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Can Camp Get You Into a Good Secondary School? A Field Experiment of Targeted Instruction in Kenya

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Access to quality secondary schooling can be life-changing for students in developing contexts. In Kenya, entrance to such schools has historically been determined by performance on a high-stakes exam. Understandably then, preparation for this exam is a high priority for Kenyan families and educators. To increase the share of students gaining entry to these schools, some educational providers offer targeted instruction for students they believe have a chance of securing a spot. We experimentally evaluate the impact of these "symposia" programs—week-long, sleep-away camps where eighth grade students receive a burst of academic instruction from teachers selected based on merit. While similar models have been tested in the U.S., less is known about this intervention in developing settings. Our results suggest these programs are not particularly effective for the average nominated student relative to a typical week of school. However, we find large, positive effects among students attending schools from which few students are nominated for symposia. We provide suggestive evidence that this was because students from low- representation schools had less pre-camp practice test resources outside of school. The results have implications for program design and contribute to the growing literature on the effectiveness of appropriately targeted individualized instruction.

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Abstract: Access to quality secondary schooling can be life-changing for students in developing contexts. In Kenya, entrance to such schools has historically been determined by performance on a high-stakes exam. Understandably then, preparation for this exam is a high priority for Kenyan families and educators. To increase the share of students gaining entry to these schools, some educational providers offer targeted instruction for students they believe have a chance of securing a spot. We experimentally evaluate the impact of these "symposia" programs—week-long, sleep-away camps where eighth grade students receive a burst of academic instruction from teachers selected based on merit. While similar models have been tested in the U.S., less is known about this intervention in developing settings. Our results suggest these programs are not particularly effective for the average nominated student relative to a typical week of school. However, we find large, positive effects among students attending schools from which few students are nominated for symposia. We provide suggestive evidence that this was because students from low-representation schools had less pre-camp practice test resources outside of school. The results have implications for program design and contribute to the growing literature on the effectiveness of appropriately targeted individualized instruction.

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Introduction

Receiving a secondary school education can be life changing for students around the world and Kenyan students are no exception. Entry into one of the more prestigious Kenyan "national schools" has particularly large returns in terms of students' odds of postsecondary and labor market success. As in a number of countries, progression to secondary school and consideration for a seat at a national school is largely determined by performance on a high-stakes exam taken at the end of eighth grade. Students, parents, educators and policymakers therefore have a keen interest in ensuring that students who have a chance at receiving a spot in one of these elite schools are as well-prepared for the exam as possible.

One approach to preparing these students involves a relatively short burst of supplementary, intensive, small-group instruction, provided outside of school by high-quality teachers. Similar programs have been studied in the U.S. context but we provide rare evidence on the efficacy of such a program in the developing world. Specifically, we partnered with a school operator in the Kenyan context called Bridge International Academies to conduct a field experimental study of "symposia"—week-long, overnight, academic camps, taught by select teachers, designed to help prepare relatively high-achieving students for the mandatory exam administered for all Kenyan eighth graders as their primary school experience comes to an end.

We find no evidence that these programs had particularly large benefits for the average nominated student relative to attending a typical week of school. However, we find that a subset of our sample made up of students attending schools from which very

few students were nominated for the symposia programs ("low-representation schools") saw substantial gains on the order of 0.3 standard deviations. This finding is not explained by differences in baseline test performance between students from low-representation and higher-representation schools. We find suggestive evidence that the differential effects are due to variation in the level of pre-symposia test preparation resources available to different school communities outside of the school environment. Our findings have implications for educational leaders seeking to effectively target such programs to those with the greatest potential to benefit. We also contribute to the ever-growing literature on the promise of individualized instructional programs.

Background

A robust literature developed over the past 60 years demonstrates the dramatic returns on a range of important short- and long-run outcomes that result from access to education worldwide (Psacharopoulos & Patrinos 2018). Returns are highest in developing countries and the context we study—Kenya—is no exception. Kenya has made progress in recent years toward meeting Millenium Development Goals by lowering child mortality and increasing primary school enrollment (World Bank 2019). However, the nation still struggles with a high poverty rate—37 percent of the population lives on less than $1.90 per day—and low educational attainment at the secondary and tertiary levels (World Bank 2018). Despite progress on both primary and secondary school enrollments after a 2003 constitutional change making primary education free and compulsory for all and a 2008 push for of free secondary education, net enrollment in secondary school is only 51 percent (World Bank 2018), less than 41 percent of all teenagers make it to upper

secondary school (UNICEF 2019), and the tertiary school enrollment rate is a mere 4 percent (World Bank 2018). Given that Kenya has one of the fastest growing economies in sub-Saharan Africa and that it has a relatively small educated pool, the conditions are right for education to be a high-yield investment in this context. It is therefore not surprising that scholars have previously estimated secondary school attendance improves Kenyan students' cognitive abilities, employment prospects and wages, and probability of avoiding teen pregnancy (Moraa 2014; Ozier 2018; Shimada, Khan & Wanako 2016).

However, access to secondary education in this context has largely been determined by student performance on a mandatory high stakes exam—the Kenya Certificate of Primary Education (KCPE)—taken at the end of primary school. As of 2019, the Kenyan Government changed this policy to allow all students to transition from primary to secondary school. However, historically this exam has determined not only access to but also type (e.g., vocational vs. college-preparatory) and quality of secondary school. Specifically, a certain level of performance has been required to be considered for and guaranteed a spot in one of the country's elite "national" schools. Researchers have estimated that passing the KCPE is associated with an 11 percent increase in wages while performing well enough to gain entry to and to complete secondary education at a national school represents an increase of private returns of 22 percent (Moraa 2014). Furthermore, national schools are the main entry way into university and the highly-sought after and well-remunerated civil service jobs (Glewwe et al. 2009).

Therefore, students, parents, educators and policymakers have a keen interest in learning how best to prepare students who have a decent shot at gaining entry to one of

these national schools for the qualifying examination and ultimately success in secondary school. In meta-analyses of education studies in developing contexts, scholars report that supply-side policies have generally proved insufficient when they are not accompanied by other policies that changed the daily schooling experiences of children (Masino et al. 2016; Murnane et al. 2017). Muralidharan et al. (2018) point out that expansion of education services in developing countries does not guarantee corresponding levels of skill development and learning without proper instructional support, particularly for students from lower income backgrounds. Consistent with this theme, in the Kenyan context, Lloyd et al. (2000) found that factors reflecting the school experience are the greatest predictors of student progression in school. Vermeesrch et al. (2005) find that subsidized school meals increased test scores for Kenyan students but only in schools with better trained teachers, further evidence of the importance of school quality.

One approach to providing the necessary preparation for students is through individualized instructional experiences that are provided by talented teachers and more tailored to student needs than the instruction they receive in a typical school day. The theory is that by grouping students based on prior achievement and limiting the number of students under a teacher's charge, you greatly simplify the teacher's task and reduce the need for within-class differentiation of instruction. In international contexts, there is some evidence suggesting tutoring represents a promising approach to individualized instruction. Probably most notably, Banerjee, Cole, Duflo & Linden (2007) find that remedial tutoring targeting third and fourth graders that had not yet achieved mastery of their respective grade's material in India showed large gains concentrated among the

lowest performing students. Dang et al. (2008) conduct a meta-analysis of the broader literature and argue that among studies that control for endogeneity and selection, private tutoring has been shown to have a positive relationship with academic performance in India, Israel, Japan, US, and Vietnam. However, it appears that program design matters given not all tutoring programs have demonstrated success internationally (e.g., Cabezas 2011; Jayachandran 2014; Song et al. 2018).

This is consistent with the evidence from the U.S. context which suggests that low-intensity tutoring (fewer hours, higher student-teacher ratios, less differentiation) has less success (e.g., Heinrich, Meyer & Whitten 2010; Heinrich et al. 2014) than so called "high-dosage tutoring" for which a persuasive and robust literature documents substantial benefits (e.g., Cook et al. 2014; Fryer 2014; Kraft 2015; Fryer 2016; Chabrier, Cohodes & Oreopoulos 2016). Tutor quality also likely influences the success of such programs given the known importance of teacher effectiveness in explaining and improving student academic achievement and long-term success (e.g., Rivkin, Hanushek & Kain, 2005; Chetty et al. 2011). However, the variation and impact of teacher quality on student outcomes is not as well understood in developing countries as it in the U.S. context (Glewwe & Muralidharan 2016).

