



## Multivariate summer school effects

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### ABSTRACT

The effect of assignment to and participation in summer school for a moderately at-risk sample of kindergarten students was examined with multivariate analytic methods. A multivariate analysis of variance applied to difference scores capturing the change in summer literacy outcomes revealed that kindergarten students randomly assigned to summer school outperformed their control group peers on a linear composite of early literacy indicators. The estimated group difference was greater when participation in summer school was distinguished from receipt of the summer program offer in analyses that explicitly adjusted for the proportion of students who failed to comply with their assignment. These results demonstrate that the nature and generalizability of the inference regarding program performance varies in relation to the intended and achieved design and the analytic model applied to data. Implications for the evaluation of summer school programs are discussed.

### 1. Introduction

Summer recess poses a challenge for students struggling to acquire academic knowledge and skills (Atteberry & McEachin, 2016; Burkam et al., 2004; Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996). Over the summer months, the learning rate of economically advantaged students slows relative to the academic year while the performance of economically disadvantaged students and their peers at the lower end of the achievement distribution tends to stagnate or decline (Alexander, Entwisle, & Olson, 2001; Downey, von Hippel, & Broh, 2004; Downey, von Hippel, & Hughes, 2008; Heyns, 1987, 1978). The summer learning slowdown has been attributed to the reduction in formal and informal opportunities to engage with instruction and other learning activities that are conducive to building academic skills and academic patterns of thinking (Alexander et al., 2001; Cooper et al., 1996; Entwisle, Alexander, & Olson, 1997). Access to key educational resources (e.g., books, educational media, trips to the library) can be particularly limited for students from disadvantaged backgrounds as their families may not possess the financial means or hold and convey the academic expectations requisite to facilitate a culture of summer learning (Benson & Borman, 2010; Gershenson, 2013; Pallas, 2016; Slates, Alexander, Entwisle, & Olson, 2012). Awareness of the basis for and consequences of the “summer slide” has led many school districts to enact policies or programs that seek to provide an instructional scaffold during the summer months (Kim & Quinn, 2013; Kim & White, 2008; McCombs et al., 2014; Patall, Cooper, & Batts Allen, 2010). The purpose

of this paper is to investigate the impact of one academically rigorous, school-based summer literacy program. In the following, we estimate and evaluate the effect of a targeted summer school program on the change in student performance on a weighted composite of early literacy skill indices.

Differential summer learning rates serve to further exacerbate pre-existing achievement gaps between those less and more advantaged (Benson & Borman, 2010). Analysis of national and local survey data reveals that disadvantaged students continue to lose ground relative to their more advantaged peers despite similar academic year growth rates (Alexander et al., 2001; Downey et al., 2004, 2008; Heyns, 1987, 1978). The in- and out-of-school achievement growth pattern established in these studies demonstrates the benefit of school-based instruction, but also illustrates the structural challenges that schools face (Rambo-Hernandez & McCoach, 2015; von Hippel, 2009). Despite the efforts of school staff, disadvantaged students find themselves falling further behind their peers and increasingly unsuccessful in challenging subject matter. Compounded over time, students from disadvantaged backgrounds are less likely to take the advanced courses requisite for college preparation, and instead are more likely to disengage from and drop out of formal schooling (Alexander, Entwisle, & Olson, 2007). The summer disparity in learning has thus become a focal point for educational leaders seeking to keep their most at-risk students (i.e., low performing and/or economically disadvantaged students) on track to achieve positive short and longer term educational goals (McCombs et al., 2011).

To address the challenges that stem from a 3-month summer break

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from schooling, some school districts have chosen to adopt a year round schedule (NAYRE, 2007; Skinner, 2014) while others have implemented a targeted summer enrichment program for at-risk students (McCombs et al., 2011, 2014). Year round schools rearrange the traditional 180 day school calendar to provide for shorter breaks (e.g. 15–20 days of intersession for every 45–60 instructional days) in an attempt to keep the rhythm of instruction more constant (Cooper, Valentine, Charlton, & Melson, 2003). Notably, a rearrangement of the school calendar to a year round schedule affects factors proximal to students, teachers, and parents (e.g., time for teacher planning and professional development, complications with child care for parents), but does not increase the total amount of time available for instruction (Cooper, 2004; von Hippel, 2007, 2016). When academic outcomes in year round and nine month calendar schedules are compared, findings indicate that students in year round schools learn relatively faster during summer months (when in session) whereas students in nine month schools learn faster during the rest of the year, resulting in equivalent annual achievement gains (von Hippel, 2016).

