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# School Effects on Middle School Reading Achievement of Students with Disabilities: A Multilevel, Longitudinal Analysis

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# Minimal Research on the Growth Trajectories of Middle School Readers in Special Education

- Morgan, Farkas, & Wu (2011) used ECLS-K
  - Compared Grade K-5 students with specific learning disabilities (SLD) and with speech-language impairments (SLI) to students without disabilities
  - Achievement gap remained stable for SLD
  - Achievement gap widened for students with SLI
  
- Wei, Blackorby, & Schiller (2011) used SEELS
  - Compared age 7-17 students with SLD to 10 exceptionality categories
  - Initial status differences for all categories except students with hearing impairments (HI) and traumatic brain injuries (TBI)
  - All categories demonstrated growth with deceleration
    - Students with SLI, HI, and autism demonstrated slower linear growth than those with SLD
    - SLI demonstrated steeper deceleration than those with SLD

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# Research Questions

1. To what extent do middle school students exhibit growth in reading achievement as measured by state reading tests?
2. To what extent is variance in status and growth parameters attributable to differences between schools?
3. To what extent does growth over this period vary as a function of disability category (including students with a range of exceptionality classifications and students designated as academically or intellectually gifted) as compared to students without a disability?
4. To what extent is there evidence of parameter variance for differences in status and growth estimates for exceptionality classifications?

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# Study Context

- North Carolina reading accountability data
- Single cohort of 58,960 students
  - Nested in 543 schools
  - Followed from Grade 6 to Grade 8
- Inclusion criteria
  - At least one state reading test score in Grades 6-8
  - Did not switch schools within-state in Grades 6-8
- Dependent variable: State reading test
- Independent variable: Exceptionality classification

# Achievement Levels for the North Carolina Testing Program (2<sup>nd</sup> edition)

Descriptors		Grade 6	Grade 7	Grade 8
Level I	Students performing at this level do not have sufficient mastery of knowledge and skills in this subject area to be successful at the next grade level.	228-241	228-242	231-243
Level II	Students performing at this level demonstrate inconsistent mastery of knowledge and skills that are fundamental in this subject area and that are minimally sufficient to be successful at the next grade level.	242-251	243-251	244-253
Level III	<b>Students performing at this level consistently demonstrate mastery of grade level subject matter and skills and are well prepared for the next grade level.</b>	<b>252-263</b>	<b>252-263</b>	<b>254-265</b>
Level IV	Students performing at this level consistently perform in a superior manner clearly beyond that required to be proficient at grade level work.	264-283	264-287	266-290

# Exceptionality classifications

	Sixth grade	Seventh grade	Eighth grade
Total Enrollment	58,863 / 100%	58,908 / 100%	58,869 / 100%
All exceptionality classifications	11,030 / 18.74%	11,060 / 18.79%	11,061 / 18.79%
AIG (Academically/intellectually gifted)	5,038 / 8.56%	5,041 / 8.56%	5,040 / 8.56%
SLD (Specific learning disability)	3,033 / 5.15%	3,033 / 5.15%	3,020 / 5.13%
SLI (Speech/language impairment)	1,506 / 2.56%	1,505 / 2.55%	1,503 / 2.55%
OHI (Other health impairment)	596 / 1.01%	602 / 1.02%	596 / 1.01%
EMH (Educable mental handicap)	418 / 0.71%	438 / 0.74%	465 / 0.79%
BEH (Behavioral/emotional handicap)	222 / 0.38%	228 / 0.39%	220 / 0.37%
<b>HI (Hearing impaired)</b>	<b>72 / 0.12%</b>	<b>72 / 0.12%</b>	<b>72 / 0.12%</b>
<b>ASD (Autistic)</b>	<b>70 / 0.12%</b>	<b>72 / 0.12%</b>	<b>71 / 0.12%</b>
<b>OI (Orthopedic impairment)</b>	<b>41 / 0.07 %</b>	<b>41 / 0.07%</b>	<b>41 / 0.07%</b>
<b>VI (Visually impaired)</b>	<b>25 / 0.04%</b>	<b>25 / 0.04%</b>	<b>25 / 0.04%</b>
<b>TBI (Traumatic brain injury)</b>	<b>9 / 0.02%</b>	<b>9 / 0.02%</b>	<b>8 / 0.01%</b>

# Research Questions 1 & 2

- Regardless of whether modeled accounting for between-school differences
  - Mean score in sixth grade of about 260
  - Growth rate per year of about 2.4 points