Despite impressive impacts and cost-benefit ratios of high-dosage tutoring (Harris 2009), concerns persist about the scalability of programs with one-to-one or two-to-one student-teacher ratios (Bloom 1984). This has led some school systems to adopt intensive small group instructional programs, led by high quality teachers, for targeted groups of students based on ability. For example, "vacation academy" programs in struggling

Massachusetts schools that provide students on the cusp of academic proficiency with instruction from teachers selected on merit in a single subject over week-long vacation breaks have demonstrated positive results in both experimental (Schueler 2018) and quasi-experimental studies (Schueler, Goodman & Deming 2017). These programs appear more easily scalable than high-dosage tutoring models given they have somewhat higher student-teacher ratios (i.e., ten-to-one) than high dosage tutoring. To our knowledge, this type of program has not yet been evaluated in a developing context, such as Kenya, where it might stand to greatly benefit students.

Muralidharan et al. (2018) analyze a randomized trial of small-group tutoring combined with computer-aided instruction in India and find large benefits but are not able to disentangle the effects of technology from the effects of small group instruction. Banerjee et al. (2017) study day camps in the context of India but these are remedial programs taught by volunteers and targeting students in third to fifth grade, rather than programs focused on promoting high school admission among those eighth graders who educators perceive are likely to gain entry with extra support.

Therefore, we study one such intensive instructional program carried out by teachers selected based on teaching merit and designed to target students likely to benefit from such a program, in the context of Kenya. Since these programs have proved especially effective with disadvantaged groups of students in the U.S., and given that in this context some students may – regardless of their access to the program we study – have more or less access to resources preparing them to succeed on the KCPE, we also study whether the program was more effective among those who appear to have fewer

preparatory resources outside of school in order to learn how the provision of these programs might be most effectively targeted to the students who stand to benefit most.

Symposia

Setting. Our study was conducted in partnership with Bridge International Academies ("Bridge"), an organization that seeks to expand access to quality schooling for children through the operation of a network of schools, including both government schools operated as part of public-private partnerships and low-cost private schools. Since 2009, this network has served over 500,000 children through hundreds of schools (called "Academies") in India, Kenya, Liberia, Nigeria, and Uganda (Bridge 2018). The Bridge model has previously been independently evaluated in the Liberian context (Romero, Sandefur, & Sandholtz 2019) and is currently undergoing independent evaluation in Kenya (World Bank, 2017). The symposia we study were conducted in the East African nation of Kenya, in the city of Nakuru, located approximately 170 km away from the capital city of Nairobi.

All Kenyan students in the eighth year of their primary school education are required to take the KCPE, a standardized examination administered by the Kenyan Ministry of Education that is used to certify that a student has completed primary schooling. The KCPE covers five subjects: math, English, Kiswahili, social and religious studies, and science. The exam was high stakes at the time of the study in that students who did not pass were not able to move on to secondary schooling and scores were used to place students into different kinds of secondary education such as vocational training schools or the more prestigious national schools.

Given the stakes associated with the KCPE, Bridge operates overnight academic camps called "symposia" to prepare its students for the exam. The symposia we study were weeklong programs that occurred during September and October of 2018, one to two months before the 2018 KCPE administration. For these programs, Bridge targeted relatively high performing students from across their network who they believed, with symposium-based extra preparation, had the potential to earn KCPE scores that would qualify them for entry into one of the country's more prestigious national schools. In other words, they selected the students would they believed would benefit most from the program.

Student Nomination. Bridge nominated 957 students for the symposia from 235 Bridge schools located in various regions across Kenya, representing 75 percent of the total Bridge schools that had students sitting for the KCPE in 2018. To nominate students for the program, Bridge identified those students who were in the top performance quartile of all Bridge students in Kenya based on Bridge-administered practice KCPE exam scores. These practice exams were taken from previous years of official KCPE administrations. More specifically, Bridge created an index for all its grade eight pupils based on their average KCPE score, across all five subjects and up to three 2018 practice test administrations from mid-term and end-term periods. Students missing all three scores for any single subject were excluded from the nomination process. The top 957 students on this index were nominated for symposia participation. This population's performance on practice KCPE exams was similar to the performance of the top quartile of KCPE

performers nationwide. On average, students in our sample earned a score of 357 on baseline practice KCPE exams out of a maximum of 500 points.

Importantly, students were nominated on the basis of their baseline performance relative to the full distribution of students across the Bridge network rather than their performance relative to students at their own schools. One result of this decision is that some schools had a greater number and share of their students nominated for the symposia than other schools. In Appendix Figure A1, we display the number of students in our sample on the y-axis by the number of students nominated from a given school on the x-axis. For example, the second bar on the left of Figure A1 indicates that there are 114 students in our analytic sample who came from schools where they were one of only two students from that school nominated for the symposia. Schools had between one and 19 students nominated from their school. The median school had three of their students nominated for symposia. We later describe schools that had three or fewer students nominated as "low-representation schools."

Experimental Design. The 957 nominated students were divided into 12 strata based on their baseline performance. Randomization was done within strata to improve statistical power, leaving 478 students in the control group and 479 in the treatment group. After accounting for the inclusion of covariates that explain 60 percent of the variation in the outcome, the sample size and within-strata randomization provided 0.80 power to detect a minimum program effect of 0.07 standard deviations on test score outcomes. This is similar to the effect of small group math instruction provided at "Vacation Academies" in low-performing schools in Springfield, Massachusetts (Schueler

2018). In Appendix Table A1, we describe the treatment and control groups, illustrating that randomization successfully generated two groups that were balanced on all baseline characteristics available, including prior achievement (overall and by subject).

Student Recruitment. Bridge sent each student who was selected for the treatment group a symposium invitation letter and required parents to return a consent form prior to participation. Parents were notified that the program would be provided to students free of charge. Attending the symposia was branded as an honor for the students given their relatively high performance on the practice exams, as well as an opportunity to gain further training that could be helpful for admission into a national school and potentially even the receipt of scholarship opportunities. Despite the potential benefits of the program, we were still surprised to learn that 96 percent of all students selected for the treatment group actually returned consent forms and attended a symposium and no students from the control group attended. This high compliance rate simplifies our analysis and the interpretation of results.

Programming. In 2018, Bridge ran six weeklong sessions of symposia over the course of a month and a half. Students were sorted into sessions on the basis of their baseline performance. Each randomization stratum was paired with one other adjacent stratum and placed in a single session. Each session served approximately 80 students. Fourteen students were able to switch sessions due to individual situations but we do not have data on which individual students switched. Given these were supervised overnight programs, students who came to the camps had nearly perfect attendance in the daily classes and activities except for three students who reportedly got sick during the program.

The symposia treatment consisted of five-day overnight academic camps. The programs were held at a site that had formerly been used as a private boarding high school and is currently used as an institute for training Bridge teachers and school managers. The facilities included classrooms, sleeping areas, playgrounds, and a dining hall. For academic instruction, students were grouped into classes of at most 20 students, and were further grouped into small teams of four or five students for various activities. Each class had its own classroom and pair of teachers, one for humanities and one for science and math. These teachers taught the same set of students throughout the symposia, taking turns acting as the lead and assistant teacher, for an overall student-to-teacher ratio of ten-to-one. The symposia were taught in English, except for the class sessions covering Kiswahili. The daily schedule included nine hours and ten minutes of academic instruction, for a total of 45 hours and 50 minutes of instruction over the course of the week. On most days of symposium, this was broken up into 50-minute segments for each subject. However, two full days were dedicated to single subjects: science and social studies.

The main instructional method for math and the languages was the distribution of pre-prepared handouts used to review concepts and vocabulary and the completion of exercises and essay writing practice. The main instructional method for science and social studies was printed flashcards and pairs or small group activities in a more interactive setting. After lunch, to keep students engaged, students were asked to develop their own presentations in groups without using any reference materials. Assessments were also used

to check progress. For all subjects, students returned home with handouts for further practice.

Students also received three meals a day and regular breaks. During breaks and in the evenings, students participated in extracurricular games and activities and watched films meant to provide academic motivation, such as a film about a student spelling bee competition and another film about Ben Carson, the African American politician and neurosurgeon.

Staffing. A total of eighteen instructors rotated through teaching the various sessions of symposia (eight teachers per session). These instructors also served as Bridge Academy teachers during the regular academic year. The teachers were selected based on Bridge's perception that they were particularly effective educators. Approximately 40 percent had taught at symposia in previous years. Teachers who were new to the symposia in 2018 were paired with a teacher who had previously taught at a symposium. The teachers were instructed that the symposia attendees were high-performing students that needed to acquire better tools to prepare for the KCPE. Following the Bridge model, teachers received a curriculum and were onboarded on rules and regulations and what to teach although the teachers were given more flexibility than teachers in a typical Bridge Academy classroom during the regular school year.

