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# A Longitudinal Study of Reading Growth for Students with Visual Impairments

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## Abstract

Little is known about growth in reading for students with visual impairments. Understanding reading development for students with visual impairments as they progress through school provides expectations for academic growth and informs instructional practices. Using data from Northwest Evaluation Association's Measures of Academic Progress assessment, reading achievement was analyzed from 224 students with visual impairments in grades 3 – 10, in four states over an eight-year time period. Reading growth for students with visual impairments were compared with a nationally normed group of students from the general population. Findings indicate students with visual impairments initial performance in reading achievement in third grade is lower than the national norm. While this population's growth trajectories in reading are trending upward at a steady pace, the gap between students with visual impairments and the national norm is wide. However, the initial review of the data suggests that the rate of growth for students with visual impairments is greater. In particular, the results indicate accelerated growth between 9$^{th}$ and 10$^{th}$ grade, whereas students at the same grade level in the nationally normed group tend to drop in reading growth at this time. Study limitations and recommendations for future research are discussed.

## Keywords

Academic achievement, visual impairment, assessment, accessibility, reading

## Introduction

With the reauthorization of Every Student Succeeds Act (ESSA), states will still need accountability systems that include subpopulations such as students with disabilities. In addition, with Common Core consortia, the use of growth measures for levels of proficiency on statewide accountability systems has grown. Measuring student growth is important information for an accountability system because it allows schools and teachers a more accurate understanding of student learning over time. According to the 2011 National Assessment of Educational Progress (NAEP), 33% of fourth grade students were below proficiency on basic reading assessment. Additionally, 24% of eighth grade students were below proficiency (National Center of Educational Statistics, 2011). The potential problem is data from the test results are interpreted with the assumption that all items are equal to all learners, all standards are assessed equally, and that all students with the right accommodations are all growing equally.

Unfortunately, little is known about the growth in reading achievement for students with visual impairments. Learning to read for students with visual impairments is very different than the majority of children. Some students with visual impairments learn to read Braille, which is a tactile language, others need the print to be enlarged or have field of vision issues. In general, students with visual impairments are delayed in reading development by two years (Edmonds and Pring 337) compared to their sighted peers. While there is a growing number of studies that focus on the acquisition of reading skills for students with visual impairments (Emerson et. al.; Gillon and Young), there are no studies that have determined academic growth norms in reading for these students. Currently, results on academic achievement for students with any disability are typically combined together because all students with disabilities make up about 10% - 15% of the total school population (Buzick and Laitusis 540; Wei 19; Wei et al. 90). Empirical data

on subpopulations are not differentiated, thus making differences among each subpopulation unknown. Classroom teachers of students with visual impairments should have access to academic growth norms to ensure appropriate learning and instructional expectations.

Across the US, there are approximately 28,000 students in general education or residential settings who are visually impaired (American Printing House for the Blind). Section 300.8 of IDEA (Individuals with Disabilities Education Act) regulations states that "visual impairment including blindness means an impairment in vision that, even with correction, adversely affects a child's educational performance. The term includes both partial sight and blindness" (Individual with Disabilities Education Act). State Departments of Education define visual impairment specifically for their student population, for example, Kentucky's regulations specify that a student's visual acuity with prescribed lenses is 20/70 or worse, or the student has a condition that causes a functional loss of vision (Kentucky Department of Education 10).

The purpose of this study is to examine academic growth in reading for students with visual impairments in grades three through ten. This grade span was selected because by third grade, students who read Braille are starting to be fluent and potentially have experience with assessments on computers, and after tenth grade, reading growth is minimal. Differences between students with and without visual impairments will be examined to determine if the gap in reading achievement is increasing, decreasing or consistent across grade levels.

**Methods**

Data was collected from the Measures of Academic Progress (MAP) Reading tests administered for students with visual impairments through grades 3-10 from four different states: Arizona, Indiana, New Mexico, and South Carolina. The study used exploratory analysis of longitudinal data to discover patterns of score change over time across students with and without

visual impairments. Conditional score distribution was examined across grade levels. Group means and standard deviations were compared to the MAP reading norm (Thum and Hauser 55) to examine if the two groups were growing in a similar or different fashion. The distributions of difference between two groups across time was examined.

