

## PURPOSE

The purpose of the research was to test the effectiveness of an innovative PL model in improving achievement in mathematics, reading and language usage in a diverse population of K-5 school students. Research questions included:

1. Is there any impact on students' academic achievement over the course of the building phase and after one year of full implementation of the PL model? If so, what is the magnitude?
2. What is the student growth trajectory during the years of implementation? What are the trajectories for two disadvantaged groups, socioeconomically disadvantaged and English Learners?

The research also highlights a relatively new methodology, the use of a virtual comparison group (VCG) in the study design.

## SIGNIFICANCE

Personalized learning (PL) has expanded rapidly (EdWeek, 2017), with policies and funding sources supporting PL growing significantly (Banister, Reinhart, & Ross, 2015; U.S. Department of Education, 2017). PL is described as instructional practices in which students' needs and goals are accounted for during design and implementation of instruction (see Pane, et al., 2017). Digital technologies show great promise in supporting PL (Bingham, Pane, Steiner, and Hamilton, 2016). Though several studies of PL have reported positive results (U.S. Department of Education, 2017), there is a lack of research about the effectiveness of PL models.

## PARTICIPANTS AND INTERVENTION

### Participants

The treatment group included 2,304 K-5 students in a high-poverty mid-size school district in the Western U.S. who were enrolled in the district in fall 2013 (Year 1) and participated in the pre-test. The analytic sample was balanced by gender (51% females) and majority Hispanic (60%). Most were socioeconomically disadvantaged (64%) and a large percentage were English-language learners (ELL, 25%) at baseline.

### Intervention

The intervention was implemented over a four-year period, with Years 1-3 considered the "building phase" and included: a growth model, individual PL plans, computer-adaptive assessments, a learning management system, blended and extended learning, student goal-setting and reflection, strengths-based learning, cross-curriculum ELD, and educator PL. By Year 3, nearly all aspects were in place and students experienced PL in classrooms, extended learning environments and, starting in year 3, at home via free internet connectivity to technology and the district learning management system.

## STUDY DESIGN AND DATA SOURCES

The NWEA MAP was administered to the treatment group three times per year from fall 2013 to spring 2017. We considered fall 2013 administration as the baseline or pre-test, and the final administration (i.e., spring 2017 for mathematics and reading, and spring 2016 for language usage) as the post-test. Because the intervention was carried throughout the entire school district, it was impossible to conduct random assignment of conditions. Alternatively, we used a pre-post quasi-experimental design with a matched "business-as-usual" comparison group. For the comparison group, we used a national database of students' performance on MAP to construct the virtual comparison group (VCG, Ma & Cronin, 2009) using the baseline data. This VCG was followed longitudinally during the same time period in which the treatment students had MAP data. Data included students' performance on the NWEA's MAP (NWEA, 2017) assessments. For the comparison group, we used a national database of students' performance on MAP to construct the virtual comparison group (VCG, Ma & Cronin, 2009) using the baseline data. This VCG was followed longitudinally during the same time period in which the treatment students had MAP data.

Table 1

Treatment Impact Estimates for 1 Year After Full Implementation

	Treatment		Control		Estimated Difference (SE)	95% CI	Effect Size <sup>a</sup>	p value	R <sup>2</sup>
	N	M	n	M					
Mathematics	1,899	219.39	1,893	217.42	1.96 (0.42)	[1.15, 2.78]	.12	<.001	.80
Reading	1,878	212.95	1,870	211.26	1.69 (0.40)	[0.91, 2.46]	.12	<.001	.75
Language usage	1,345	213.45	1,344	212.22	1.22 (0.37)	[0.49, 1.96]	.10	.001	.79

<sup>a</sup>Effect sizes were calculated using Hedge's *g*, consistent with the guidance in the *What Works Clearinghouse Procedures and Standards Handbook* (Version 4.0). The mean difference is standardized by the unadjusted student-level pooled standard deviation of posttest scores. The unadjusted student-level standard deviations were 18.38 for the treatment group and 15.06 for the control group in mathematics; 15.86 for the treatment group and 12.81 for the control group in reading; and 13.52 for the treatment group and 11.17 for the control group in language usage.

Table 2

Contrast of Treatment Group Differences Over Time

	Mathematics			Reading			Language Use		
	Est.	SE	p.	Est.	SE	p	Est.	SE	p
S15 vs. S14	-1.23	0.23	0.00	0.66	0.24	0.01	1.10	0.24	0.00
S16 vs. S15	0.59	0.23	0.01	0.26	0.24	0.29	0.50	0.24	0.04
S17 vs. S16	1.28	0.23	0.00	1.11	0.24	0.00			

## ANALYSIS AND FINDINGS: RESEARCH QUESTION 1

To address Research Question 1, we regressed the treatment status on post-intervention scores, adjusting for covariates including baseline MAP scores. The impact was positively significant on all three subjects (mathematics, reading, and language usage), all with an effect size greater than 0.10. This suggests that the PL model intervention was effective. Table 1 shows treatment impact estimates and effect sizes by academic subject for these analyses.

## ANALYSIS AND FINDINGS: RESEARCH QUESTION 2

For Research Question 2, we extended the primary model to a mixed effect model, using all waves of spring MAP data as the dependent variable. Results of the student growth trajectory analysis suggests that after an initial dip in scores in the early building period of the initiative, particularly in mathematics, the treatment group scores in mathematics, reading, and language usage grew continuously and significantly in the remaining years. Though not statistically significant, the trajectories for the high-poverty and English Learners groups mirrored the upward trajectories of the overall group. Table 2 shows that compared to the comparison group, the performance of the treatment group improved steadily over time.

## CONCLUSIONS

The practice of PL is growing rapidly, in part, because digital technologies have become more available in schools (Project Tomorrow, 2018). This study contributes to the growing literature in the field of PL by contributing evidence related to a successful PL model that includes blended and adaptive learning, a growth model, individual PL plans, student goal-setting and reflection, strengths-based learning, cross-curriculum English Language development (ELD) and educator PL. The study also builds on the growing practice of using VCGs to study educational interventions (see Pane et al., 2017). VCG designs can be relatively low-cost and allow for rigorous studies of educational interventions when randomization is not practical or possible. Overall, this study's findings will be valuable to educators, researchers, and policymakers.

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