In addition to the academic teachers, other on-site, non-teaching staff consisted of a program manager and four counselors to help with motivational and enjoyable non-academic activities during breaks and after learning hours, as well as managing student

behavior. There was also a nurse on-site and staff in charge of food preparation and accommodation logistics.

Control Condition. Importantly, control group students attended school as usual while the symposia were occurring. Therefore, our findings represent the effect of symposia relative to a typical week of school rather than the effect of symposia relative to a lack of structured instructional time. In a typical school day, Bridge students receive eight hours and 25 minutes of instruction, Monday through Friday and another five hours and 25 minutes on Saturdays. Therefore, over the course of the five-day programs, symposia students actually received about one hour and 40 minutes less instruction than the average control group student received. Therefore, the treatment/control contrast does not represent additional learning time. The typical eighth grade average pupil-to-student ratio for Bridge schools in Kenya is roughly 12 students, and classes are typically led by a single teacher at a time. Therefore, the ten-to-one student-to-teacher ratio at the symposia was slightly lower than the ratio for the control group students, though not dramatically so. Additionally, a period in a typical Bridge school day is 35 minutes (shorter than the 50-minute periods at the symposia). We do not have data on the school attendance of the control group children during this period.

Therefore, when thinking about the treatment-control contrast for the week of symposia, the average treatment group student had a teacher selected based on merit (vs. a Bridge teacher of average ability), a class of peers that had been grouped based on ability rather than grade level alone, instruction tailored to ability level and focused on KCPE content, a teacher who was given some additional instructional autonomy relative

to the highly standardized typical Bridge model, a slightly smaller class, and a sleep-away "camp" experience. They had also been identified and celebrated as a high performer in the process of receiving the symposia invitation.

Methods

Data. We relied on administrative data provided by Bridge for the full analytic sample of 957 students who were nominated for the symposia in 2018. At the individual student level, these data include information on student randomization and symposia attendance, as well as post-symposia KCPE scores overall and by subject. We also have student-level demographic variables including gender, age, and years a student attended a Bridge school, as well as pre-symposia, baseline school attendance records, pre-symposia baseline scores on in-class evaluations mostly consisting of practice KCPE exams taken in eighth grade overall and by subject, and each student's placement exam score when first entering Bridge. We also know the school each student attended.

Finally, Bridge also provided school-level data for the schools represented in our analytic sample, including information on each school's urban/peri-urban/rural location, average baseline scores of all eight graders, total enrollment, gender breakdown, and average attendance records for students, teachers, and managers. While the student-level demographic and performance data was fully populated (as shown in Table 1), the school-level data has a greater degree of missingness which we describe in greater detail below. No students were missing final KCPE scores in our data.

Outcome Measures. Our outcomes focus on KCPE performance at the end of eighth grade, including both continuous measures as well as binary measures indicating

whether a student performed at or above a given policy-relevant threshold. For the continuous measure, we standardized KCPE test scores using the full analytic sample to have a mean of zero and a standard deviation of one. We do this for total KCPE scores as well as scores by subject. For the binary outcomes, we generated three variables all focused on total, rather than subject-specific, KCPE scores and each representing a different performance threshold: (1) earning 250 points or more which is necessary to pass the KCPE exam, (2) earning 300 points or more which is the score necessary to be considered for a spot at a national school, and (3) earning 400 points or more which is the cutoff that has traditionally guaranteed a spot in a national school. These binary outcomes were coded one if a student scored at or above the relevant performance threshold and zero if they scored below that threshold.

Empirical Strategy. We begin by estimating the causal effect of receiving an invitation to attend a symposium, or assignment to the treatment group, on achievement outcomes by generating intent-to-treat (ITT) estimates with the following model:

$$KCPE_i = \beta_0 + \beta_1 Treatment_i + X_i + \alpha_s + \varepsilon_i$$

where $KCPE_i$ refers to our outcome measures described above for student i. $Treatment_i$ is a dummy indicator for whether the student was invited to the symposia (regardless of whether he or she attended), and X_i refers to a vector of individual-level covariates, including the student's gender, age, years at Bridge, baseline school attendance record, baseline scores on the Bridge-administered KCPE practice exams, number of baseline scores recorded, and placement exam score taken when the student first entered a Bridge school. We include these controls in order to improve the precision of our causal

estimates. Finally, we include fixed effects for randomization strata *s* and cluster standard errors at the strata level. Given the binary nature of the dependent variables representing various thresholds, we also ran probit models for these outcomes. However, since our interpretation of the results was not dependent on this modelling choice, we display results from the linear specifications in the paper for consistency and ease of interpretation.

As we discuss above, 96 percent of invited students attended the symposia and none of the control group students attended. In Appendix Table A2, we show that invited non-compliers were less likely to be female but were otherwise similar to compliers. However, since an invitation to the symposia did not guarantee attendance at the programs, we also generated treatment-on-the-treated (TOT) estimates to assess the effect of attending symposia for those who were induced to attend by the symposium invitation. We do so by predicting attendance based on assignment to the treatment group and then regressing predicted attendance on our outcomes. As we illustrate in Appendix Tables A3 and A4, our TOT estimates are very similar to the ITT results and do not change our overarching conclusions. Therefore, our central results focus exclusively on the ITT estimates given these are the most conservative estimates and the causal interpretation of these results is most clear.

Findings

Symposia Impacts Overall. We start by presenting raw achievement data for the full analytic sample in Figure 2, a density plot of standardized KCPE scores by treatment group assignment. This Figure shows that the scores for the treatment group, represented

in dark grey, are shifted slightly to the right of the control group, represented in light grey. However, the differences are subtle and appear to be concentrated in particular parts of the distribution (around the 250 and 350 thresholds), a finding that we will return to when presenting our formal estimates.

Next, we display the results from our ITT model described above. Table 1 provides estimates of symposia impacts on standardized KCPE scores overall and by subject. We observe small positive effects on total KCPE scores on the order of 0.03 standard deviations but these effects do not achieve statistical significance. Given that we do not have the statistical power to detect effects of such a small magnitude, we cannot be sure whether or not these effects are true program impacts or due to random chance. Similarly, we find small, positive, non-significant effects within all subjects (ranging from 0.04 to 0.06 standard deviations) except for social studies and religious education where we observe small, negative, non-significant effects.

In Table 2 we provide results for the binary threshold outcomes. We find that symposia had no impact on a pupil's likelihood of scoring 400 or higher (guaranteeing entry into a national school) and only a small, non-significant, positive effect on the likelihood of scoring over 300 or higher (guaranteeing consideration for a national school). We also find a small negative effect that does achieve formal statistical significance on the likelihood of scoring 250 or higher (passing the KCPE). Visual evidence of this result can be found in Figure 1 which shows a bump in the treatment group distribution right below the 250 cutoff.

Impacts for Students from Low-Representation Schools. As we have already described, there was variation in the number of students that were nominated from each of the 235 Bridge schools that are represented in our analytic sample. To examine whether the effects of symposia programming varied depending on how many students came from a sending school, we generated a binary variable equal to one if a student came from a school that had three or fewer students nominated for symposia (three being the median number of students nominated from a given school in our sample). We describe these students as coming from "low-representation schools" given the schools sending a greater number of students had greater representation at the symposia. In Table 3, we show that these low-representation schools not only had fewer students nominated in terms of absolute numbers but also a smaller share of their overall schoolwide populations.

After generating this binary "low-representation" indicator, we interact it with our treatment dummy and include the interaction and both the main effect of treatment and coming from a low-representation school in the main model described above. We display results in Table 4, showing that the effects of symposia were substantially and significantly larger for students from the low-representation schools of origin than students sent from schools with a greater number of nominated students. This is true for total KCPE scores but the differences are particularly concentrated in English, math, and SSRE (the interaction terms for Kiswahili and science are sizable but do not achieve statistical significance). In Figure 2, we display the total effects of an invitation to the symposia for the full sample as well as the subsamples of students from low-representation schools and non-low-representation schools. We do this overall and by subject. Symposia had large effects on

overall KCPE scores for students from low-representation schools on the order of 0.312 standard deviations, compared to a statistically insignificant -0.043 standard deviations for the rest of the students.