1. For students with visual impairments, does their MAP score change over time? What is the pattern of change?
2. Do students with visual impairments have different growth over time comparing to students without visual impairments? How does the pattern differ?

*Sample*

Table 1 (Appendix B) presents student demographic information. The final sample included 511 test events that were collected from four schools for the blind and visually impaired in Arizona (N = 218), Indiana (N = 122), New Mexico (N = 97), and South Carolina (N = 74). These test events were completed by 224 students, including 101 females and 123 males. These students were from grades 3 to 10 and completed MAP reading test between spring 2008 and spring 2016. In the longitudinal data matrix, for all the students, there were 490 valid scores out of the total (N = 1792) across grades 3 to 10, containing 73% missing data.

Table 1. Sample Summary

| State | Female | Male | Total Number of Students |
|---|---|---|---|
| Arizona | 44 | 47 | 91 |
| Indiana | 23 | 35 | 58 |
| New Mexico | 19 | 21 | 40 |
| South Carolina | 15 | 20 | 35 |
| Total | 101 | 123 | 224 |

*Measures*

MAP is computerized adaptive assessments that schools typically administer at times between their high stakes accountability assessments and are often referred to as interim assessments. Specifically, MAP assessments are administered seasonally (fall, winter, and spring) as they were for the students in the study. MAP assessment items are calibrated on a vertical scale that is specific for each subject area, using a one-parameter item response theory model (Rasch) (NWEA 23; Barker 19). MAP assessments show high reliability and consistency attributable to following the AERA/APA/NCME Standards for Educational and Psychological Testing protocol. Since the tests are adaptive, each student experiences a different set of items. Items are selected from an item pool using an algorithm that searches for the most informative item, where $\hat{\theta}$ is the interim ability estimate and $\delta$ is the difficulty of the item required. The test taker's estimated ability is updated after each item response. The update is used to identify the difficulty of the next item to be presented. Because of this method, students have a roughly 50% probability of responding correctly to any given item, with their response (correct/incorrect) driving the selection of the next item presented.

**Discussion**

To address our research questions we computed group means and standard deviations for these 511 test events across grades 3-10, and compared results to the national MAP reading status norms that represent national performance in MAP reading test.

As seen from Table 2 (Appendix B) and Figure 1 (Appendix A), this group of students exhibits steady growth across grades. The curve follows a monotonic pattern. In general, students show larger growth in the lower grade levels (grades 3 – 6) than the upper grade levels (grades 7-10). Students with visual impairments show larger growth from grade 5 to 6 and grades 7 to 8.

Interestingly, the national norm student group shows no growth from grade 9 to 10, while the students with visual impairments accelerated growing from grade 9 to 10.

Table 2. Descriptive Statistics of Data Sample

| Grade | Mean RIT Score | SD |
|---|---|---|
| 3 | 181.52 | 23.28 |
| 4 | 187.73 | 22.62 |
| 5 | 190.71 | 21.19 |
| 6 | 196.43 | 20.39 |
| 7 | 197.38 | 20.22 |
| 8 | 201.32 | 21.97 |
| 9 | 201.76 | 21.45 |
| 10 | 207.96 | 18.79 |

