STATISTICAL ANALYSIS PLAN

OFFICIAL TITLE: The Role of Knowledge Retrieval in Inference-making among Struggling Readers

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Overview of Aim 1 Statistical Analysis Plan: Role of Knowledge Retrieval.

Analytic Plan. The project will use a randomized controlled trial design to evaluate how knowledge retrieval and inferencing differs under the three different learning conditions. We estimated the necessary sample size at pretest using the G*Power software with power of 0.80, estimated effect size of 0.25, and alpha at 0.05 for contrasts between three groups while controlling for at least one covariate. The recommended sample size for the specified minimal detectable effect size with sufficient power was N = 158. To generalize findings, the study will recruit children from both genders and diverse backgrounds including English Learners and socioeconomic status. For the data analysis, we will screen for outlying values and evaluate the distributional properties of observed variables, making transformations only when necessary and appropriate. Pre-intervention equivalence will be established and pretest scores included as covariates to maximize power and adjust for nonequivalence (if necessary). We will monitor rates of overall and differential attrition and calculate potential bias under assumptions about the relationship of response and the outcome of interest, considering bias that results in no more than 0.05 of a SD difference on the outcome as tolerable. Missing data due to student attrition will be assumed missing at random and handled analytically using a full information maximum likelihood estimator or imputation of missing values. We will model the effects of knowledge retrieval on inferencing without dichotomizing the distribution. To determine whether reader characteristics (i.e., knowledge retrieval, metacognition, reading comprehension, word reading efficiency, background knowledge, working memory, and grade) make unique contributions to inferencing across the posttest and follow-up data collection time points, we will fit linear mixed effect models to include both fixed and random effects to account for individual-level variation among participants and test items (Baayen, Davidson, & Bates, 2008) using the *lme4* (Bates et al., 2015) package in R (R Core Team, 2015).

Overview Aim 2 Statistical Analysis Plan: Inference Intervention

Analytic Plan. We estimated the necessary sample size at pretest using the G*Power software for main effects and interaction with power of 0.80, estimated effect size of 0.25, and alpha at 0.05 for contrasts between two groups while controlling for at least one covariate. The recommended sample size for the specified minimal detectable effect size with sufficient power to detect main effect of treatment and interactions was N = 158. In order to generalize findings, the study will recruit males and females for participation as well as children from diverse backgrounds including English Learner status and socioeconomic status. For the data analysis, we will screen for outlying values and evaluate the distributional properties of observed variables, making transformations only when necessary and appropriate. Pre-intervention equivalence will be established, and pretest scores included as covariates to maximize power and adjust for nonequivalence (as needed). We will monitor rates of overall and differential attrition and calculate potential bias under assumptions about the relationship of response and the outcome of interest with bias that results in no more than 0.05 of a SD difference on the outcome considered tolerable. Missing data due to student attrition will be assumed missing at random and handled analytically using a full information maximum likelihood estimator or imputation of missing values. To test Aim 2, we will first consider several structural models depending on the patterns of clustering in the data as students may be nested in teachers, schools, or tutors. We will run unconditional models to estimate the intraclass correlation (ICCs) for each level of the study design. If ICCs are significant, we will fit multilevel models to evaluate the effectiveness of the intervention while controlling for covariates such as pre-test performance on inference-related measures and child-attributes such as English Learner status. We will also test if student-level factors such as their pre-intervention reading proficiency moderate the association between treatment assignment and posttest performance. Our primary analysis plan assumes an intent-to-treat model, in which we test the efficacy of two intact conditions. The intent-to-treat model provides researchers with unbiased estimates of the efficacy of the intervention on the central study outcome at the level of adherence observed in the study. Finally, we will estimate effect sizes to report the magnitude of difference between the two conditions.