One possibility is that the larger effects for students from low-representation schools are driven by a phenomenon whereby a student benefits more from the program because of that student's own self-perception based on being the sole person from his or her school to receive a symposium invitation. In other words, perhaps students who are sent on their own either feel special or feel greater pressure to try hard and get as much as possible out of the symposia. We test this possibility by adding a control variable to our model for whether a student was a "singleton" (the only student from his or her school to be invited to a symposium) based on the idea that this phenomenon would be most salient for students who are the sole invitee. In the second column of Table 4, we show that the symposia impact is still 0.209 standard deviations larger for students from low-representation schools, even after controlling for singleton status. Therefore, the differential effects do not appear to be exclusively the result of some of these students being the sole student from their school to be invited to a symposium. This finding begins to suggest that the differential effects are due to some other school-level rather than student-level phenomenon (something we explore in greater depth below).

We also examine whether symposia impacts vary by school of origin representation on the three threshold outcomes of interest and display the results in Table 5. We find that the symposia did indeed have a larger effect on the likelihood of scoring over 300 (guaranteeing consideration for a national school) for students from low-representation

schools than for students nominating a greater number of students. We find no differences in the effect of symposia on either the 250 or 400 point threshold between these two groups. We display more easily interpretable impacts overall and by subgroup on each threshold outcome in Figure 3. There we show that symposia increased the probability that students from low-representation schools scored a 300 or higher by 9 percentage points relative to a control group rate of 66 percent scoring 300 or above. Interestingly, we also find that the small average negative effect of symposia on passing the KCPE reported earlier seems to be fully driven by students from non-low-representation schools though these differences are not statistically significant.

Understanding the Differential Effects. Given the sharply different results for students from the low- versus higher-representation schools, one must wonder what makes symposia so much more effective for students from low representation schools. While we are not able to definitively pin down the reason(s) for these differences with the available data, we provide suggestive evidence that this difference is due to variation in access to pre-symposia resources for preparing for the KCPE exam outside of school. Specifically, it appears that those from low-representation schools had more limited access to pre-symposia KCPE preparation resources than students from schools that sent a greater number of students and therefore benefitted more from symposium-based KCPE preparation. It is unlikely that there were dramatic differences in school-based resources given the standardization of Bridge's model across schools and regions. Furthermore, anecdotally, our research partners at Bridge indicated that communities surrounding some Bridge schools have greater access to old KCPE exams from previous years and greater

circulation of these exams outside of school than other communities. This results in some students having more opportunities to work on practice exams at home such that by the time they take the in-school examinations, they may have seen the test or some test questions before. In other communities, parents are less likely to circulate these practice exams outside of school making in-home test preparation a less common practice.

If the low-representation schools reside in communities where this at-home KCPE preparation is less common, we would expect baseline grades for higher-representation schools to be a noisier proxy for mastery of KCPE material than for low-representation schools. This indeed appears to be the case. In Appendix Figure A1, we show that all students in our sample, on average, had higher absolute scores on the baseline practice exams than on the actual post-symposia KCPE. However, the difference between average baseline and final KCPE performance was smaller among students from the low-representation schools than from the rest of the schools. More specifically, students from low-representation schools scored 350 points on the baseline exams and 319 points on the final exams, while students from the higher-representation schools scored 359 points on the baseline exams and 314 on the final exams, on average.

To explore this issue further, we calculated a "disappointment index" by subtracting each student's final KCPE score from his or her baseline KCPE score. In other words, a larger value on the disappointment index would suggest that a student's final KCPE exam score was lower than she might have expected based on her practice KCPE. For this exercise, we limit our sample to the control group only in order to avoid picking up on the confounding effect of treatment. In Appendix Figure A2, we show that the

average disappointment index (or difference between baseline and final KCPE) is significantly smaller for students from the low-representation schools than the higher-representation ones. This result is robust to various definitions of low-representation schools (expanding and contracting the threshold window by two students). This finding is consistent with the story that students from the higher-representation schools had baseline scores that were inflated by pre-symposia KCPE preparation and were therefore a less accurate measure of true mastery of the skills assessed by the final KCPE. Students from the low-representation schools, on the other hand, had fewer pre-symposia KCPE prep resources which was reflected in their baseline scores and therefore benefitted more from the provision of KCPE preparation at the symposia.

It is important to keep in mind that students were not randomly assigned to low- versus higher-representation schools. Therefore, there could be differences between these schools other than access to test preparation resources that explain the differential symposia impacts. Unfortunately, we do not have complete data on the schoolwide characteristics of all schools in our sample. As we show in Table 3, the school covariates display some missingness unlike the fully-populated individual-level data. Within the 235 schools, there are on average 2.5 missing values among all twelve school-level data covariates, and we find that low representation schools have on average 1.1 more missing values than the rest of the schools. With the caveat that the data are incomplete and that we have a somewhat higher rate of missingness for low-representation schools than higher-representation ones, we compare the average school-level characteristics of low- versus non-low-representation schools in Table 3. We find no differences on common

indicators of school quality in developing contexts including student, teacher and academy manager attendance rates. This combined with Bridge's highly standardized delivery model suggests that it is unlikely major differences in quality across low- and higher-representation schools explain the differential effects across these school types.

However, we do find evidence that these schools differ on other important dimensions. Specifically, on average, the low-representation schools are smaller (by 61 students), more likely to be in a rural location (by 18 percentage points), and lower scoring at baseline (by 21.53 points). Finally, students at these schools were on average newer to Bridge than students at the higher-representation schools (by 0.35 years). However, we find no evidence that it is any of these observable differences that are driving our result regarding the large impacts for students from low-representation schools. In Table 7, we show results from tests of these alternative explanations after we interact each of these school level characteristics with our treatment indicator. We find that within school type (low- and higher-representation schools) students are no more or less likely to benefit from symposia if they come from a rural, higher achieving, or smaller school.

Furthermore, we do not find that the differential effects are driven by any of the student-level characteristics that we observe in our data. We first contrast the characteristics of students at the two types of school in Appendix Table A7 (an exercise for which we have better data coverage than for the school-level analysis described in the previous paragraph). At the student level, among those nominated for symposia, students from the low-representation schools had been at Bridge schools for slightly longer (by 0.22 years or ~80 days), had lower placement scores when they originally entered a Bridge

school (by less than a point on a scale of 0 to 27) and, as we have already mentioned, were lower achieving on their baseline KCPE scores (by 8.91 points) than those at the higher-representation schools.

In Table 6 we show results from formal tests of interactions between treatment and each of the major student-level demographic and baseline performance characteristics. We do not find that the effects vary based on student sex, age, years at Bridge, placement score, pre-symposia attendance, or baseline KCPE score. The lack of significant interactions based on any measure of baseline performance is particularly notable since it eliminates the possibility that students from low-representation schools benefit more from symposia simply because they are lower achieving students. We also control for all baseline achievement measures in all of our previous models which provides further evidence on this point. Although we do not include results here for the sake of parsimony, we have also calculated an Oaxaca-Blinder decomposition and found additional evidence that our results were driven primarily by differential treatment effects for the two groups rather than differences in values of the independent variables (e.g., baseline performance) within the treatment and control groups. This fact pattern lends further credibility to the idea that the differential effects for students from low-representation schools are due to a school- rather than student-level phenomenon.

Discussion

We used a field experiment to test the provision of week-long overnight academic camps—"symposia"—designed to prepare relatively high achieving Kenyan students for the high-stakes KCPE exams that play a major role in determining students' secondary

school experiences. Our study does not reveal strong evidence that these programs were beneficial for the average invitee relative to a typical week of school. Specifically, we find symposia have a small positive effect on average students' KCPE performance, but these effects do not achieve formal statistical significance and we do not have the power to detect effects this small in magnitude. Therefore, we are not able to rule out the possibility that we have observed this result due to chance alone. Perhaps surprisingly, we find that, for the average student, symposia had a small negative effect on KCPE passing rates. However, in order to interpret this result, it is important to keep the counterfactual in mind. Since the control group attended school as usual, this finding simply suggests that students near the passing threshold would have been better off simply attending school rather than symposia. These findings suggest that educational leaders should look elsewhere or rework the program design in order to provide effective supplemental support for average high performers on their high-stakes exams.

While we do not find strong evidence that the symposia were particularly beneficial for the average nominated student, we do find that these symposia had large positive effects for a subset of students who attend schools from which only a small number of students were nominated for the program. The magnitude of effects on KCPE performance for this group is substantively meaningful. Average KCPE scores for students from low-representation schools increased from 314 to 328. Brudevold-Newman (2018) have found that an increase of this kind on the KCPE exam is associated with a 3.4 percentage point increase in the probability of sitting for the secondary school exit exam which is a strong proxy for completion of secondary school.

