

General Outcome Measures for Students with Significant Cognitive Disabilities in Mathematics

Two-Year Study

February 2010

Teri Wallace, PhD * Renáta Tichá, PhD

Minnesota State University, Mankato * University of Minnesota

teresa.wallace@mnsu.edu • tich0018@umn.edu



Vision

Students with Significant Cognitive Disabilities



To support the **inclusion** of students with **cognitive disabilities** in state accountability systems by creating **General Outcome Measures (GOMs)** that assess students' progress in outcome areas that can be linked to **state grade level content standards**. While the measures will target academic outcomes by extending our present work in progress monitoring, for some students additional measures might also assess their progress on **functional outcomes** related to their IEP goals.

Defining “Significant Cognitive Disabilities”

Students who participate in alternate assessments with alternate achievement standards linked to state grade level content standards

- Students who are (1) within one or more of the existing categories of disability under the IDEA (e.g., autism, multiple disabilities, TBI, etc.); and (2) whose cognitive impairments may prevent them from attaining grade-level achievement standards, even with the very best instruction.

- August, 2005 – NCLB non-regulatory guidance

Progress Monitoring in Math

Students with Significant Cognitive Disabilities



Currently

- Research missing
- Research with typically developing students in K-1st grade the closest - early numeracy measures (Clarke et al. and VanDerHeyden et al., Lembke, Foegen)

New GOMs

- Focus on computation: “numbers and operations”
- Timing: 5 min (first administration only), 3 min and 1 min
- 60 cards (1 model, 2 practice, 57 test)
- Administered individually with a prompting system
- Requiring non-verbal responses only (pointing)

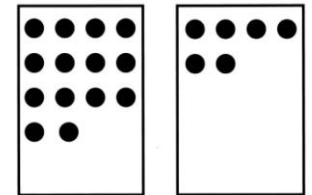
GOMs in Math

Students with Significant Cognitive Disabilities

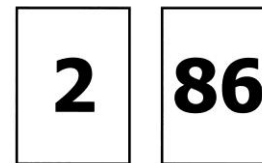
- **Number Identification (NI)**

6 41 52

- **Quantity Discrimination (QD)**



- **Number Order (NO)**



$$1 + 4 = \underline{\quad}$$

5

4

2

- **Number Facts (NF)**

Research Questions

- Do the GOMs in math produce **reliable and valid** data when used with students with significant cognitive disabilities?
- Do the GOMs in math show **growth over time** when used with students with significant cognitive disabilities?

Demographics – Years 1, 2 and 3

Characteristic		n	%
Grade	1 – 4	14	54
	5 – 8	9	35
	9 – 10	3	11
Gender	Male	19	73
	Female	7	27
Ethnicity	American Indian	1	4
	African American	11	42
	Hispanic	5	19
	White	9	35
ELL	ELL	4	15
	non-ELL	22	85
SES	Free/Reduced	21	81
	Not receiving	5	19
Primary disability	Developmental cognitive disability	16	61
	Severe multiple impairment	2	8
	Other health impairment	1	4
	Traumatic brain injury	1	4
	Student needing alternative program	6	23
Total		26	100

Descriptive Statistics: Math GOMs, Checklist, and EMDA - Year 1

Measure	Mean	SD	Minimum	Maximum	n
NI 1 min c Winter 07	10.08	5.64	1	19	26
NI 3 min c Winter 07	28.96	18.82	1	57	26
NI 5 min c Winter 07	37.64	22.52	1	57	25
QD 1 min c Winter 07	11.08	6.92	1	23	26
QD 3 min c Winter 07	31.62	19.68	1	57	26
QD 5 min c Winter 07	32.16	20.71	1	57	19
NO 1 min c Winter 07	6.42	4.95	0	20	26
NO 3 min c Winter 07	14.19	13.30	0	49	26
NO 5 min c Winter 07	18.04	17.87	0	53	26
Checklist t Winter 07	29.15	17.05	7	64	26
EMDA t Winter 07	16.35	9.84	2	39	26

Note: c = correct; t = total; NI - number identification, QD = quantity discrimination, NO = number order; EMDA = Early Math Diagnostic Assessment; results are adjusted for prompting and guessing with a 3 consecutive error rule

