Effects of a School-Community Math Intervention Partnership

Background: Schools are expected to provide supplemental intervention for students struggling to meet grade-level benchmarks in math (Johnson, Mellard, Fuchs, McKnight, 2006; Lembke, Hampton, & Beyers, 2012). Consensus exists among math experts that such supplemental intervention should be evidenced-based and target foundational skills such as working with whole and rational number (Gersten et al., 2009). Yet, a recalcitrant—and even increasing—gap between current national performance and math proficiency goals (National Center for Education Statistics, 2016) suggests that practical implementation of such intervention support has not been feasible, which is likely due to stressors placed on school systems trying to implement intervention frameworks and their corresponding data systems (Noell & Gansle, 2016). Community partnerships offer a unique opportunity to merge evidence-based educational practices with the human capital needed to help schools implement math interventions.

Objective: The purpose of this paper session is to present and discuss the results of a large-scale randomized control trial (RCT) of a school-community partnership for math intervention. Specifically, the math intervention program employed evidence-based educational practices derived from extant research (e.g., Gersten et al., 2009) using resources made available via federal policy for AmeriCorps. In addition to details on the study itself, we will provide a background on how AmeriCorps produces resources for implementing educational initiatives, alternative resource for implementing educational interventions, and general lessons from scaling the math intervention program across a variety of school settings.

Setting: The RCT occurred in 12 schools across Minnesota who implemented the school-community math intervention program in fall 2016. All activities took place during the school day at the school sites. Schools were equally distributed across urban and rural settings, and all served relatively high proportions of at-risk students. Specifically, at least 40% of students served at participating schools were required to be eligible for free or reduced-price lunch (FRPL). Student demographics approximated the overall state with approximately 65% White, 14% Black, 12% Hispanic, and 5% Asian.

Population: Participants included 552 students across grades four through eight. On average, 61% of students received FRPL. Those students were served by 17 interventionists, who were trained AmeriCorps members committing a year of service to the school. Interventionists also received ongoing twice-monthly coaching support and fidelity observations during the entire school year.

Intervention: The school-community math intervention program provided students support in pairs for either two 45-min sessions or three 30-min sessions each week. Interventionists delivered specific, scripted interventions targeting conceptual understanding (Butler, Miller, Crehan, Babbitt, & Pierce, 2003), computational proficiency (Coddington et al., 2007), and word problem solving (Montague, Krawe, Enders, & Dietz, 2014). For example, students in fifth grade working on multi-digit multiplication received intervention that first built an understanding of the conceptual basis for multi-digit multiplication (Butler et al., 2003), then developed procedural proficiency in multi-digit computation (Coddington et al., 2007), and then used a structured approach to solve word problems with multi-digit multiplication (Montague et al., 2014).

Research Design: Students with fall screening scores (STAR Math; Renaissance Learning, 2015) below state benchmarks were eligible for randomization. Students were randomly assigned into treatment or control group conditions, using an approximately 60:40 probability for treatment assignment. Students assigned to the control group were not allowed to receive the program until after winter post-test, but were allowed to receive other school-based services as permitted with typical program implementation. The final analytic sample (n = 490) included 311 treatment and 179 control students, and reflected approximately 11% attrition, primarily to students not having posttest scores. Missing data was not
associated with assignment to treatment, and with the exception of ethnicity (Asian and Hispanic), there was no relationship between missing data and demographic or pre-test data.

**Data Collection and Analysis:** Students in the intervention program and the control group both completed STAR Math in the fall (prior to group assignment) and winter. STAR Math is a computer-adaptive assessment intended to be used as a screening and periodic progress monitoring tool. To evaluate the extent to which students assigned to the math intervention program demonstrated higher STAR Math scores than those assigned to the control group, we fit an intent-to-treat (ITT) model in which students’ post-test STAR Math scores were regressed on treatment assignment regardless of dosage received. Prior to selecting the final model, we evaluated the extent to which the treatment effect differed by grade, ethnicity, and school. No substantive impact on the treatment effect was found for complex models that incorporated demographic and school factors. Thus, only pre-test score was included as a covariate. Slopes from the student level covariates were treated as fixed across schools.

**Findings:** Average STAR Math scores increased across grade and from pre- to post-test, which was expected given the scaling of the assessment and the provision of math instruction during the fall semester. The average difference between pre- and post-test STAR Math scores was approximately 31 scaled score points for students assigned to the control group and 48 scaled score points for students who participated in the school-community math intervention program. Thus, the average score for students in the treatment group was approximately 17 scaled score points higher than the average score for control students. Assignment to the math intervention program was therefore associated with a statistically significant positive effect on students’ post-test STAR Math scores, controlling for pre-test scores ($R^2 = .44, F(2,487) = 2.23, p < .01$). The effect size for group assignment was relatively small ($d = 0.15$).

**Conclusions:** In education, conventionally-small effect sizes can have meaningful implications when interpreted in the broader context of student age, study rigor, and outcome measure (Hill, Bloom, Black, & Lipsey, 2008). The current study suggests that school-community math intervention programs facilitated by broadly-available resources like AmeriCorps have promise in late elementary and middle school. These results will be discussed in the context of challenges schools face in implementing intervention programs (Vujnovic et al., 2014), as well as the study limitations and directions for future research.
References