Furthermore, we find suggestive evidence that students from low-representation schools receive greater benefits from symposia because they have had fewer opportunities for pre-symposia KCPE preparation outside of school. Although we cannot definitively pinpoint the mechanism, our evidence still provides some guidance for educational leaders and policymakers seeking to effectively target programs to those students with the greatest potential to benefit. Leaders may also want to consider new approaches to equalizing the distribution and circulation of test preparation materials and resources to ensure that students from the schools that are not currently well-represented at the symposia can improve their chances of performing well on the KCPE regardless of whether or not they attend the symposia. Our study adds to a growing literature about the benefits of intensive individualized instructional experiences, delivered by high-quality teachers for targeted student populations that has, up until now, focused more heavily on the U.S. rather than developing nations.

Based on a back-of-the-envelope calculation, for the low-representation group, symposia have a comparable cost-effectiveness to other educational interventions in developing contexts such as personalized technology-aided instruction. Specifically, symposia appear slightly more cost effective at raising language arts performance and slightly less cost-effective at raising math performance (Muralidharan et al. 2018). However, symposia involved only a week of programming and were therefore especially time-effective. That said, there are other educational interventions with even smaller cost-benefit ratios (McEwan 2015) and it is not impossible that merely distributing preparatory materials to students at low-representation schools could prove to be a more cost-effective

alternative. To reiterate, these programs do not appear to be a particularly good use of resources for the average high-scoring Bridge student. Positive cost-benefit ratios appear to depend on effective targeting within the population of high scoring Bridge students.

There are a number of questions that our study leaves unanswered. For example, we are unable to determine the mechanisms that make symposia effective for students from low-representation schools. In previous studies in the Kenyan context, Duflo et al. have found benefits of class size reduction in some cases (2015) and of tracking, or the placement of students in a class with other students of similar ability level (2011). It could be the lower teacher-student ratios, the teachers selected on the basis of perceived merit, the ability grouping, the teacher autonomy, or the combination of any or all of these program features that are essential to producing the gains we observe for this subgroup.

Furthermore, we study the effectiveness of a program targeting relatively high performers. Even the students from the low-representation schools were still in the top quartile of Bridge student performance at baseline. Our findings may not generalize to lower achieving students. On the other hand, the gains we do find are concentrated among students from schools with a greater share of low performers. The program could have even larger impacts for lower achieving students and indeed in the U.S. context, similar programs have demonstrated substantial benefits for students at lower ends of their respective performance distributions. Regardless of these limitations, our study documents a relatively cost- and time-effective approach that, when effectively targeted, can meaningfully increase the odds that Kenyan students get to secondary school.

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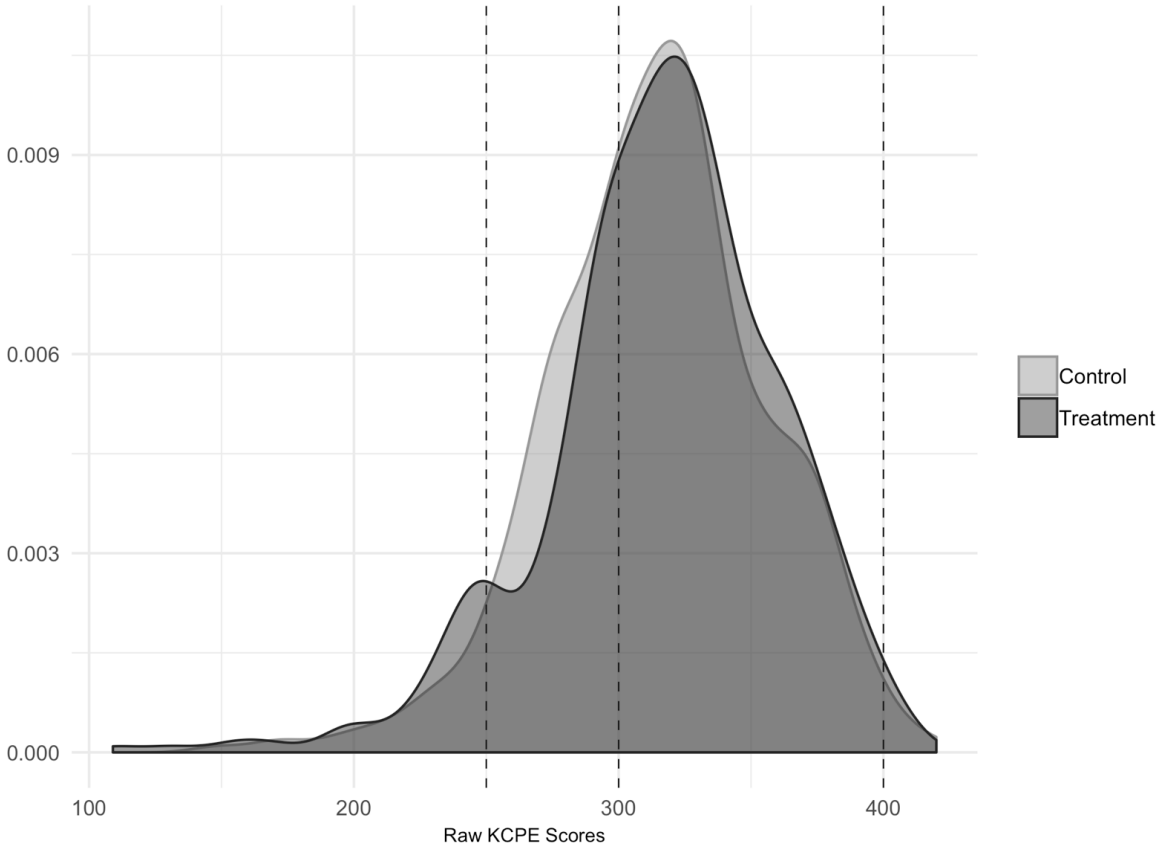
Figure 1: density plot of total raw KCPE scores by experimental assignment



Note: KCPE = Kenya Certificate of Primary Education.

Table 1: the effect of a symposium invitation on KCPE scores overall and by subject (n=957)

	(1) Total	(2) English	(3) Kiswahili	(4) Math	(5) Science	(6) SSRE
Treatment	0.028	0.047	0.055	0.037	0.044	-0.049
	(0.057)	(0.076)	(0.062)	(0.054)	(0.043)	(0.063)
Female	-0.133**	0.089	0.134**	-0.120*	-0.363***	-0.240***
	(0.058)	(0.050)	(0.058)	(0.061)	(0.067)	(0.055)
Age	-0.047*	-0.118***	0.012	-0.014	-0.014	-0.071**
	(0.025)	(0.023)	(0.021)	(0.026)	(0.025)	(0.026)
Years at Bridge	0.054***	0.082***	0.028	0.022	0.037**	0.046**
	(0.014)	(0.010)	(0.017)	(0.018)	(0.012)	(0.020)
Baseline attendance	0.341	0.082	-0.080	0.602**	0.325	0.266
	(0.246)	(0.265)	(0.130)	(0.198)	(0.280)	(0.239)
N of baseline scores	0.010**	0.014***	0.007	0.007	0.014***	0.001
	(0.004)	(0.003)	(0.005)	(0.006)	(0.003)	(0.003)
Placement score	-0.064**	-0.049**	-0.044*	-0.045**	-0.062***	-0.053**
	(0.022)	(0.019)	(0.020)	(0.018)	(0.018)	(0.022)
Control mean	-0.022	-0.041	-0.035	-0.012	-0.021	0.025

Note: Each column represents a separate model in which we regress the listed outcome on a binary indicator for treatment group assignment, controlling for the covariates specified in the table, as well as baseline test score for the same subject as the outcome and randomization strata fixed effects. Treatment coefficients are displayed in standard deviation units. KCPE scores have been standardized to the analytic sample. Standard errors are clustered at the randomization strata-level and presented in parentheses. SSRE = Social Studies and Religious Education. * p<0.1,** p<0.05,*** p<0.01.

