Online Mathematics Homework Increases Student Achievement

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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

ESSA Tier 1 Online Mathematics Homework Increases Student Achievement

Adaptive teaching is an individualized learning approach where the teacher uses the product of a student's work to offer individualized feedback and guidance to meet the student's particular needs. Closely related to adaptive teaching is the practice of formative assessment. Formative assessments from practice problems provide access to real time problem solving that provides the data for adaptive teaching.

The study presented here is a well-executed, two-year large-scale investigation of an online implementation of adaptive learning with formative tests, published by Roschelle, Feng, Murphy, Mason (2016). The researchers randomly assigned 43 schools to either a treatment condition incorporating teacher training and online homework using the ASSISTments learning platform, or a control group. In the treatment group, students were given *adaptive instruction*, *guidance*, and *hints* in problem solving while doing their homework. The system provided teachers with "timely, organized information about students' work."

The ASSISTments platform administered problems from the class textbook which the teacher could assign in clusters. Teachers assigned practice problems to students who worked at home. The web software gave immediate feedback (correct/incorrect) to students and offered hints toward the solution. At the same time, teachers received reports from the platform informing them how many students were succeeding at each question and suggesting possible misconceptions based on answers.

The control group performed homework as usual. Teachers could use whatever practices they currently use.

Year one of the study was to familiarize teachers and students with the platform. Standardized testing produced outcome data the following year.

Results showed:

- An average increase for the online homework condition of 7 percentile points on the Terra Nova mathematics assessment. This is a statistically significant result.

- Those students with a history of low mathematics achievement benefitted most from the intervention.

ASU Prep Digital Academy offers online homework via automatic learning assignments at the student's own pace via the Exact Path learning platform, which aligns with the homework intervention features.

Alignment of Intervention Features

Feature	Tier 2 Study	ASU Prep Digital Academy
Computer-based activities to enhance direct instruction	X	X
Engaging multimedia materials to illustrate application of learned material	X	X
Media implements Interactive curriculum	X	X
Multiple practice opportunities	X	X

Features of ASU Prep Digital Academy are those incorporated into the online Exact Path instructional design.

Tier 1 evidence is germane to any educational context that reliably replicates the essential approach of online homework, and therefore one might expect positive results from online homework with ASU Prep Digital Academy.

Tier 1 Evidence for Online Homework

ESSA Criteria for Tier 1 Evidence	Study Characteristics of Online Homework vs Classroom Instruction
Well-designed and implemented experimental study that meets WWC standards without reservations.	Randomly assigned 43 schools with 2,830 children in 7th Grade math classrooms to a treatment (online homework on the ASSISTments platform) or control (usual homework practice) condition. The outcome was Terra Nova standardized achievement test for Mathematics.
Statistically significant positive effect on a relevant outcome.	1 statistically significant positive outcome. Online Homework Intervention .18 Effect Size +7 Percentiles
No strong negative findings from experimental or quasi-experimental studies.	

Roschelle, Jeremy, Mingyu Feng, Robert F. Murphy, and Craig A. Mason. (2016). Online Mathematics Homework Increases Student Achievement." *AERA Open* 2 (4). http://files.eric.ed.gov/fulltext/EJ1194398.pdf.