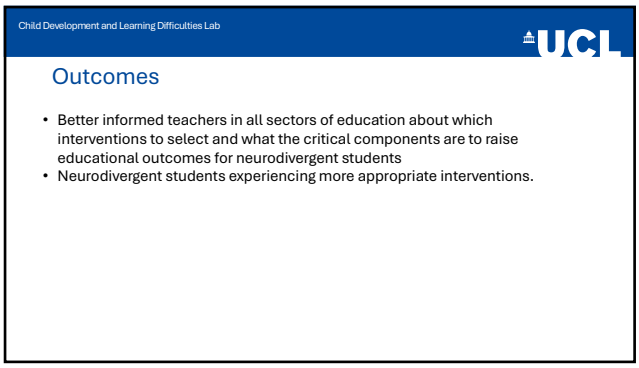
23


CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB
UCL
Search
Logout
The Number Race
Brief Description
Areas of Improvement
How does it work (theory of change):
Whom it is for (type of SEND) according to the authors:
Whom it is for:
Recommended age:

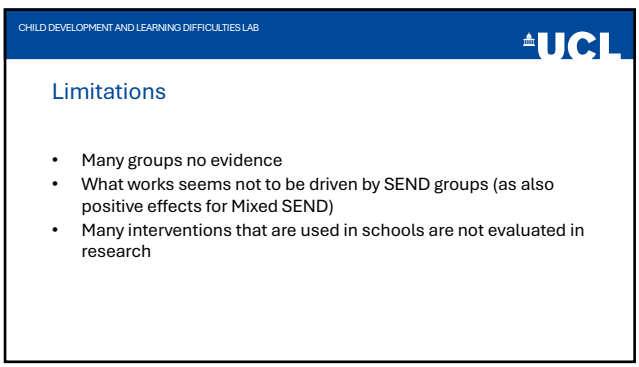
24


CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB
UCL
Whom it is for:
Specific learning difficulties
Moderate learning difficulty
Severe learning difficulty
Profound and multiple learning difficulty
Speech, language and communication needs
Social, emotional and mental health
Autistic spectrum disorder
Visual impairment
Hearing impairment
Multisensory impairment
Physical disability
"SEN support" but no specialist assessment of type of need
Recommended age:
Age 4 to 8 years old
KS1
KS2
Dosage:
N/A
What does our evidence tell us?:
There are currently two studies that were included in the MetaSENse study that have evaluated Number Race with evidence that it makes a difference. The evidence is therefore promising.
Evidence from MetaSENse:
Salminen (2015): examined impact of Number Race in 17 students in mainstream schools in the Finland aged 6 to 7 years old who were at risk for mathematical learning difficulties and with a dosage delivery of 12-15 sessions across 6 weeks, for 10-15 minutes each, found a significant impact on mathematical outcomes compared to an active control group who read e-books. (The quality of this study was moderate and effect size: .55 the equivalent of 7 months).
Sella (2021): examined the impact of Number Race in 41 children with Down syndrome in Italy who attended primary and secondary special schools. The students played the game for 20-30 minutes in 20 sessions spread over 10 weeks. They found a significant impact on mathematical outcomes compared to an active control group. (The quality of this study was moderate and effect size: .15 the equivalent of 2 months).
Further Info:
http://www.thenumberrace.com/mihome.php?lang=en
Centre for Educational Neuroscience
University College London – Birkbeck University of London – UCL Institute of Education

25


Child Development and Learning Difficulties Lab
UCL
Outcomes
Better informed teachers in all sectors of education about which interventions to select and what the critical components are to raise educational outcomes for neurodivergent students
Neurodivergent students experiencing more appropriate interventions.

26


CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB
UCL
Limitations
Many groups no evidence
What works seems not to be driven by SEND groups (as also positive effects for Mixed SEND)
Many interventions that are used in schools are not evaluated in research

27

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

What aspects of targeted interventions might result in good outcomes?

28

Child Development and Learning Difficulties Lab

UCL

Previous research

Hattie 2009

- Teacher clarity (setting goals)
- Formative assessment (retrieval practice)
- Effective feedback
- Direct instruction (explicit teaching)
- Cooperative learning (collaboration)

EEF

- Explicit Instruction
- Cognitive and Metacognitive Strategies
- Scaffolding
- Flexible Grouping
- Using Technology

Mostly based on Non-SEND research

29

Child Development and Learning Difficulties Lab

UCL

MetaSENse Keys

- To assess which components are included in educational interventions for students with SEND?
- Which components of the interventions resulted in greater effect sizes?
- How are these findings differentiated by SEND group and/or outcome domain?