Table 2: the effect of a symposium invitation on KCPE score thresholds (n=957)

	(1) Over 250	(2) Over 300	(3) Over 400
Treatment	-0.038**	0.014	-0.000
	(0.015)	(0.031)	(0.005)
Female	-0.009	-0.058	-0.003
	(0.015)	(0.035)	(0.003)
Age	-0.015	-0.015	-0.000
	(0.009)	(0.012)	(0.001)
Years at Bridge	0.011*	0.006	0.000
	(0.006)	(0.010)	(0.001)
Baseline attendance	0.105	0.155*	-0.010
	(0.086)	(0.072)	(0.010)
N of baseline scores	0.003*	0.007**	-0.000
	(0.001)	(0.002)	(0.000)
Placement score	-0.013*	-0.031***	0.004
	(0.007)	(0.009)	(0.004)
Control mean	0.952	0.663	0.010

*Note: Each column represents a separate model in which we regress a binary indicator for whether a student scored higher than the specified threshold on the KCPE on a binary indicator for treatment group assignment, controlling for the covariates specified in the table along with fixed effects for randomization strata, as well as the total baseline score. The coefficients can therefore be interpreted as the change in probability of scoring above a given threshold in percentage point units. Standard errors are clustered at the randomization strata-level and presented in parentheses. KCPE = Kenya Certificate of Primary Education. * p<0.1,** p<0.05,*** p<0.01*

Table 3: balance test of school-level characteristics between low- and non-low-representation schools (n=957)

	Low representation (mean)	Low representation (SD)	N	Non-low representation (mean)	Non-low representation (SD)	N	Low-Non-low	p-value
Total enrollment	146.49	64.76	122	207.03	79.91	98	-60.54***	0.00
Urban	0.25	0.44	55	0.47	0.50	57	-0.22**	0.02
Peri-urban	0.11	0.31	55	0.07	0.26	57	0.04	0.47
Rural	0.64	0.49	55	0.46	0.50	57	0.18*	0.06
Share invited to symposia	0.01	0.01	122	0.04	0.02	98	-0.02***	0.00
N of nominated students from school	1.84	0.75	134	7.04	3.45	101	-5.20***	0.00
Share of girls at school	0.48	0.05	122	0.48	0.04	98	-0.00	0.81
Baseline total grades	296.63	31.59	81	318.16	32.52	78	-21.52***	0.00
Invitees-school baseline difference	47.99	32.12	81	40.61	28.57	78	7.39	0.13
Years of school being Bridge	5.79	1.18	81	6.14	1.25	78	-0.35*	0.07
Principal attendance record	0.46	0.34	122	0.48	0.37	98	-0.02	0.66
Teacher attendance record	0.70	0.07	122	0.70	0.07	98	-0.01	0.45
Student attendance record	0.43	0.13	122	0.45	0.12	98	-0.02	0.21
Average missingness of variables above	3.01	3.06	134	1.91	2.49	101	1.10***	0.00

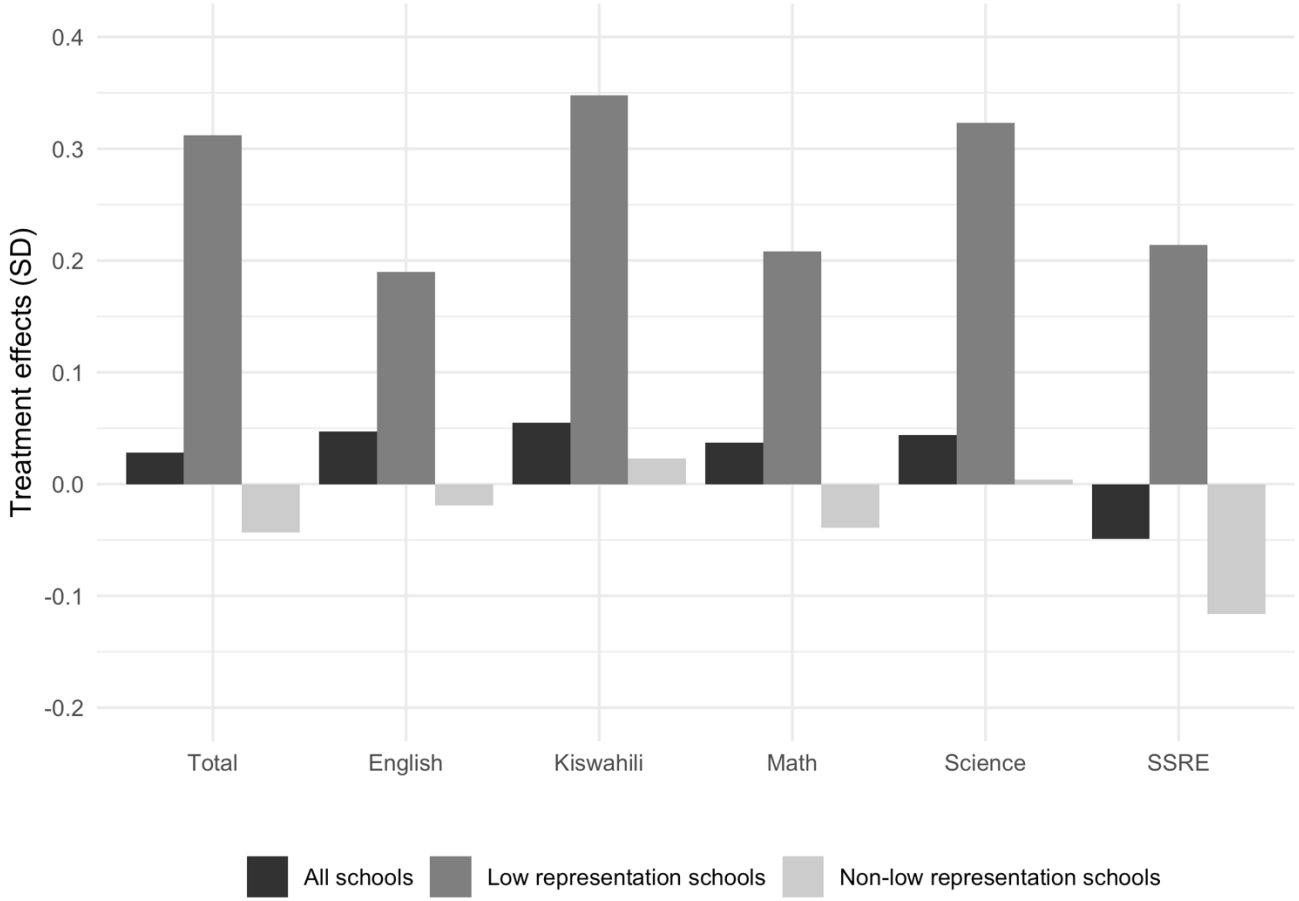
*Note: Low-representation school is defined as having three or fewer students in the analysis sample. Difference in baseline represents the difference by school in the average baseline score of symposia nominees and the rest of the eighth graders in that school. * p<0.1,** p<0.05,*** p<0.01.*

Table 4: the effect of symposium invitation on KCPE scores by school of origin representation (n=957)

	(1) Total	(2) Total	(3) English	(4) Kiswahili	(5) Math	(6) Science	(7) SSRE
Treatment and low representation	0.281***	0.209**	0.257**	0.130	0.294***	0.159	0.264**
	(0.077)	(0.080)	(0.096)	(0.125)	(0.084)	(0.118)	(0.097)
Low representation school	0.074	0.074	-0.048	0.195***	-0.047	0.160	0.066
	(0.078)	(0.078)	(0.097)	(0.062)	(0.082)	(0.102)	(0.104)
Treatment	-0.043	-0.048	-0.019	0.023	-0.039	0.004	-0.116
	(0.056)	(0.056)	(0.068)	(0.066)	(0.061)	(0.064)	(0.074)
Female	-0.135**	-0.137**	0.086	0.136**	-0.123*	-0.363***	-0.239***
	(0.060)	(0.060)	(0.050)	(0.057)	(0.063)	(0.071)	(0.056)
Age	-0.044*	-0.043*	-0.115***	0.013	-0.011	-0.012	-0.069**
	(0.023)	(0.023)	(0.023)	(0.020)	(0.025)	(0.023)	(0.026)
Years at Bridge	0.048***	0.048***	0.079***	0.021	0.018	0.031**	0.040**
	(0.012)	(0.012)	(0.010)	(0.017)	(0.016)	(0.012)	(0.018)
Baseline attendance	0.354	0.355	0.096	-0.078	0.617***	0.332	0.278
	(0.236)	(0.232)	(0.260)	(0.116)	(0.192)	(0.268)	(0.227)
N of baseline scores	0.010**	0.010**	0.014***	0.007	0.007	0.014***	0.002
	(0.005)	(0.004)	(0.003)	(0.005)	(0.006)	(0.003)	(0.003)
Placement score	-0.065**	-0.064**	-0.050**	-0.044**	-0.046**	-0.062***	-0.054**
	(0.021)	(0.021)	(0.019)	(0.019)	(0.018)	(0.017)	(0.022)
Singleton		0.154					
		(0.112)					
Control mean	-0.022	-0.022	-0.041	-0.035	-0.012	-0.021	0.025

