ESSA Tier 1 Evidence for Online Instruction in Algebra 1 for Middle School Students

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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

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Instructional interventions for K-12 children should be founded on a body of experimental evidence. The Department of Education instituted the What Works Clearinghouse to provide standards for the quality of evidence for the effectiveness of interventions.

WWC assigns ESSA evidence evaluations not only to branded technology products but practices that are "reliably replicable with different participants, in other settings, and at other times." (What Works Clearinghouse, 2012, p. 3). The paper reviewed in this brief report meets the ESSA Tier 1 Evidence standard for the effectiveness of the practice of online learning of Algebra 1. The evidence rating means that any intervention that implements the described practice with fidelity, such as ASU Prep Digital Academy may be expected to yield positive results.

The study reviewed here is a well-executed, large-scale study published by Heppen et. al (2011) which meets ESSA Tier I evidence for effectiveness of online instruction in Algebra. This is the highest level of evidence under ESSA standards.

The purpose of the study was to test whether offering Algebra I as an online course would be beneficial for students who otherwise would not have been able to enroll in Algebra. Would an online course increase their math competency? Would students become interested in higher mathematics and pursue those courses in high school and beyond?

Eighth grade students (N=450) from 68 schools in Maine and Vermont were randomly assigned to face-to-face direct instruction in algebra or a computer based online algebra curriculum over the course of the full one school year. Results showed:

- An average increase of 16 percentile points in general mathematics achievement scores compared to the traditional algebra by direct instruction.

- After the 8th grade school year, 51% if the online algebra group chose to take additional advanced mathematics in high school compared to 26% in the comparison group.

The experimental intervention features align very closely with ASU Prep Digital Academy's learning context, and therefore the evidence established by this study extends to other programs with similar facets.

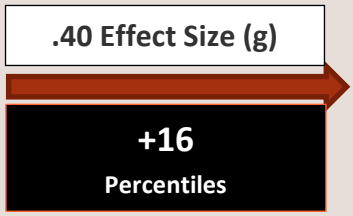
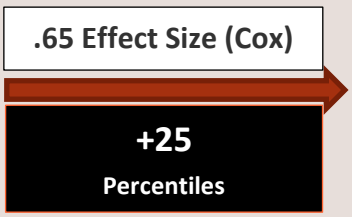
Alignment of Intervention Features

Feature	Tier 1 Study	ASU Prep Digital Academy
Computerized online direct instruction	X	X
Guided practice	X	X
Practice problem sets	X	X
Automated feedback	X	X
Quizzes	X	X
Outcome Exams	X	X

*Features of ASU Prep Digital Academy refer to the Exact Path instructional design used by ASU Prep Digital Academy.

The importance of the findings, gleaned from the research review conducted by Heppen et al (2011), is the evidence that Algebra I operates as a gateway to more advanced mathematics courses in high school and college, and that students who succeed in Algebra I in middle school have more success in mathematics throughout high school and college than students who take Algebra I later.

Tier 1 Evidence for Online Instruction in Algebra Infographic

ESSA Criteria for Tier I Evidence	Study Characteristics Algebra 1 Online Course vs Classroom
Well-designed and implemented experimental study that meets WWC standards without reservations.	Randomly assigned 450 children within 8th Grade classrooms to a treatment (online) and control (classroom only) condition. No attrition threat, psychometrically sound outcome measures, no confounding factors. The majority of students completed at least half of the self-paced curriculum. Treatment was an online Algebra I curriculum given to the 8th Grade treatment group. Outcomes were (1) scores on a computer adaptive algebra test with reliability of .80, and (2) enrollment in advanced math classes after taking algebra online.
Statistically significant positive effect on a relevant outcome.	2 statistically significant positive outcomes. Algebra I Knowledge Post Test  Subsequent High School. Enrollment in Advanced Math  51% of online/blended students took advanced math grades 9-10.

	26% control group took advanced math grades 9-10.
No strong negative findings from experimental or quasi-experimental studies.	Some studies in the last 20 years have reported finding small negative effects for online learning, but none show **strong** negative findings. The magnitude of effect for this study outweigh any negative effects reported in the literature from experimental or quasi-experimental studies

Heppen, J.B., Walters, K, Clements, M., Faria, A., Tobey, C., Sorenson, N., Culp, K, Garcia, G. (2011). Access to Algebra I: The Effects of Online Mathematics for Grade 8 Students. ERIC: https://files.eric.ed.gov/fulltext/ED527394.pdf

References

Heppen, J.B., Walters, K, Clements, M., Faria, A., Tobey, C., Sorenson, N., Culp, K, Garcia, G. (2011). Access to Algebra I: The Effects of Online Mathematics for Grade 8 Students. https://files.eric.ed.gov/fulltext/ED527394.pdf.

What Works Clearinghouse (2012) WWC Evidence Review Protocol for Middle School Mathematics Interventions, Version 2.0. Accessed January 31, 2023. https://ies.ed.gov/ncee/wwc/Docs/ReferenceResources/msm_protocol_v2.0.pdf