30

Child Development and Learning Difficulties Lab

UCL

Components (N= 18): HLPs McLeskey and EEF

- Interleaving
- Physical movement
- Communication
- Rewards
- Pupil-led engagement
- Behaviour
- Goals
- Explicit Teaching
- Mastery
- Chunking
- Metacognitive Strategies
- Scaffolds
- Technology
- Retrieval
- Feedback
- Working Memory
- Collaboration
- Adapted Teaching

31

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

Results

137 High Quality cases

Different outcomes

Range of SEND groups

	High quality
Overall Attainment	9
Maths	26
Reading	77
Writing	24
Science	1

	High qual
ADHD	11
Autism	4
Dyslexia/ reading difficulties	59
Hearing Impaired	2
Maths/Dyscalculia	15
Mixed SEND	23
Severe LD (SLD)	2
SEMH	5
SCLN	14
Writing difficulties	1

32

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

What is the impact of different components on the outcome?

33

Institute of Education

Is there a significant difference in effect sizes, when a certain component is always present as opposed to always absent? (All Outcomes/No Outliers)

Component	t	df	p	95% CI Lower	95% CI Upper	Mean Group One	Mean Group Zero
GOALS	0.250	40.005	0.804	-0.142	0.182	0.275	0.255
BEHAV	-0.016	10.502	0.988	-0.282	0.278	0.257	0.259
EXPTCH	3.054	101.700	0.003	0.071	0.335	0.343	0.140
ADPTCH	-2.062	119.930	0.041	-0.265	-0.005	0.193	0.328
MAST	1.181	80.888	0.241	-0.058	0.228	0.315	0.230
CHUNK	-0.405	19.678	0.690	-0.362	0.244	0.251	0.309
METACOG	0.653	57.955	0.516	-0.098	0.193	0.295	0.248
SCAFFS	1.558	77.174	0.123	-0.032	0.258	0.299	0.186
COMM	1.315	17.978	0.205	-0.091	0.395	0.393	0.240
REWS	-2.699	27.581	0.012	-0.450	-0.062	0.047	0.303
PLE	1.988	31.212	0.056	-0.005	0.355	0.403	0.228
TECH	-1.484	72.710	0.142	-0.258	0.038	0.187	0.297
RETR	1.766	95.014	0.081	-0.015	0.249	0.338	0.220
FDBCK	-0.538	63.081	0.593	-0.196	0.113	0.246	0.288
PHYSMV	0.820	13.258	0.427	-0.200	0.445	0.369	0.247
WM	0.073	52.309	0.942	-0.152	0.164	0.261	0.255
INTL	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COLLAB	2.046	79.577	0.044	0.004	0.273	0.357	0.219

34

Institute of Education

Is there a significant difference in effect sizes, when a certain component is always present as opposed to always absent? (Reading/No Outliers)

Component	t	df	p	95% CI Lower	95% CI Upper	Mean Group One	Mean Group Zero
GOALS	-2.521	30.639	0.017	-0.363	-0.038	0.070	0.271
BEHAV	-0.292	5.836	0.780	-0.479	0.378	0.191	0.241
EXPTCH	1.069	62.863	0.289	-0.086	0.283	0.282	0.184
ADPTCH	-0.765	59.137	0.448	-0.259	0.116	0.205	0.277
MAST	1.735	52.801	0.089	-0.026	0.352	0.337	0.174
CHUNK	0.050	9.458	0.961	-0.530	0.554	0.239	0.227
METACOG	-1.246	28.054	0.223	-0.301	0.073	0.145	0.259
SCAFFS	-0.262	35.737	0.795	-0.248	0.191	0.227	0.256
COMM	-0.107	10.725	0.917	-0.261	0.237	0.226	0.238
REWS	-0.604	11.756	0.557	-0.457	0.259	0.153	0.252
PLE	0.732	17.061	0.474	-0.169	0.349	0.311	0.221
TECH	1.094	42.472	0.280	-0.093	0.315	0.306	0.196
RETR	0.010	66.577	0.992	-0.172	0.173	0.238	0.237
FDBCK	-0.615	42.601	0.542	-0.265	0.141	0.216	0.278
PHYSMV	1.261	8.837	0.240	-0.199	0.695	0.454	0.206
WM	-0.095	26.404	0.925	-0.250	0.228	0.234	0.245
INTL	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COLLAB	-0.394	60.936	0.695	-0.196	0.131	0.214	0.247

