
# ASU Prep Digital Academy:

# Evidence of Effectiveness

MARCH 17, 2023

### About EDataSci

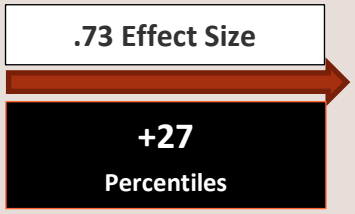
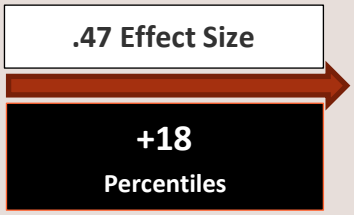
EDataSci is a research firm in education and other sciences. Senior Director Jeff McLeod holds a doctorate in quantitative methods in education and psychology. He is certified by WWC as a research reviewer under version 4.1 standards. He has over 20 years of experience as a senior psychometrician in high stakes testing programs and has consulted on a variety of outcome studies in education, psychology, and health sciences. LinkedIn page www.linkedin.com/in/jeff-mcleod-EDataSci

# Overview

ASU Prep Digital appointed an independent educational research firm EDataSci to analyze the growth outcomes after a year of virtual coursework during the 2020-21 school year at Arizona Preparatory Digital Academy. The purpose of the study was to measure the extent to which student improvement after one year of instruction in a virtual or blended environment was (1) positive and statistically significant, and (2) comparable in magnitude to growth as detected by recognized growth measures from national samples.

This brief report is a condensed version of an academic paper in preparation for publication.

# ASU Prep Digital Academy Info-Graphic

| ESSA Criteria for Promising Evidence | Study Characteristics Meet ESSA Requirements |
|---|---|
| Well-designed and implemented correlational study, statistical controls for selection bias. | Correlation of online learning with student achievement in mathematics and reading. Growth pre- to post-test growth scores control for baseline achievement. |
| Intervention: Fully online math and reading curriculum using Edmentum's Exact Path personalized learning delivered in purely virtual and blended learning environments.<br><br>Design: Within-subjects treatment effects controlling for grade level and individual student pre-test scores.<br><br>Outcome: Student growth for one year of instruction.<br><br>Results: Statistically significant positive growth effect sizes after one school year of instruction.<br><br>Growth Effect Sizes: Growth is difference between end of year and beginning of year test scores divided by the standard deviation of the differences<br><br>Improvement Index: How many percentiles the average child advanced from beginning of year to end of year. | Statistically significant growth for both Mathematics and Reading was observed on **Edmentum Exact Path Summative Assessments**<br><br>**Mathematics Growth**<br>  <br><br>**Reading Growth**<br>  |
| No strong negative findings from experimental or quasi-experimental studies. | No strong negative effects have been found using experimental or quasi-experimental studies that meet WWC group comparison standards.<br><br>WWC identifies online or distance learning as a promising intervention worthy of further research. |

# Hypothesis

The hypothesis of the study was that ASU Prep Digital Academy's online virtual learning program using a personalized learning framework would facilitate academic growth at least comparable to national growth norms after one year of instruction.

# Rationale

A report from the United States Department of Education (2009) emphasized that outcome research for online learning should clarify the intended purpose. On one hand online learning may be compared to traditional education outcomes to answer the question of whether an online program could effectively replace traditional education for students who might otherwise not have access to traditional models. When this replacement alternative motivation exists, a positive outcome is for online education produces equivalent outcomes. Thus, the hypothesis looks for growth that is at least comparable.

Researchers in this study consider any gains between baseline growth and growth for online students is due to the program features, not the online medium itself. Such programmatic features such as staff interaction, curriculum, and engagement, are considered educational enhancements which all programs (e.g., face to face, virtual direct instruction, blended learning) could benefit from.

One year of online learning at ASU Prep Digital Academy is hypothesized to be comparable to traditional education because children naturally learn if they are given the opportunity. If children exceed the growth normally achieved, it would be because the learning experience in this program is personalized, guided, and computer assisted. These are aspects of many successful face to face programs as well, and these factors are hypothesized to explain why one might expect the online program to be effective.