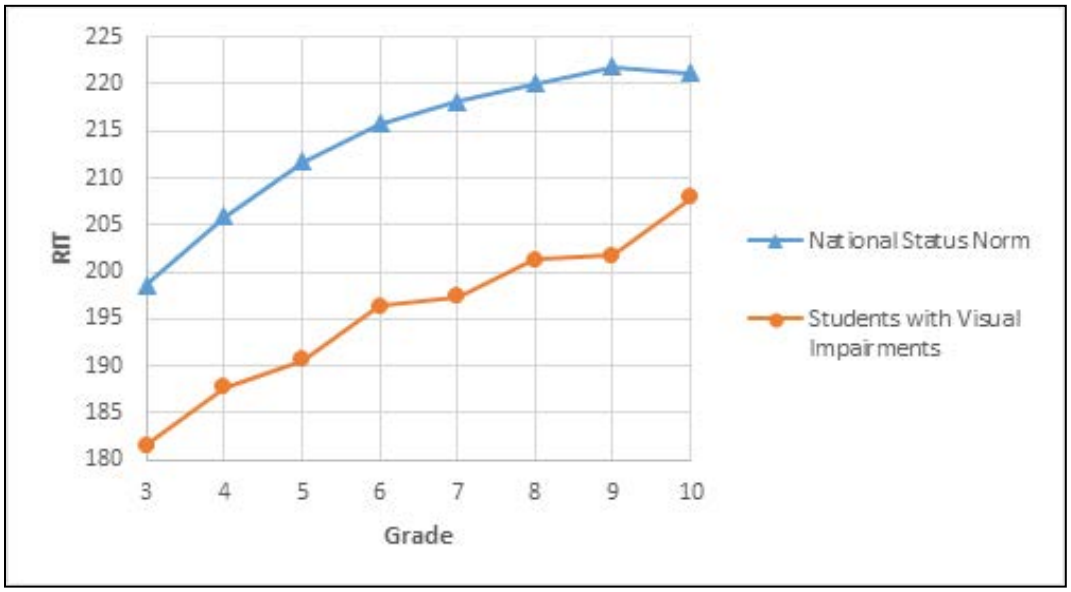


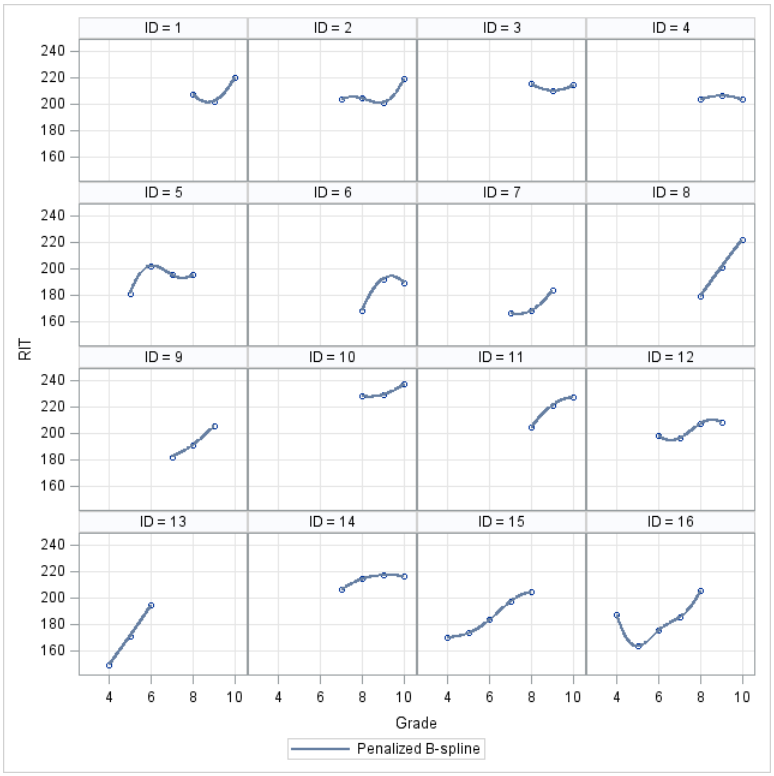

Fig. 1. Reading Score Group Mean Across Grade

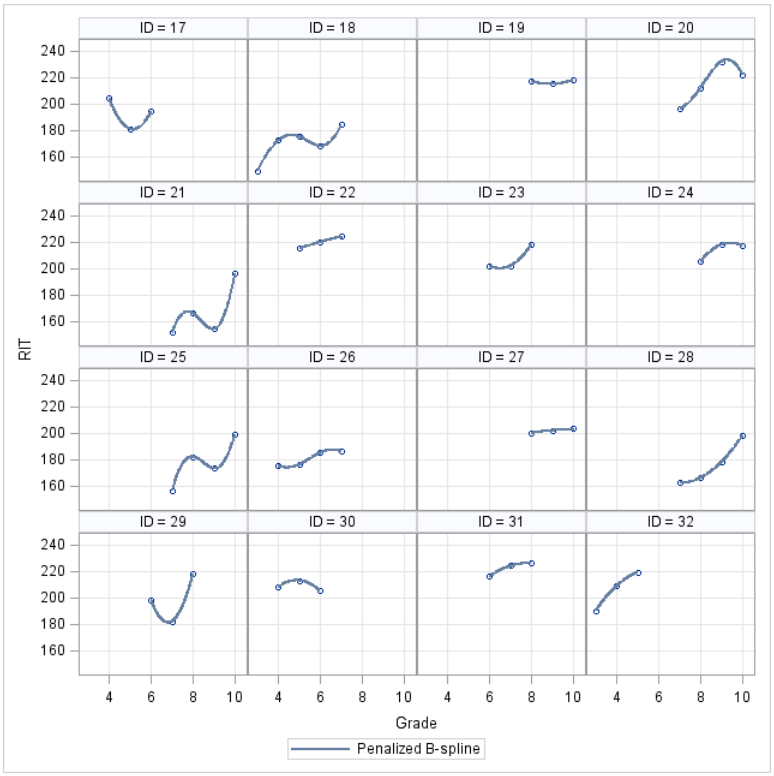
On average, there is an achievement gap between students with visual impairments and the overall national sample. The achievement of this particular group is approximately 20 RIT points lower than the average MAP reading performance. This achievement gap could be explained by disparities in when students with visual impairments acquire literacy skills