		Two-level model		Three-level model	
Parameter		Estimate	ICC	Estimate	ICC
Random effects					
	Level-1, $e$	11.73	.1810	11.77	.1795
	Level-2 intercept, $r_0$	52.57	.8190	45.43	.6975
	Level-2 slope, $r_1$	0.50		0.30	
	Level-3 intercept, $u_{00}$			7.88	.1229
	Level-3 slope, $u_{01}$			0.18	
Deviance		1097812		1090613	

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# Research Question 3

- Regardless of whether modeled accounting for between-school differences
  - Initial status: Significant differences for **all classifications except Orthopedic Impairments (OI) and Visual Impairments (VI)**
  - Growth: Significant differences **only for specific learning disabilities (SLD) and OI**
    - Significant difference in growth for academically and intellectually gifted (AIG) only when between-school variance is modeled



# Intercepts by exceptionality classification

	Two-level model			Three-level model		
	Coefficient	<i>SE</i>	<i>p</i> -value	Coefficient	<i>SE</i>	<i>p</i> -value
Intercept, $\beta_{00}$	260.45	0.03	<.001	260.30	0.12	<.001
<b>AIG, <math>\beta_{01}</math></b>	<b>8.26</b>	<b>0.08</b>	<b>&lt;.001</b>	<b>7.75</b>	<b>0.15</b>	<b>&lt;.001</b>
<b>SLD, <math>\beta_{02}</math></b>	<b>-6.69</b>	<b>0.16</b>	<b>&lt;.001</b>	<b>-6.80</b>	<b>0.18</b>	<b>&lt;.001</b>
<b>SLI, <math>\beta_{03}</math></b>	<b>-1.88</b>	<b>0.21</b>	<b>&lt;.001</b>	<b>-1.91</b>	<b>0.22</b>	<b>&lt;.001</b>
<b>OHI, <math>\beta_{04}</math></b>	<b>-6.18</b>	<b>0.35</b>	<b>&lt;.001</b>	<b>-6.57</b>	<b>0.38</b>	<b>&lt;.001</b>
<b>EMH, <math>\beta_{05}</math></b>	<b>-16.53</b>	<b>0.32</b>	<b>&lt;.001</b>	<b>-15.30</b>	<b>0.38</b>	<b>&lt;.001</b>
<b>BEH, <math>\beta_{06}</math></b>	<b>-9.59</b>	<b>0.60</b>	<b>&lt;.001</b>	<b>-8.95</b>	<b>0.59</b>	<b>&lt;.001</b>
<b>HI, <math>\beta_{07}</math></b>	<b>-4.24</b>	<b>0.98</b>	<b>&lt;.001</b>	<b>-4.67</b>	<b>0.98</b>	<b>&lt;.001</b>
<b>ASD, <math>\beta_{08}</math></b>	<b>-6.04</b>	<b>0.97</b>	<b>&lt;.001</b>	<b>-6.81</b>	<b>1.04</b>	<b>&lt;.001</b>
OI, $\beta_{09}$	-2.56	1.37	.062	-2.89	1.53	.059
VI, $\beta_{010}$	-2.08	2.00	.299	-2.36	1.96	.229
<b>TBI, <math>\beta_{011}</math></b>	<b>-5.45</b>	<b>2.07</b>	<b>.009</b>	<b>-6.20</b>	<b>2.08</b>	<b>.003</b>

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SLD, $\beta_{02}$	-6.69	0.16	<.001	-6.80	0.18	<.001
SLI, $\beta_{03}$	-1.88	0.21	<.001	-1.91	0.22	<.001
OHI, $\beta_{04}$	-6.18	0.35	<.001	-6.57	0.38	<.001
<b>EMH, <math>\beta_{05}</math></b>	<b>-16.53</b>	<b>0.32</b>	<b>&lt;.001</b>	<b>-15.30</b>	<b>0.38</b>	<b>&lt;.001</b>
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SLI, $\beta_{03}$	-1.88	0.21	<.001	-1.91	0.22	<.001
<b>OHI, <math>\beta_{04}</math></b>	<b>-6.18</b>	<b>0.35</b>	<b>&lt;.001</b>	<b>-6.57</b>	<b>0.38</b>	<b>&lt;.001</b>
EMH, $\beta_{05}$	-16.53	0.32	<.001	-15.30	0.38	<.001
BEH, $\beta_{06}$	-9.59	0.60	<.001	-8.95	0.59	<.001
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<b>ASD, <math>\beta_{08}</math></b>	<b>-6.04</b>	<b>0.97</b>	<b>&lt;.001</b>	<b>-6.81</b>	<b>1.04</b>	<b>&lt;.001</b>
OI, $\beta_{09}$	-2.56	1.37	.062	-2.89	1.53	.059
VI, $\beta_{010}$	-2.08	2.00	.299	-2.36	1.96	.229
TBI, $\beta_{011}$	-5.45	2.07	.009	-6.20	2.08	<b>.003</b>