*Note: Each column represents a separate model in which we regress the listed outcome on a binary indicator for treatment group assignment, a binary indicator for coming from a low-representation school and an interaction between those two binary variables, controlling for the covariates specified in the table along with the baseline test score for the same subject as the outcome and randomization strata fixed effects. KCPE scores are in standard deviation units. Standard errors are clustered at the randomization-strata level and presented in parentheses. KCPE = Kenya Certificate of Primary Education. SSRE = Social Studies and Religious Education. Low representation school is defined as having three or fewer students in the analysis sample. Singleton is a binary indicator for being the only student from a school who received a symposium invitation. * p<0.1,** p<0.05,*** p<0.01*

Figure 2: the effect of symposium invitation on KCPE scores, by subject and school of origin representation



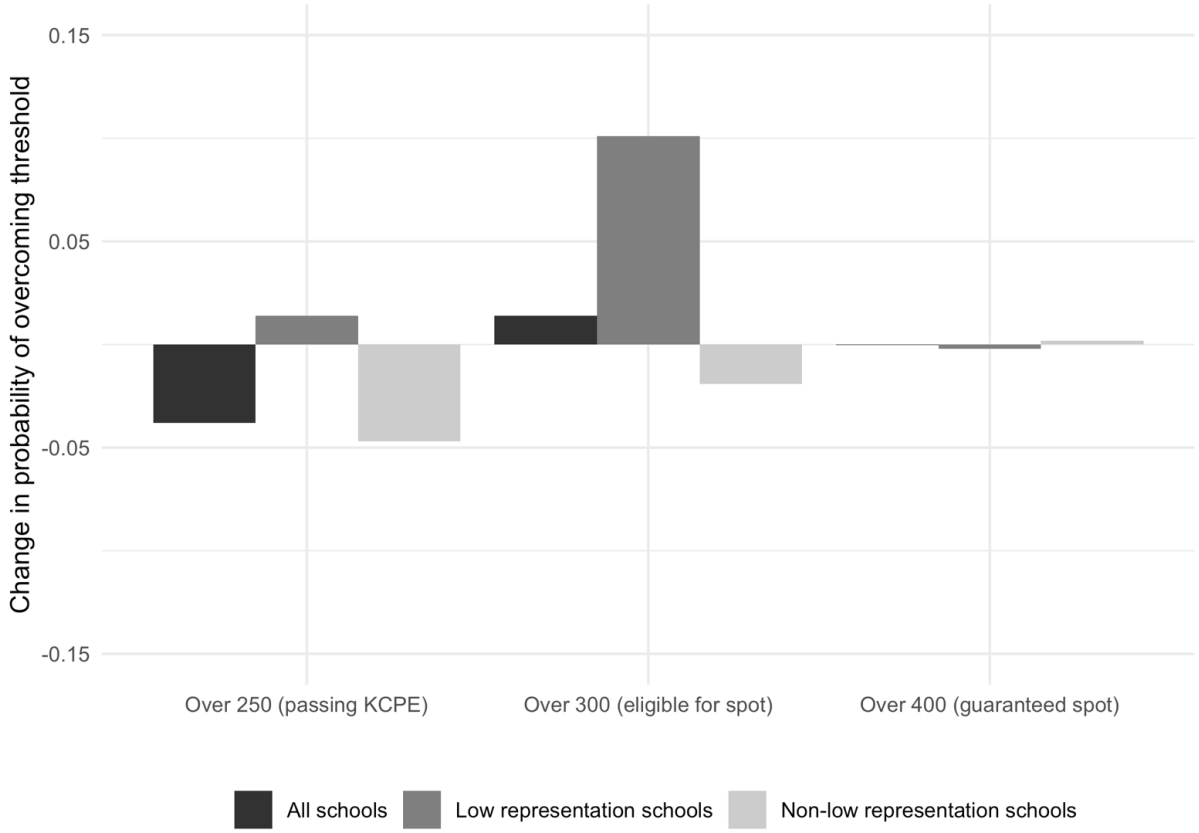
Note: The bars represent the full effect of treatment by group. The bar for low representation schools is the sum of the coefficient on treatment, on low representation, and on the interaction between these two. The bar for non-low representation is only the coefficient on treatment on the regression that included the interaction between low representation and treatment. The bar for all schools represents the coefficient for the regression without any interactions. KCPE scores are in standard deviation units. KCPE = Kenya Certificate of Primary Education. SSRE = Social Studies and Religious Education.

Table 5: the effect of symposium invitation on KCPE threshold by school of origin representation (n=957)

	(1) Over 250	(2) Over 300	(3) Over 400
Treatment and low representation	0.035	0.130**	-0.007
	(0.025)	(0.045)	(0.013)
Low representation school	0.026	-0.010	0.003
	(0.022)	(0.049)	(0.009)
Treatment	-0.047**	-0.019	0.002
	(0.017)	(0.026)	(0.008)
Female	-0.009	-0.060	-0.003
	(0.015)	(0.036)	(0.003)
Age	-0.015	-0.013	-0.000
	(0.009)	(0.012)	(0.001)
Years at Bridge	0.010*	0.004	0.001
	(0.006)	(0.010)	(0.001)
Baseline attendance	0.107	0.162**	-0.010
	(0.087)	(0.069)	(0.011)
N of baseline scores	0.003*	0.007**	-0.000
	(0.001)	(0.002)	(0.000)
Placement score	-0.013*	-0.032***	0.004
	(0.007)	(0.009)	(0.004)
Control mean	0.952	0.663	0.010

*Note: Each column represents a separate model in which we regress a binary indicator for whether a student scored higher than the specified threshold on the KCPE on binary indicators for being both assigned to the treatment group and coming from a low-representation school, treatment group assignment, and a binary indicator for coming from a low-representation school, controlling for the covariates specified in the table along with baseline test scores and fixed effects for randomization strata. The coefficients can therefore be interpreted as the change in probability of scoring above a given threshold in percentage point units. Standard errors are clustered at the randomization strata-level and presented in parentheses. Low-representation school is defined as having three or fewer students in the analysis sample. KCPE = Kenya Certificate of Primary Education. * p<0.1,** p<0.05,*** p<0.01*

Figure 3: the effect of symposium invitation on KCPE score thresholds, by subject and school of origin representation



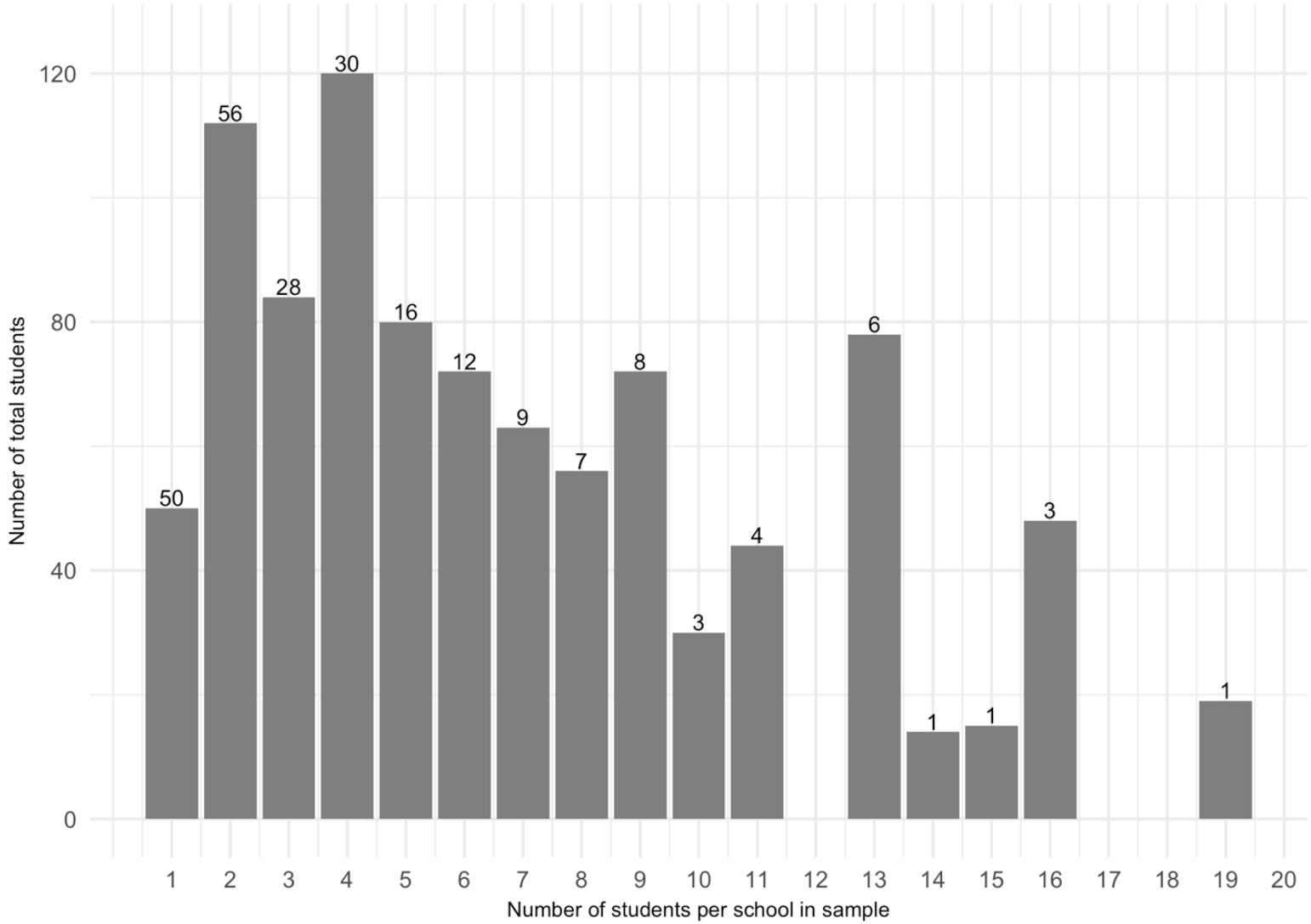
Note: The bars represent the full effect of treatment by group. The bar for low representation schools is the sum of the coefficient on treatment, on low representation, and on the interaction between these two. The bar for non-low representation is only the coefficient on treatment on the regression that included the interaction between low representation and treatment. The bar for all schools represents the coefficient for the regression without interactions.