Descriptive Statistics: Math GOMs, Checklist, and EMDA - Year 2

Measure	Mean	SD	Minimum	Maximum	n
NI 1 min c Fall 07	11.28	5.25	2	23	25
NI 3 min c Fall 07	31.64	16.77	6	57	25
NI 1 min c Spring 08	10.52	4.71	2	18	25
NI 3 min c Spring 08	31.80	15.48	2	55	25
NO 1 min c Fall 07	7.23	4.99	0	17	26
NO 3 min c Fall 07	17.23	14.63	0	49	26
NO 1 min c Spring 08	8.48	4.78	0	17	21
NO 3 min c Spring 08	18.86	15.73	0	52	21
NF 1 min c Fall 07	3.24	2.47	0	8	25
NF 3 min c Fall 07	7.16	6.14	0	20	25
NF 1 min c Spring 08	3.68	3.00	0	10	22
NF 3 min c Spring 08	7.45	7.64	0	29	22
Checklist t Fall 07	32.50	17.11	5	70	26
Checklist t Spring 08	37.19	18.17	7	70	26
EMDA t Winter 08	18.19	11.63	0	41	26

Reliability of GOMs

Years 1 and 2

- Inter-observer reliability:

- NF: 99%
- Other GOMs: 100%

- Inter-scorer reliability:

- NI: 97%
- QD: 96%
- NO: 98%
- NF: 99%



Math: Concurrent Validity Years 1 and 2

GOM	EMDA total Winter 07	Checklist total Winter 07	Checklist total Fall 07	Checklist total Spring 08
NI 1 min c Winter 07	.68**	.73**		
NI 3 min c Winter 07	.64**	.67**		
NI 1 min c Fall 07			.51**	
NI 3 min c Fall 07			.54**	
NI 1 min c Spring 08				.62**
NI 3 min c Spring 08				.62**
QD 1 min c Winter 07	.40*	.39		
QD 3 min c Winter 07	.42*	.44*		
NO 1 min c Winter 07	.65**	.60**		
NO 3 min c Winter 07	.68**	.70**		
NO 1 min c Fall 07			.69**	
NO 3 min c Fall 07			.71**	
NO 1 min c Spring 08				.65**
NO 3 min c Spring 08				.68**
NF 1 min c Fall 07			.56**	
NF 1 min c Fall 07			.59**	
NF 1 min c Spring 08				.78**
NF 3 min c Spring 08				.79**

Note: * = correlation significant at .05 level, ** = correlation significant at .01 level; c = correct; GOM = general outcome measure

Math: Predictive Validity Year 2

GOM	EMDA total Winter 08	Checklist total Spring 08
NI 1 min c Fall 07	.56**	.50*
NI 3 min c Fall 07	.58**	.52**
NO 1 min c Fall 07	.72**	.70**
NO 3 min c Fall 07	.73**	.69**
NF 1 min c Fall 07	.57**	.41*
NF 3 min c Fall 07	.72**	.58**