## Personalized Learning

Personalized learning implements the following commonalities of successful learning programs.

**It is data driven…**
Personalized learning interventions make use of student information including granular data about competencies, strengths, needs, and progress. Student interaction with technology-based learning platforms retain this data to guide teachers toward effective interventions. Student interaction in distance learning platforms leaves data logs indicating how students engaged in the material and how long they engaged.

**It is adaptive…**
Students in effective personalized learning programs follow customized learning paths toward goals. The curriculum is adapted to their current ability level and systematically leads them toward command of the content so they can continue in the learning path. This is often accomplished using adaptive, formative testing throughout the year. ASU Prep Digital Academy implemented an online learning platform, Edmentum's *Exact Path*. This is an adaptive learning environment for Mathematics and Reading that performs cognitive diagnostics to assess present level of progress. The system intelligently places students at the optimum place in a learning progression based on over 20 years of research on student progress nationwide.

**It is flexible…**
A student's aptitude to learn should dictate the amount of time a learner is allowed to devote to assignments. Students who need more time on a class module should be given that time within practical constraints. Such flexibility may be more naturally provided in an asynchronous design where the teacher can have multiple students working at different paces.

**It uses technology well…**
Students interact with learning materials using immersive, graphical environments such as 3D simulation, gaming, story lines, goals, and rewards. A growing body of research (Moreno & Mayer, 2007) suggests that immersive learning environments are effective

because they address affective factors in motivation. Immersive learning offers guided activity, feedback, and control. Distance learning activities frequently offer a storyline and a personal challenge with frequent rewards.

# Methods

A sample of 969 students from grades K-8 from ASU Prep Digital Academy was used to test the implementation of their distance learning program during the 2020-2021 school year.

Only students who had both pre-test and end-of-year post-tests in Math or Reading qualified for the analysis. There were 516 students in the K-8 Math program who had pre- and post-test and 463 students from the K-8 Reading program who had pre- and post-tests.

Pre-and post-test scores were used to derive growth metrics in Reading and Mathematics, and these metrics would be compared to national benchmarks of the amount of growth that cognitive and developmental psychologists might expect after one year of instruction.

# Measures

Student growth could be rigorously measured in this study because ASU Prep Digital Academy uses a national vertically scaled growth measure implemented by Edmentum's Exact Path (Edmentum, 2022). Technical materials on the Edmentum product website indicate it is a computerized adaptive test with national norms, a reliability of .90 and a strong validity claim as documented by multiple studies correlating the scale with other recognized national growth scales. Because Exact Path implements a vertical scale it is possible to compare its growth measure to other large vertically scaled assessments. In addition, a pre-test lets each student serve as their own control case. In this way, end of year results are automatically controlled for prior academic achievement at baseline.

The content blueprint for the Edmentum vertical scale items is based on common core standards but modified to meet the needs of all states, including those that do not use common core. Scores on Exact Path range from 800 to 1600.

The primary growth benchmarks were derived from Hill et al (2008) who created growth trajectories for Math and Reading using an aggregate of seven national, vertically scaled exams in Reading and Math including CAT/5, SAT 9, TerraNova CTBS, TerraNova CAT, Gates-MacGinitie, MAT 8 and SAT 10. The authors averaged the effect sizes for each grade over grade transition to derive a set of point-predictions for the amount of growth expected due to instruction for students over the course of a development.

An additional comparison measure was provided using another prominent set of growth benchmarks from a study by Dadey and Briggs (2012). These authors, like Hill et al (2008) averaged the grade over grade growth metrics from all statewide vertical scales used in high stakes end-of-year testing programs. These benchmarks might be considered very compelling when interpreting growth outcomes from any outcome study,

# Results

Growth effect sizes were calculated by grade level in grades K-8 for ASU Prep Digital Academy. Corresponding benchmarks were taken directly from the published work of Hill et. al (2008), and from the work of Dadey and Briggs (2012).