In contrast, targeted summer programs serve as an extension to the school calendar and offer students who are most at-risk strategic supplemental instruction. Summer instructional programs or “summer school” are strategic in that educational resources can be used to target those most in need of support. Summer programs provide additional opportunity for students to receive content area instruction and practice academic tasks. As a result, students are more likely to increase their academic achievement in the content areas in which supplemental instruction is delivered (McCombs et al., 2011). More specifically, Cooper et al. concluded that economically disadvantaged students who participated in summer school were able to maintain or slightly improve upon academic gains from the prior year in reading and mathematics (Cooper, Charlton, Valentine, & Muhlenbruck, 2000). Other findings revealed a U-shaped relationship across grade levels as early-elementary and late-secondary students were the largest benefactors from program participation. The size of the summer school effect across all samples examined was approximately one quarter of a standard deviation. However, when disaggregated by economic background, the average effect for middle class students ( $d = 0.44$ ) was larger than that observed from low income students ( $d = 0.20$ ).

Although the literature on summer school indicates that students who attend summer programs generally benefit from the experience (Cooper et al., 2000; Kim & Quinn, 2013; but also see Augustine et al., 2016), many authors advise caution when interpreting summer program outcomes. For example, if a program’s effectiveness is evaluated by pretest-posttest gain scores, then statistical regression to the mean may inflate observed gains and lead to an overestimation of program effects. Also, if a comparison group is not available, then it is not possible to measure the effect the program had on students relative to students not attending the program (Cooper et al., 2000; Stein & Fonseca, 2016). To begin to evaluate the efficacy of summer school, it is typically requisite that a control condition or a comparison group be available to contrast achievement outcomes. However, it should be noted that a summer program that offers placements on a need basis may also be serving students with a home environment that is concomitantly less conducive to academic success. If at-risk students are later compared to a group of students that did not receive an invitation (due higher performance), achievement outcomes are confounded by initial group differences and extraneous factors (e.g., home-based instruction and educational resource access) that are non-randomly distributed across households (Borman, Benson, & Overman, 2005; Stein & Fonseca, 2016). The difficulty in separating instructional effects from the distinct background characteristics of summer school participants thus often weakens the inferences drawn regarding summer program outcomes. As a result, researchers need to carefully consider the manner in which students are invited to participate and whether invitees choose to attend (Augustine et al., 2016; Borman & Dowling, 2006).

To mitigate the presence of extraneous factors that can distort treatment and control group comparisons, strong methodological approaches such as experimental designs with random assignment to conditions are recommended (Shadish, Cook, & Campbell, 2002). In situations where randomization is not feasible, strong quasi-experimental alternatives like the regression discontinuity or interrupted time series designs are encouraged (Murnane & Willett, 2011; Shadish et al., 2002). The use of designs where the selection mechanism is known and/or can be completely modeled enables the causal impact of summer school to be identified. As attendance at a summer program is often voluntary, researchers who study these programs using random assignment or other techniques should also be prepared to examine outcomes as a function of the compliance status of students. For example, in a study where over 600 early elementary students were randomly assigned to a 7-week summer school program, the experimental effect associated with treatment assignment was not statistically significant. However, in supplemental analyses that adjusted for non-compliance with treatment offer, a positive summer school effect for the complier subgroup was observed (Borman & Dowling, 2006).

In light of the evaluative challenge presented by nonrandom sorting into conditions, the current study utilized a randomized field experiment as a basis for ascertaining the efficacy of a summer literacy intervention. The intervention context was that of a 5-week summer program delivered to struggling early readers who completed kindergarten in the prior academic year. To implement the design, a screening assessment administered in the spring of the kindergarten year was used to identify a pool of students at moderate risk of future reading difficulty. These students were then randomly assigned to receive a summer school placement offer. As the summer program was focused on developing multiple beginning literacy components and skills (e.g., phonemic awareness, alphabetic understanding, fluency/automaticity), we used a multivariate analysis that permitted the simultaneous examination of the change in several literacy outcomes. Statistical adjustments were also made to account for noncompliance with treatment assignment in order to estimate the impact of summer school for those who attended. Overall, the study was designed to examine (a) whether students assigned to summer school outperformed comparable students not assigned to summer school, and (b) how the size and nature of estimated summer school effect changed when noncompliance with the treatment offer was taken into account.

## 2. Method

### 2.1. Data source

The study was conducted in a moderately-sized school district in the United States’ Pacific Northwest. In a typical year, the district serves approximately 6000 students. During the implementation period, the student population was 74% White, 14% Latino, 3% African American, 3% Asian American, 3% Native American, and 2% other. Approximately 50% of students were eligible for a free or reduced priced lunch and 3% of district students were identified as English language learners.

### 2.2. Summer literacy program

Summer school was offered to kindergarten alumni for 5-weeks during the middle of the 3-month summer vacation period (mid-July to mid-August). Summer school was provided 3.5 h/day 4-days per week (Monday through Thursday) at a central school site. The summer program focused on the development of early literacy skills as proactive intervention efforts in beginning reading are viewed as the primary way to address and prevent initial reading difficulties from progressing into long-term reading and scholastic failure (Fuchs & Fuchs, 2006; Gersten et al., 2008; National Early Literacy Panel, 2008; National Reading Panel, 2000; Torgesen, 2002). Each day, students received a minimum

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