

## Translating Test Achievement Losses into Instructional Weeks and Earnings

In order to make comparisons across contexts and over time, researchers generally convert test scores to standard deviation units (a measure of dispersion) to make the estimates more easily comparable. . But this is not a measure that will be well-understood by many educational practitioners. So, to understand the implications of differences in test performance and typical gains in pre-pandemic years as compared to performance and gains across years of the COVID-19 pandemic, we translate these tests measures both into typical weeks of student learning and describe the implications of the changes in achievement in terms of how they are predicted to affect lifetime earnings.

### ***Calculation of average weeks behind in math and reading***

We begin by observing the approximate difference in average student achievement between fall 2019 and fall 2021 test scores on the NWEA Map Growth tests (known as “RIT score”). Table 1, for math, and Table 2, for reading, show how a 1 standard deviation (SD) difference in RIT scores varies by grade, from a low of 14.4 in grade 4 to 18.9 in grade 8.<sup>1</sup>

We used a .25 SD and .13 standard deviation gap in student scores in math and reading based on standardized mean differences in RIT scores across grades 4 to 8.<sup>2</sup> We convert the RIT score points to weeks of instructional using the estimated linear weekly gain between weeks 4 and 32 for the median student. This calculation is illustrated by grade in the table below.

**Table 1: Converting a 0.25-SD loss into instructional weeks, math**

Grade	SD loss	1 SD in RIT points	RIT point loss	RIT gain per week	Loss in instructional weeks
4	0.25	14.4	3.6	0.39	9.2
5	0.25	15.2	3.8	0.34	11.1
6	0.25	16.1	4.0	0.29	13.9
7	0.25	17.4	4.4	0.23	18.7
8	0.25	18.9	4.7	0.19	24.6

**Table 2: Converting a 0.13-SD loss into instructional weeks, reading**

Grade	SD loss	1 SD in RIT points	RIT point loss	RIT gain per week	Loss in instructional weeks
4	0.13	16.8	2.2	0.29	7.5
5	0.13	16.4	2.1	0.23	9.2
6	0.13	16.5	2.1	0.19	11.5
7	0.13	16.5	2.1	0.15	14.4
8	0.13	17.0	2.2	0.13	17.0

<sup>1</sup> Thum, Yeow Meng, and Megan Kuhfeld. *NWEA 2020 MAP Growth achievement status and growth norms for students and schools*. NWEA Research Report. Portland, OR: NWEA, 2020, Tables B.1 and B.2.

<sup>2</sup> Grade-specific standardized mean differences can be found in Tables 5a and 5b of Kuhfeld, M. & Lewis, K. (2021). *Technical appendix for: Learning during COVID-19: An update on student achievement and growth at the start of the 2021-22 school year*. NWEA.

Note that the loss in instructional weeks is largest in grades 7 and 8. That's largely because the linear RIT point gain per week for the median student is lower for students in higher grades.

Averaging the last column into buckets for grades 4-5 and grades 6-8 gives the numbers in the report: 10 weeks for grade 4-5 math, 8 weeks for grade 4-5 reading, 19 weeks for grade 6-8 math, and 14 weeks for grade 6-8 reading. We also tested how these figures would change if the SD loss was allowed to vary by grade. In that case, the weekly loss would be 11 weeks for grade 4-5 math, 10 weeks for grade 4-5 reading, 18 weeks for grade 6-8 math, and 11 weeks for grade 6-8 reading.

### ***Calculation of expected loss in lifetime earnings***

To assess the implications for students' later earnings, we rely on prior research studies, which connected adults' earnings with their achievement test scores in their youth. Earlier studies by others—such as Murnane, Willett and Levy (1995) and Neal and Johnson (1996)—yielded estimates of 8.0% and 12.6% for men and women and 18.7% and 25.6% for men and women respectively.<sup>3</sup> We use a more recent estimate from Heckman et al. (2006), that a standard deviation in cognitive test scores is associated with a 14.3% difference in earnings.<sup>4</sup>

Starting with a 0.25-standard deviation loss in test scores, we calculate the expected loss in lifetime earnings using an estimate of the relationship between earnings and cognitive skills and an estimate of the present value of lifetime earnings of recent cohorts. We converted to lifetime earnings using an estimate of the present value of lifetime market earnings for an 11-year-old from Grosse et al. (2019), assuming a 3% discount rate and annual productivity growth of 0.5%.<sup>5</sup>

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<sup>3</sup> Murnane, Richard J., John B. Willett, and Frank Levy. "The growing importance of cognitive skills in wage determination." *The Review of Economics and Statistics* (1995): 251-266; Neal, Derek A., and William R. Johnson. "The role of premarket factors in black-white wage differences." *Journal of Political Economy* 104, no. 5 (1996): 869-895.

<sup>4</sup> Heckman, James J., Jora Stixrud, and Sergio Urzua. "The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior." *Journal of Labor Economics* 24, no. 3 (2006): 411-482, Table 5.

<sup>5</sup> Grosse, Scott D., Kurt V. Krueger, and Jamison Pike. "Estimated annual and lifetime labor productivity in the United States, 2016: implications for economic evaluations." *Journal of Medical Economics* 22, no. 6 (2019): 501-508.