compared to students who are sighted. Research points to lack of incidental exposure to print as the reason that students with visual impairments are delayed in starting to read (Hatton et al. 744). "Children with normal vision encounter writing on walls, labels on food packages, directional road signs, and so forth. Because these opportunities are out of scope of children with low vision, they necessarily have less experience with written materials" (Bosman et al. 218). Another possible explanation suggests that deficits in general knowledge cause a difference between reading ability and age expectations (Gillon and Young 48), which may also be attributed to incidental learning.

In addition, we investigated the pattern of student growth. Due to the large amount of missing data, we examined individual student's longitudinal profile. First, we included all students who have valid scores in more than two consecutive years (N = 64). Second, we included all students who have valid scores in more than three successive years (N = 28). To help explain these change patterns, repeated measurements of individual MAP reading scores obtained from 64 students and 28 students are plotted in Figures 2A and 2B (Appendix A), respectively. Figure 2A contains 64 students' profiles that display a variety of growth patterns. For example, five students exhibit linear growth (e.g., ID = 8, 13, 26, 31, and 55) showing consistent growth over time. As can be seen from other students, changes in MAP reading scores are not adequately characterized by linear trajectories—individual growth is not linear. Figure 2B contains 28 students' profiles that all display non-linear growth. The results indicate that, there is no uniform growth pattern for this group of students with visual impairments. Since our sample size is small, these patterns of growth, which include steeper gains and score drops, are easier to isolate. The NWEA national status norms represent the growth of the general school

population and are based on tens of thousands of test results. The NWEA norms study does not isolate individual test results which could also show these irregular patterns of growth.