Results for K-8 Reading (N = 463) are shown in Table 1 below. Effect Size is the metric used to quantify growth. While some researchers overlay crude categories for interpreting effect size magnitudes (.20 = small, .50 = medium, .80 = large), these interpretations are not used here because we identified point predictions, a standard of comparison using benchmark cognitive development trajectories. It should be noted however that all effect sizes were statistically significant at the $p < .05$ level. Note that Grade 6 has a small number of students who took the Exact Path tests which appears to have resulted in outlier observations. The effect sizes are given in Table 1 below for reading. The figures presented later will eliminate Grade 6 ASU data to avoid unjustified conclusions from sparse data.

**Table 1.**

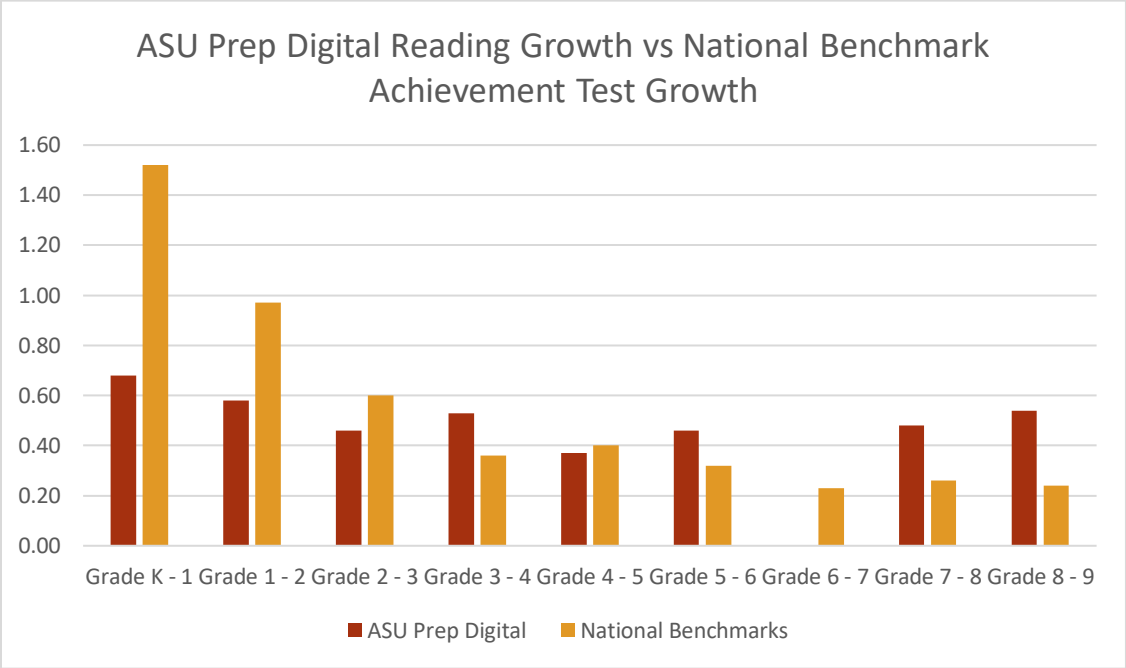
| Grade | N | Growth Effect Size | 95% C.I. |
|---|---|---|---|
| K | 35 | 0.68* | [0.31, 1.05] - |
| 1 | 28 | 0.58* | [0.18, 0.98] |
| 2 | 58 | 0.46* | [0.19, 0.73] |
| 3 | 52 | 0.53* | [0.24, 0.82] |
| 4 | 84 | 0.37* | [0.15, 0.59] |
| 5 | 63 | 0.46* | [0.20, 0.71] |
| 6 | 17 | 0.05 | [-0.42, 0.53] |
| 7 | 66 | 0.48* | [0.23, 0.74] |
| 8 | 60 | 0.54* | [0.27, 0.81] |

Table 2 shows the comparison for Math (N=516) grades K-8. Again, the ASU Prep Digital Academy math program showed statistically significant effect sizes except for Grade 6 which had unacceptably small numbers of students for clear interpretation.