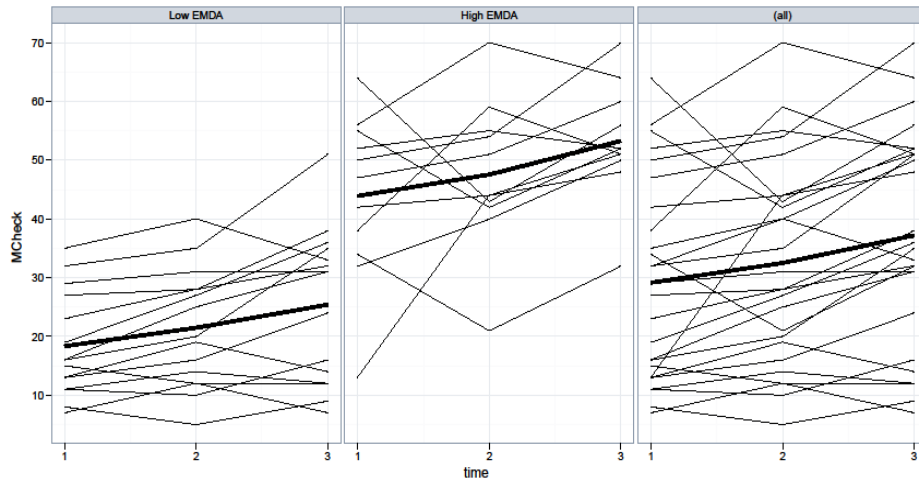
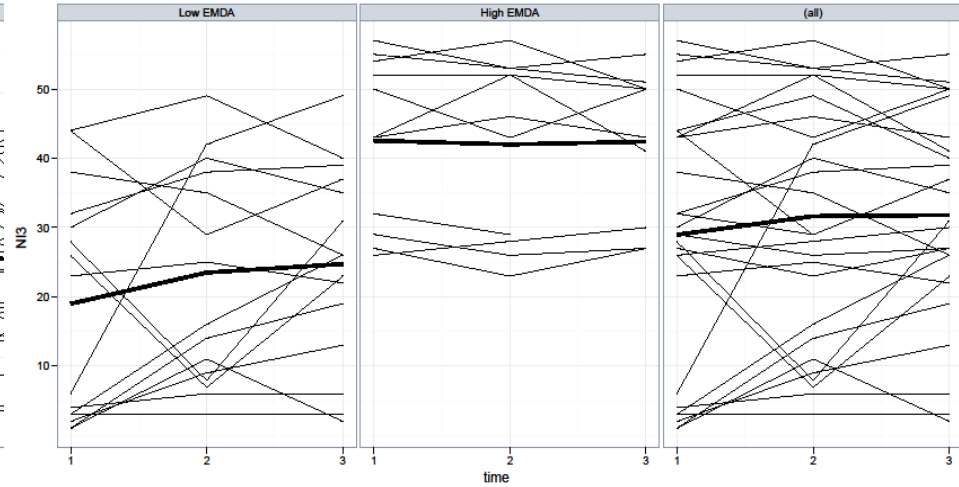
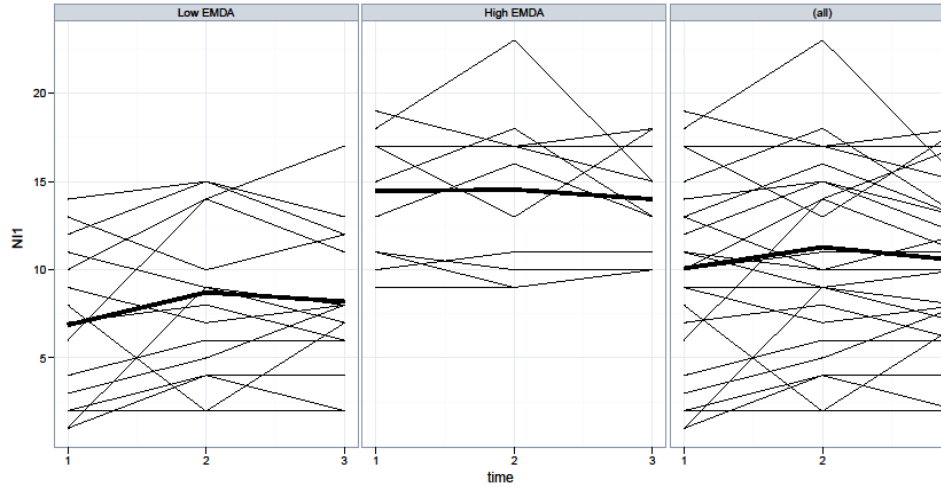
Note: * = correlation significant at .05 level, ** = correlation significant at .01 level; GOM = general outcome measure

Significant Growth

Years 1 and 2

Number identification 1min
 $\beta_1 = 1.0$

Number identification 3 min
 $\beta_1 = 4.0$



Math Checklist
 $\beta_1 = 3.6$

Summary

- **Format** of math GOMs is promising
- 3 and 1 minute **timings** appear to be most suitable
- NO and NF indicate a **floor effect**
- NI indicates a **ceiling effect**
- **Reliability** was strong for all GOMs
- NI, NO and NF showed strong **validity** most consistently across criterion measures
- NI at 1 and 3 min and Math Checklist indicated significant **growth** (but small sample size to be certain about other GOMs)
- Further research is needed

