Registry of Efficacy and Effectiveness Studies

Study Title:
Longitudinal Follow-up to the Efficacy Study of Zoology One: Kindergarten Research Labs

Registry ID: 5980.2v1

Version History

The first version of this entry was published on July 6, 2023 3:08:43 PM EDT
Currently viewing this version.

Section I: General Study Information

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Primary Funding Source(s):
Institute of Education Sciences
National Center for Education Research

Award Number(s):
R305A160109

IRB Name:
University of Pennsylvania Institutional Review Board

IRB Approval Date:
2021-02-05

IRB Approval Number:
825099

Other Registration Name:
-

Other Registration Date:
-

Other Registration Number:
-

Study Start Date:
2020-01-01

Study End Date:
2023-12-31

Intervention Start Date:
2016-09-01

Timing of entry:
Prior to analysis of outcome data

Brief Abstract:
This is a longitudinal follow-up to the primary RCT study that examined the efficacy, cost, and implementation of an integrated science and literacy curriculum for kindergarten. The study was conducted in a large urban district and included 1,589 students in 71 classrooms in 21 schools. The research includes a multi-site, longitudinal cluster-randomized controlled trial and mixed-methods cost and implementation studies. Analysis revealed significant impacts on comprehension, letter naming fluency, and motivation to read. Analysis revealed significant impacts on comprehension, letter naming fluency, and motivation to read. No impacts were observed on decoding, word identification, or writing. The cost to produce the observed effects was estimated at $480 per student, two-thirds of which was borne by the school. Treatment classrooms achieved savings by using an average of three fewer instructional programs than control classrooms. Teachers reported positive effects from the integrated curriculum on student engagement, learning, and behavior. A cost extension was later awarded to examine longitudinal impacts on students who participated in the original study. This longitudinal analysis examines impact on reading, writing, and science outcomes into 4th grade.

Keywords:
RCT; evaluation; efficacy; literacy; science; kindergarten; longitudinal study; implementation study

Comments:
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Section II starts on the next page.

Section II: Description of Study

Type of Intervention:
Curriculum/Product

Topic Area of Intervention:
Reading and Writing

Number of intervention arms:
1

Target school level:
Kindergarten

Target school type:
Urban

Location of Implementation:
United States: United States : Northeast

Further description of location:
School District of Philadelphia. Philadelphia, PA

Brief Description of Intervention Condition:
Zoology One is a full-year curriculum centered around a daily 120-minute integrated literacy and science instructional block. The program includes four 9-week units, implemented in succession. The first unit is introductory, designed to orient students to the basics of books and literacy and to build key classroom procedures. Following this introduction, the curriculum proceeds through a Zoology unit, an Ecology unit, and an Entomology unit. Teachers receive a new set of topically aligned instructional materials and texts to use with each 9-week unit, but the structures and practices that guide instructional delivery are consistent throughout the year. Zoology One uses a balanced literacy framework that incorporates each of the following in every daily instructional block: direct instruction in reading, writing, and science; complex text exposure delivered via multiple daily, themed teacher read-alouds; high-volume print exposure via supported independent reading in themed, leveled texts; formative assessment and progress monitoring implemented by the teacher during individual conferences or small-group instruction; high-volume writing practice related to the science theme; and science inquiry, including hands-on science activities and drama, music and art activities oriented around the science themes. Zoology One also includes a focus on parental involvement; students are expected to build the stamina to read for 30 minutes in class, and 30 minutes at home each day.

Brief Description of Comparison Condition:
The control condition was business-as-usual kindergarten literacy and science instruction. Literacy instruction included

a combination of direct instruction, teacher read-alouds, shared reading, small-group instruction, and independent practice in both reading and writing. Science instruction was provided outside the literacy block.

Comparison condition:
Business-as-usual

Comments:
-

Section III: Research Questions

Confirmatory research questions:
Question 1:
Do students who received a literacy curriculum that integrates science (Zoology One) in kindergarten outperform students in business-as-usual control classrooms in reading up to four years after the intervention?

Exploratory research questions:
Question 1:
Do students who received a literacy curriculum that integrates science (Zoology One) in kindergarten outperform students in business-as-usual control classrooms in writing up to four years after the intervention?

Question 2:
Do students who received a literacy curriculum that integrates science (Zoology One) in kindergarten outperform students in business-as-usual control classrooms in science up to four years after the intervention?

Question 3:
Do literacy treatment effects persist within subgroups based on study cohort and teachers' fidelity of implementation?