**Table 2.**

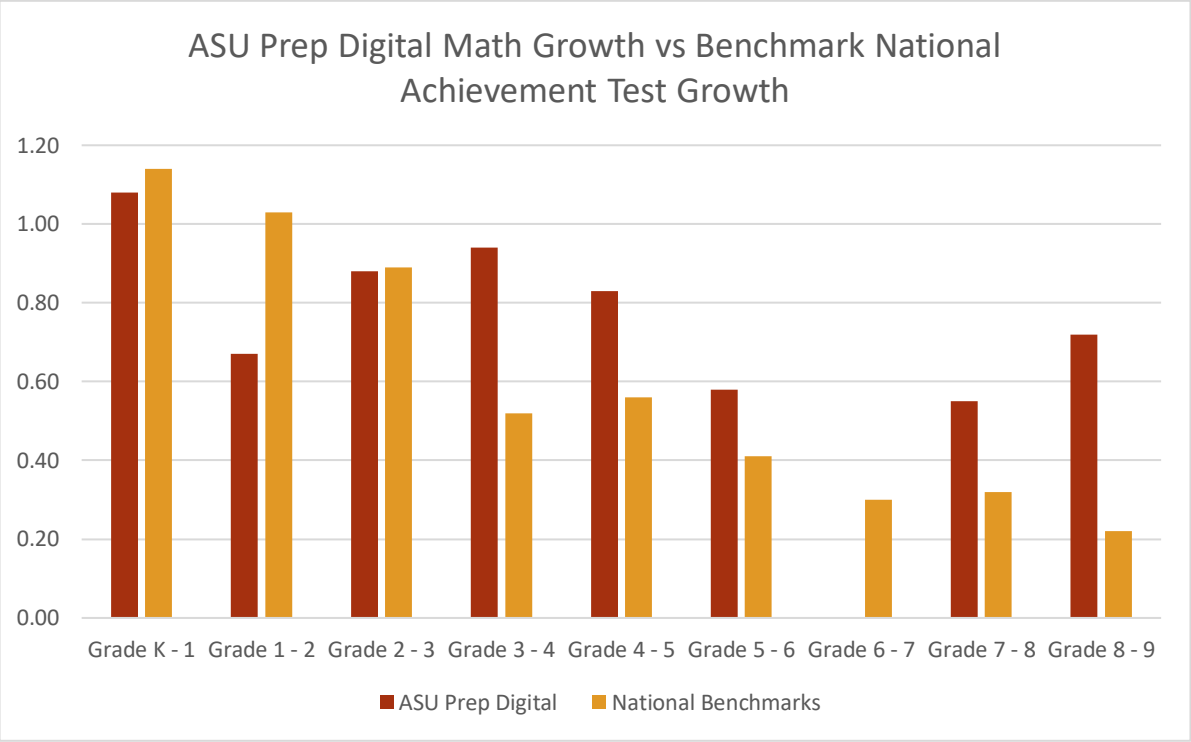
| Grade | N | Growth Effect Size | 95% C.I. |
|---|---|---|---|
| K | 37 | 1.08* | [0.69, 1.49] |
| 1 | 28 | 0.67* | [0.26, 1.08] |
| 2 | 62 | 0.83* | [0.54, 1.12] |
| 3 | 55 | 0.94* | [0.82, 1.26] |
| 4 | 85 | 0.83* | [0.58, 1.07] |
| 5 | 63 | 0.58* | [0.31, 0.84] |
| 6 | 19 | 0.24 | [-0.21, 0.70] |
| 7 | 102 | 0.55* | [0.34, 0.76] |
| 8 | 65 | 0.72* | [0.45, 0.99] |

## Benchmark Comparisons




* ASU Prep Digital Academy grade 6 did not have a large enough sample for a fair comparison so it is omitted in this figure.

Reading growth for ASU Prep Digital Academy compares very favorably to cognitive development trends provided by Hill et al (2008) for Grades 3 through 8. There was not a close correspondence for Grades K-2. Close inspection of the data revealed that children in K-2 had very strong reading ability at the start of the school year which resulted in relatively small effect sizes even though end of year performance remained strong.