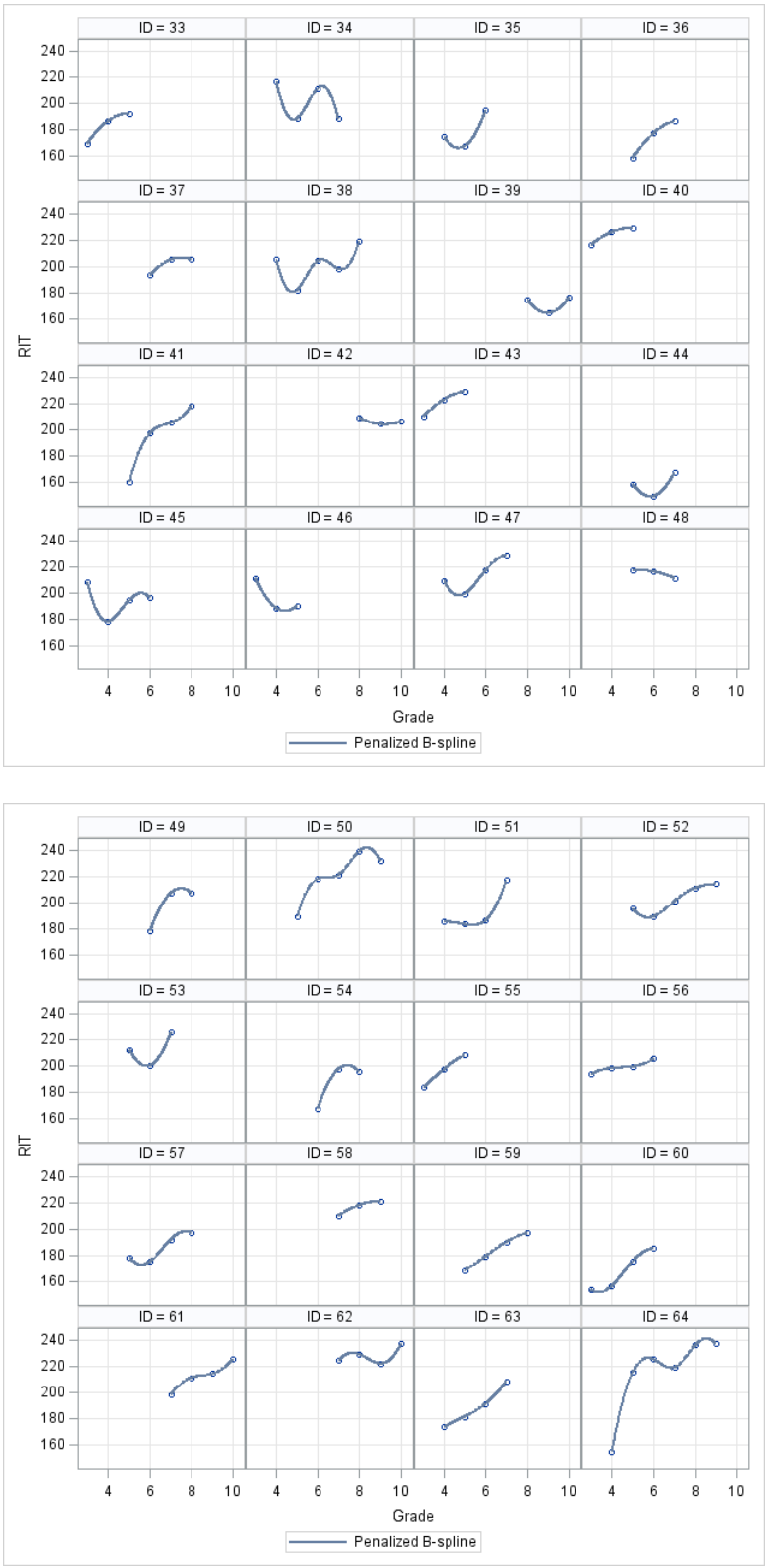



Fig. 2A. Longitudinal Observation of Individual Student (N = 64).