Comments:
-

Section IV-A: Study Design (Selection)

Study Design:
Randomized Trial (RT)

Comments:
-

Section IV-B: Study Design (Input)

Study Design: Input

Unit of random assignment of intervention:
Teacher Class Section

Assignment within sites or blocks:
Yes

Define the sites or blocks:
School

Probability of assignment to treatment the same across sites or blocks:
Yes

Probability of assignment to treatment:
.5

Unit outcome data measured:
Student

Intermediate clusters between unit of random assignment and unit of measurement:
No

Comments:
-

Design Classification

Based on the responses above, this study has been classified as:
RT: Multisite (Blocked) Cluster Randomized Trial

Section V: Sample Characteristics

Approximate number of students per teacher class section: 22

Approximate number of teacher class sections in the comparision condition within each school: 2

Approximate number of teacher class sections in the intervention condition within each school: 2

Number of schools: 21

No No No No No Yes - Schools were required to have at least 2 kindergarten classrooms to participate in the study.
Comments:
-

Section VI: Outcomes (Input)

Confirmatory question 1: Outcome Measure 1

Outcome domain: Student Achievement - Literacy
Minimum detectable effect size: .1
Outcome measure: Quarterly and final core course letter grades - reading
Scale of outcome measure: Ordinal
Normed or state test: No
Test-retest reliability: N/A
Internal consistency: N/A
Inter-rater reliability: N/A
Same outcome measure in treatment and comparison groups: Yes

Confirmatory question 1: Outcome Measure 2

Outcome domain: Student Achievement - Literacy

Minimum detectable effect size: .1

Outcome measure: Woodcock Reading Mastery Test 3rd Edition Passage Comprehension subtest

Scale of outcome measure: Continuous

Normed or state test: Yes

Same outcome measure in treatment and comparison groups: Yes

Confirmatory question 1: Outcome Measure 3

Outcome domain: Student Achievement - Literacy

Minimum detectable effect size: .1

Outcome measure: Woodcock Reading Mastery Test 3rd Edition Word Attack Subtest

Scale of outcome measure: Continuous

Normed or state test: Yes

Same outcome measure in treatment and comparison groups: Yes

Section VII: Analysis Plan

Baseline data collected prior to start of intervention:

Yes

Description of baseline data:

Woodcock Reading Mastery Test 3rd Edition - Reading Readiness Cluster

Covariates you plan to include in the model:

Student Pretest

Covariates you plan to include in the model:

Analytic model:

Long-term effects.

Using course grades from 1st to 4th grade, we will implement three-level mixed-effects ordinal logistic model to explore longitudinal impacts on course grades. In this type of model, measurement time points (level 1) are nested within students (level 2), who are nested within sites (level 3). This model follows Hedeker & Gibbons (2006) and is presented in section VIII, Additional Materials.

Single year impacts.

Course grades – 1st to 4th grade. Longitudinal analyses will be follow-up with single year impact analyses to explore impacts on course grades from 1st to 4th grade. Three level ordinal logistic model will be used for each grade level analysis. In this model, students (Level 1) are clustered within classrooms (Level 3), which are in turn clustered within sites (Level 3). A baseline assessment variable will be included to increase the power to detect intervention effects. The three-level model is presented in Equations 1-3 in section VIII, Additional Materials.

Standardized Assessments – 1st and 2nd grade. Our

longitudinal analyses will also estimate impacts for single years in 1st and 2nd grade using standardized assessment data. Based on our prior study heterogeneity findings, average effects were complemented with estimates by cohort using multilevel analysis of covariance, which included a baseline assessment variable. This approach increased the power to detect the effect of the intervention on the outcome. Level 1, 2, and 3 models are presented in equations (4) - (6) in section VIII, Additional Materials.
We expect to find different levels of attrition across grade levels. To address this issue in our single years analyses, we will use an inverse probability weighting (IPW) approach to minimize the bias of group differences at baseline between the retained sample and the sample of students who were dropped out due to missing outcomes in later grades. Weighting participants who had all the relevant data needed in kindergarten by the inverse probability of being in the retained sample as of later grades generates a hypothetical sample, in which being in the retained sample or dropped sample is independent of the listed covariates (Austin & Stuart, 2015; Reynolds et al., 2011). The IPW approach for addressing potentially non-random attrition has been used to study education outcomes over time in other studies (Amadon et al., 2022; Reynolds et al., 2011; Weiland et al., 2021).
Heterogeneity Analyses. We will conduct exploratory analysis of treatment effect variation among subgroup of students over time. One predictor that is of particular interest is the fidelity of implementation at the classroom level. In addition, we will investigate the variation across study cohorts (cohort 1 and cohort 2). Other subgroup of interest includes study analytical samples, gender, IEP status, language and home language status, and eligibility for lunch assistance.< /span>

Plan to handle cases with missing outcome data:
Delete all cases with missing data on any outcome measure

Planned multiple comparisons adjustment, confirmatory question 1 :
Yes

Number of planned comparisons to adjust, confirmatory question 1 :
4

Correction for multiple comparisons, confirmatory question 1 :
Benjamini-Hochberg correction

Comments:
The exploratory analysis considers separate hypothesis tests for each grade level, and adjustments for multiple comparisons will be made accordingly.

Section VIII: Additional Information

Links:

https://www.cpre.org/edit-product-zoology-one-efficacy-evaluation-summary-findings-april-2020
Policy Brief summarizing early findings

Files:
File Name: Analytic Model Zoology One - Longitudinal Study.pdf

Description: Longitudinal study analytic models description

Comments:

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