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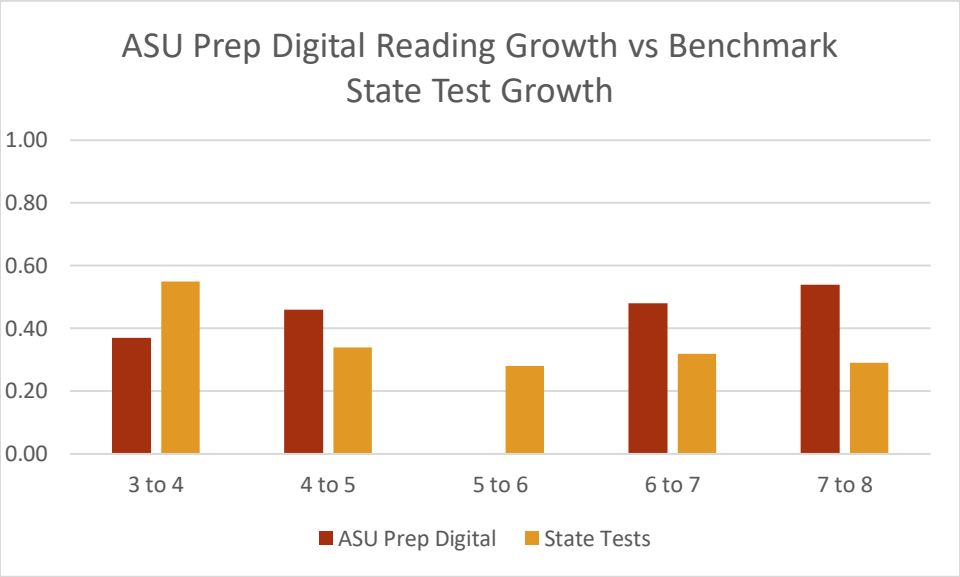


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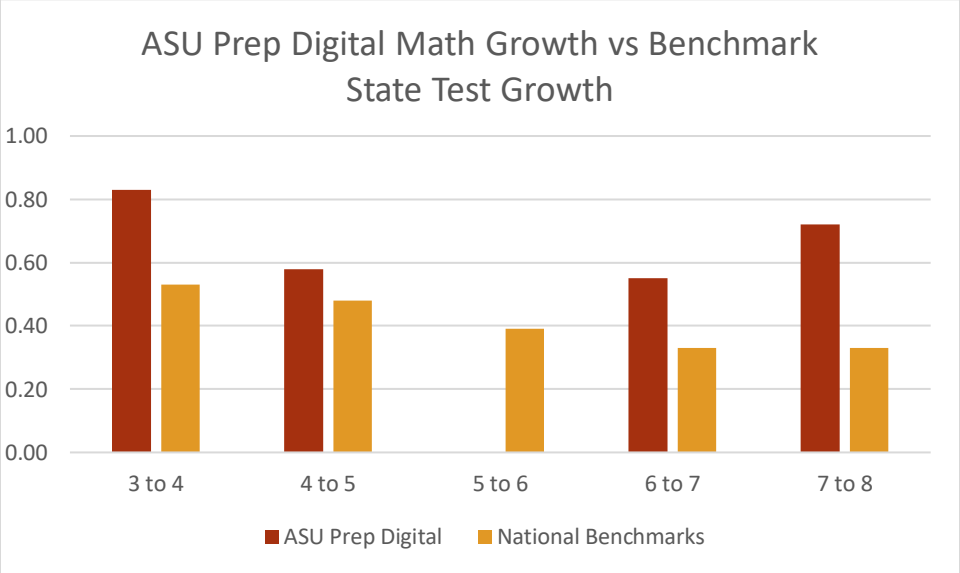


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Reading and math benchmarks versus growth on state tests can only be compared for grades 3-8 because younger grades were not included in the No Child Left Behind assessment requirement for most schools. Here we see that ASU Prep Digital Academy student growth compares very favorably with nationwide cognitive benchmarks.

## References


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Hill, C. J., Bloom, H. S., Black, A. R., & Lipsey, M. W. (2008). Empirical Benchmarks for Interpreting Effect Sizes in Research. Child Development Perspectives, 2(3), 172–177. https://doi.org/10.1111/j.1750-8606.2008.00061.

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