35

Institute of Education

Is there a significant difference in effect sizes, when a certain component is always present as opposed to always absent? (Maths/No Outliers)

Component	t	df	p	95% CI Lower	95% CI Upper	Mean Group One	Mean Group Zero
GOALS	0.570	11.610	0.580	-0.182	0.310	0.240	0.176
BEHAV	2.535	1.150	0.212	-1.351	2.352	0.652	0.151
EXPTCH	3.268	14.490	0.005	0.115	0.549	0.311	-0.021
ADPTCH	-1.129	22.720	0.271	-0.353	0.104	0.127	0.251
MAST	0.504	11.250	0.624	-0.211	0.337	0.237	0.174
CHUNK	-0.545	4.800	0.610	-0.592	0.387	0.171	0.273
METACOG	0.263	20.700	0.795	-0.184	0.237	0.207	0.181
SCAFFS	2.702	22.850	0.013	0.063	0.475	0.331	0.062
COMM	N/A	N/A	N/A	N/A	N/A	N/A	N/A
REWS	-2.310	9.910	0.044	-0.544	-0.009	-0.008	0.269
PLE	1.870	1.730	0.222	-0.376	0.824	0.398	0.173
TECH	-4.077	22.110	0.001	-0.521	-0.170	-0.030	0.316
RETR	0.559	4.440	0.603	-0.311	0.475	0.260	0.178
FDBCK	1.779	11.770	0.101	-0.047	0.459	0.249	0.043
PHYSMV	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WM	N/A	N/A	N/A	N/A	N/A	N/A	N/A
INTL	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COLLAB	1.024	3.960	0.364	-0.202	0.436	0.294	0.177

36

Institute of Education

Is there a significant difference in effect sizes, when a certain component is always present as opposed to always absent? (Writing/No Outliers)

Component	t	df	p	95% CI Lower	95% CI Upper	Mean Group One	Mean Group Zero
GOALS	2.287	8.370	0.050	0.000	0.872	0.712	0.276
BEHAV	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EXPTCH	3.391	11.110	0.006	0.185	0.866	0.527	0.001
ADPTCH	-2.353	20.650	0.029	-0.723	-0.044	0.206	0.590
MAST	-0.044	10.970	0.966	-0.478	0.459	0.384	0.393
CHUNK	-0.582	2.250	0.614	-1.672	1.235	0.361	0.580
METACOG	2.871	4.960	0.035	0.055	1.023	0.835	0.296
SCAFFS	3.312	9.220	0.009	0.135	0.709	0.445	0.023
COMM	1.960	4.930	0.108	-0.156	1.142	0.775	0.283
REWS	-3.450	1.450	0.115	-2.013	0.590	-0.260	0.452
PLE	2.276	3.370	0.098	-0.140	1.025	0.775	0.332
TECH	-2.273	7.310	0.056	-0.945	0.015	0.046	0.511
RETR	3.388	20.010	0.003	0.189	0.795	0.689	0.197
FDBCK	-0.753	5.450	0.483	-0.818	0.440	0.349	0.538
PHYSMV	0.841	5.750	0.434	-0.205	0.416	0.486	0.381
WM	-0.126	1.080	0.919	-5.094	4.975	0.385	0.444
INTL	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COLLAB	2.503	20.720	0.021	0.067	0.730	0.615	0.216

37

Child Development and Learning Difficulties Lab

Overall findings

- More components do not lead to better outcomes (except for writing interventions)
- Successful components relate to the outcome domain
  - Explicit teaching (all outcomes, maths, and writing)
  - Collaboration (all outcomes and writing)
  - Physical movement (reading)
  - Meta-Cognitive strategies (writing)
  - Scaffolding (maths, writing)
  - Goals (writing)
  - Retrieval (writing)
- Components that affect results negatively:
  - Technology (writing and maths)
  - Rewards (overall and maths)
  - Goals (reading)

38

Child Development and Learning Difficulties Lab

Higher effect sizes

Hattie 2009

- Teacher clarity (setting goals)
- Formative assessment (retrieval practice)
- Effective feedback
- Direct instruction (explicit teaching)
- Cooperative learning (collaboration)

EEF

- Explicit Instruction
- Cognitive and Metacognitive Strategies
- Scaffolding
- Flexible Grouping
- Using Technology

MetaSENse keys

All yellow
+
Physical movement

Not rewards
Not Adaptive teaching
Not goals

But the outcome domain matters!!