# Growth by exceptionality classification

	Two-level model			Three-level model		
	Coefficient	<i>SE</i>	<i>p</i> -value	Coefficient	<i>SE</i>	<i>p</i> -value
Intercept, $\beta_{10}$	2.40	0.01	<.001	2.40	0.02	<.001
<b>AIG, <math>\beta_{11}</math></b>	-0.04	0.04	.221	<b>-0.09</b>	<b>0.04</b>	<b>.014</b>
<b>SLD, <math>\beta_{12}</math></b>	<b>0.22</b>	<b>0.05</b>	<b>&lt;.001</b>	<b>0.23</b>	<b>0.06</b>	<b>&lt;.001</b>
SLI, $\beta_{13}$	0.06	0.07	.357	0.08	0.07	.253
OHI, $\beta_{14}$	-0.14	0.11	.214	-0.15	0.11	.161
EMH, $\beta_{15}$	-0.06	0.14	.657	-0.05	0.14	.742
BEH, $\beta_{16}$	-0.14	0.22	.524	-0.10	0.22	.651
HI, $\beta_{17}$	-0.30	0.28	.283	-0.30	0.32	.345
ASD, $\beta_{18}$	0.42	0.33	.211	0.44	0.34	.193
<b>OI, <math>\beta_{19}</math></b>	<b>0.91</b>	<b>0.34</b>	<b>.008</b>	<b>0.87</b>	<b>0.34</b>	<b>.009</b>
VI, $\beta_{110}$	0.10	0.76	.894	0.17	0.77	.821
TBI, $\beta_{111}$	1.22	0.72	.087	1.21	0.72	.093

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## Research Question 4

- Allowed both intercept and slope to vary randomly between schools for classifications one at a time in order of prevalence
- Model fit improved for each of the following classifications:
  - Academically and intellectually gifted (AIG)
  - Specific learning disability (SLD)
  - Speech language impairment (SLI)
  - Other health impairment (OHI)
  - Educable mental handicap (EMH)
  - Behavioral emotional handicap (BEH)
- Schools varied significantly in the estimates of initial status and growth for students in these groups

# Between-School Variance in Growth

- Substantially more variance between schools for some exceptionality classifications relative to students without exceptionality classifications

	Models					
	+ AIG	+ SLD	+ SLI	+ OHI	+ EMH	+ BEH
<b>Level-3 slope, <math>u_{01}</math></b>	<b>0.19</b>	<b>0.18</b>	<b>0.18</b>	<b>0.18</b>	<b>0.18</b>	<b>0.18</b>
Level-3 slope/AIG, $u_{11}$	0.01	0.03	0.03	0.03	0.03	0.03
<b>Level-3 slope/SLD, <math>u_{02}</math></b>		<b>0.33</b>	<b>0.33</b>	<b>0.34</b>	<b>0.36</b>	<b>0.37</b>
Level-3 slope/SLI, $u_{03}$			0.14	0.14	0.20	0.19
<b>Level-3 slope/OHI, <math>u_{04}</math></b>				<b>0.51</b>	<b>0.36</b>	<b>0.35</b>
<b>Level-3 slope/EMH, <math>u_{05}</math></b>					<b>1.10</b>	<b>1.12</b>
<b>Level-3 slope/BEH, <math>u_{06}</math></b>						<b>2.72</b>

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# Summary

- All students demonstrated growth over Grades 6-8
- Significant differences between schools in both status and growth
- Achievement gaps in Grade 6 were significant and substantial for all groups except OI and VI
- Existing achievement gaps remained stable except for AIG, SLD, and OI
  - All three exhibited a modest narrowing of the achievement gap
  - Narrowing was substantial only for OI
- Although gaps are largely stable on average, schools vary significantly in the growth demonstrated by their students with disabilities



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# Limitations

- A single state
- Students crossing schools were excluded
- Many classifications had very small sample sizes despite statewide dataset
- Yet to explain the variance between schools

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# Implications

- Schools demonstrate significant variability in the reading growth of their students both overall and for several exceptionality classifications
  - These differences are **most substantial** for students with specific learning disabilities (**SLD**), other health impairments (**OHI**), educable-mental handicaps (**EMH**), and behavioral-emotional handicaps (**BEH**)
  - Schools vary more in the growth their exceptional students demonstrate relative to their non-exceptional students
- Given the relatively small sample sizes for almost all exceptionality classifications and resulting sparseness of their distribution across schools, we may only be able to understand how and why schools differ for the most common classifications