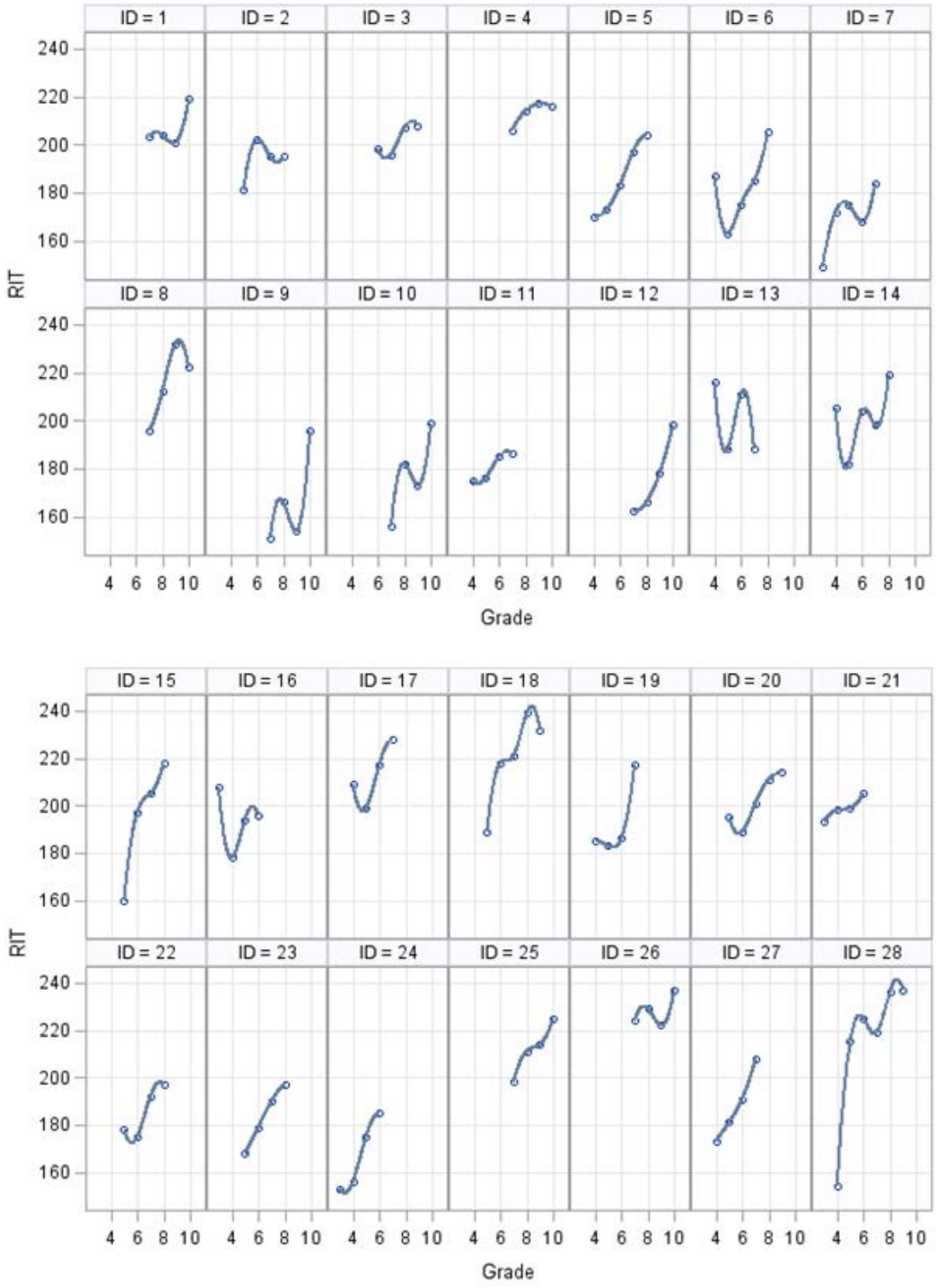



Fig. 2B. Longitudinal Observation of Individual Student (N = 28).

## Conclusion

Students with visual impairments experience learning to read in a variety of ways, and understanding what this means in terms of student growth trajectories is important. Students with visual impairments are exposed to print and reading strategies at later age than their sighted peers. Our study revealed interesting findings regarding the differences between students with visual impairments and the national MAP reading normed group. While most of our findings support prior research, others findings provide a foundation for further longitudinal investigation.

The difference between initial performance for students in the nationally normed group and students with visual impairments in grade 3, is an important finding. This data seems to support previous research from Edmonds and Pring (337) indicating a two year delay in reading between students with visual impairments when compared to their sighted peers. Additionally, while there seems to be an accelerated rate in growth for students with visual impairments in upper grades compared to the national norms. Investigating how these students continue accelerating in reading growth is important for instruction and student learning.

### *Limitations*

Findings from this preliminary study must acknowledge several limitations. First, this study is from eight years of student data, which offered a great amount of information relating to reaching achievement and growth overtime.

### *Generalizability*

Missing data was significant within the dataset with 73% missing and, therefore, the ability to generalize the results may be compromised. Additionally, since data was collected over a broad number of years, 2008 through 2016, not all states or students have data available.

Measuring longitudinal growth in a more sensitive manner such as months or weeks is suggested as a more accurate approach.

*Confounding Variables*

In addition to the potential limited generalizability of the data with a small total population and extensive missing data, there are few other covariates that could have been incorporated into the analysis such as type of visual impairment for each student. For example, whether the student used a screen reader and refreshable braille, or whether the student used a magnification software device, could provide additional information. Also, the inability to account for school type (e.g., public or residential) makes it difficult to specify why some students may be accelerating in reading while others have score drops. More specifics about the student could help to explain some of the variation and making the data more generalizable.

*Future Studies*

This study was simply a launching point, hopefully, for more informative and extensive research analysis. After this year (2016-2017), NWEA will obtain growth data from nine schools for the blind, which includes three time points within each year. This information will not only be available for reading achievement, but in mathematics, science, and language usage. Conducting studies to examine the validity of tests for students using screen readers, braille devices, and accessibility will be investigated. Further studies investigating the nesting of students within school type (e.g., public vs. residential) will also be considered. Investigating these relationships between students with visual impairments and their sighted peers helps to understand learning development which will promote growth in all areas of academic achievement.

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