39

Child Development and Learning Difficulties Lab

UCL

But

- Small sample sizes
- Effective components seem to vary by outcome domain and by SEND group
- Biased sample (all reading = dyslexia, all maths= dyscalculia

40

Child Development and Learning Difficulties Lab

UCL

Next steps

- Score moderate quality studies as well
- Machine learning: which combinations lead to best outcomes, how does this differ per increase of effect size?

41

Child Development and Learning Difficulties Lab

UCL

Outcomes

- Better informed teachers in all sectors of education about which interventions to select and what the critical components are to raise educational outcomes for neurodivergent students
- Neurodivergent students experiencing more appropriate interventions.
- Insights into cognitive mechanisms how they compare for SEND to Neurotypical populations

42

Institute of Education

UCL

Thank you!

Collaborators: Prof Julie Dockrell, Prof Susan Gathercole, Dr Rebecca Gordon, Prof Chloe Marshall, Prof Michael Thomas, Prof Joel Talcott, Dr Roisin Perry, Prof Dom Wyse
Researchers: Hiruni Duasha Aluthgamage, Thomas Masterman
Assistants: Rosie Casterton, Anson Chan, Claudia Civinini, Ruofei Du, Emma Fulford, Enkhzaya Ganzorig, Aaron Giuliano, Shiyu Ji, Isha Kala, Justine Kum, Shun Yan Kung, Jaimie Leung, Xiaoxuan Li, Feiying Na, Dr Roisin Perry, Alyssa Seriniyom, Huimin Shao, Dr Zahra Siddiqui, Hongjing Wang, Tiffany Wai, Peige Wang, Sophie Wong, Yiyang Xu, and Jintong Yan.
•Faye Howard & Sagarika Shapoor.
•**The Advisory board** included: Professor Lani Florian, Professor Alison O'Mara-Eves, Jonathan Kay, Vijita Patel, Dr Jeremy J. Monsen, Dr Erin Early, and Dr Aikaterini Kassavou.
Email: j.vanherwegen@ucl.ac.uk
Website: http://www.educationalneuroscience.org.uk/metasense/

BERA/
Kusuma Trust funding

Education Endowment Foundation

Nuffield Foundation

43

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

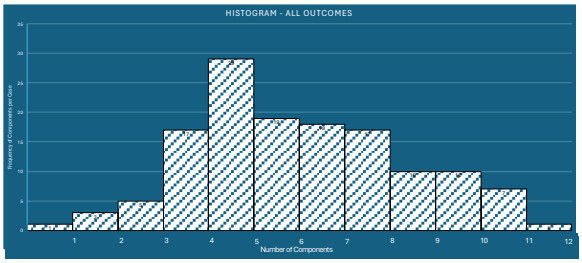
Do cases with more components have higher impact?

44

CHILD DEVELOPMENT AND LEARNING DIFFICULTIES LAB

UCL

Occurrence of components N = 137



45

Institute of Education

UCL

Correlations : Number of Components*Average Effect Size

	df	*r*	*p*	95% CI
All Outcomes	135	0.055	0.52	-0.113, 0.221
Reading	75	-0.103	0.374	-0.319, 0.124
Maths	24	0.08	0.696	−0.317, 0.454
Writing	22	0.511	0.011	0.135, 0.758
OA	7	0.187	0.631	-0.545, 0.757

Outcome Domain	M	SD	N
General Attainment	8.22	2.11	9
Maths	5.81	2.3	26
Reading	6.35	2.28	77
Writing	7.25	1.98	24
Science	2	N/A	1

Number of Case: All outcomes (137), Reading (77), Maths (26), Writing (24), Overall Attainment (9)

46