Table 6: the effect of symposium invitation on KCPE scores by student characteristics (n=957)

	(1) Female	(2) Age	(3) Years at Bridge	(4) Placement score	(5) Baseline attendance	(6) Baseline total scores
Interaction	0.060	-0.053	0.059	0.050	-0.310	0.001
	(0.13)	(0.05)	(0.04)	(0.04)	(0.35)	(0.00)
Treatment	0.000	0.802	-0.171	-0.787	0.306	-0.506
	(0.06)	(0.79)	(0.19)	(0.71)	(0.33)	(0.66)
Female	-0.163	-0.133**	-0.132**	-0.136**	-0.136**	-0.133**
	(0.09)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Age	-0.047*	-0.019	-0.044*	-0.047*	-0.048*	-0.047*
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
Years at Bridge	0.054***	0.052***	0.024	0.054***	0.055***	0.053***
	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)
Placement score	-0.064**	-0.064**	-0.065**	-0.087***	-0.064**	-0.065**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Baseline attendance	0.344	0.333	0.329	0.340	0.489	0.344
	(0.24)	(0.24)	(0.25)	(0.24)	(0.32)	(0.25)
Baseline total scores	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N of baseline scores	0.010**	0.010**	0.010**	0.010**	0.010**	0.010**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	957	957	957	957	957	957

*Note: Each column represents a separate model in which we regress total KCPE scores on an interaction between a binary indicator for being assigned to the treatment group and the characteristic listed at the top of the column, a binary indicator for treatment group assignment, and the listed characteristic, controlling for the covariates specified in the table, baseline test scores and randomization strata fixed effects. KCPE scores have been standardized to the full Bridge eighth grade population. Standard errors are clustered at the randomization strata-level and presented in parentheses. KCPE = Kenya Certificate of Primary Education. * p<0.1,** p<0.05,*** p<0.01*

Appendix Figure A1: distribution of students by school of origin representation



Note: There are 235 schools in our sample. The median is three students per school. Total number of schools in each bin are displayed at the top of each bar.

Appendix Table A1: balance test between treatment and control groups (n=957)

	Treatment (mean)	Treatment (SD)	N	Control (mean)	Control (SD)	N	Treatment-Control	p-value
Female	0.48	0.50	479	0.45	0.50	478	0.03	0.38
Age	14.53	1.12	479	14.51	1.09	478	0.02	0.83
Years at Bridge	3.39	1.58	479	3.31	1.55	478	0.08	0.44
Placement score	16.28	4.53	479	16.58	4.74	478	-0.30	0.32
Baseline attendance	0.90	0.18	479	0.90	0.19	478	-0.00	0.92
Share of baseline scores missing	23.35	0.30	479	23.35	0.30	478	0.00	0.95
Baseline English score	70.26	7.44	479	69.87	7.63	478	0.40	0.41
Baseline Kiswahili score	65.75	8.54	479	64.76	8.57	478	0.99*	0.07
Baseline Math score	62.92	12.95	479	63.92	12.48	478	-1.00	0.22
Baseline Science score	80.61	8.68	479	81.03	8.56	478	-0.41	0.46
Baseline SSRE score	76.70	7.45	479	77.09	7.29	478	-0.39	0.41
Baseline Total score	356.60	28.98	479	357.19	29.21	478	-0.59	0.75

*Note: The results are robust to balance checks controlling for strata. All students have at least one baseline score for each subject. However, most students had more than one score due to multiple pre-symposia administrations. Therefore, "share of baseline scores missing" refers to the average share of all possible baseline scores missing. * p<0.1,** p<0.05,*** p<0.01.*

Appendix Table A2: balance test between compliers and invited non-attendees (n=957)

	Compliers (mean)	Compliers (SD)	N	Invited non-attendees (mean)	Invited non-attendees (SD)	N	Compliers-Invited non-attendees	p-value
Female	0.46	0.50	933	0.67	0.48	24	-0.21**	0.04
Age	14.52	1.11	933	14.68	0.81	24	-0.16	0.48
Years at Bridge	3.36	1.57	933	2.98	1.45	24	0.38	0.24
Placement score	16.42	4.65	933	16.92	4.23	24	-0.50	0.60
Baseline attendance	0.90	0.19	933	0.86	0.26	24	0.04	0.26
Share of baseline scores missing	23.35	0.30	933	23.41	0.33	24	-0.06	0.33
Baseline English score	70.10	7.53	933	68.71	7.53	24	1.39	0.37
Baseline Kiswahili score	65.28	8.56	933	64.58	8.92	24	0.70	0.69
Baseline Math score	63.43	12.73	933	63.10	12.41	24	0.32	0.90
Baseline Science score	80.91	8.58	933	77.34	9.72	24	3.57**	0.05
Baseline SSRE score	76.97	7.36	933	73.96	7.42	24	3.02**	0.05
Baseline Total score	357.07	29.13	933	350.17	26.67	24	6.90	0.25
Complier	1.00	0.00	933	0.00	0.00	24	1.00	.

*Note: The results are robust to balance checks controlling for strata. * p<0.1,** p<0.05,*** p<0.01*

Appendix Table A3: the effect of symposium attendance on KCPE scores (n=957)

	(1) Total	(2) English	(3) Kiswahili	(4) Math	(5) Science	(6) SSRE
Attended symposium	0.029	0.049	0.058	0.038	0.047	-0.051
	(0.045)	(0.064)	(0.047)	(0.059)	(0.040)	(0.050)
Female	-0.133***	0.090**	0.136***	-0.119*	-0.362***	-0.241***
	(0.036)	(0.037)	(0.044)	(0.063)	(0.030)	(0.031)
Age	-0.047**	-0.117***	0.012	-0.014	-0.014	-0.072***
	(0.018)	(0.024)	(0.021)	(0.015)	(0.023)	(0.020)
Years at Bridge	0.054***	0.082***	0.028	0.022***	0.036***	0.046***
	(0.010)	(0.011)	(0.017)	(0.008)	(0.007)	(0.011)
Baseline attendance	0.340***	0.081	-0.082	0.601***	0.324*	0.268**
	(0.108)	(0.126)	(0.130)	(0.087)	(0.191)	(0.124)
N of baseline scores	0.010**	0.014***	0.007	0.007	0.014***	0.001
	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.003)
Placement score	-0.064**	-0.049**	-0.044**	-0.045**	-0.062***	-0.053**
	(0.027)	(0.022)	(0.022)	(0.023)	(0.020)	(0.026)
Control mean	-0.022	-0.041	-0.035	-0.012	-0.021	0.025

*Note: Each column represents a separate model in which we regress the listed outcome on a variable representing predicted attendance at symposia based on treatment group assignment, controlling for the covariates specified in the table, as well as baseline test score for the same subject as the outcome and randomization strata fixed effects. All coefficients are displayed in standard deviation units. Standard errors are clustered at the randomization strata-level and presented in parentheses. SSRE = Social Studies and Religious Education. * p<0.1,** p<0.05,*** p<0.01*

Appendix Table A4: the effect of symposium attendance on KCPE scores by school of origin representation (n=957)

	(1) Total	(2) English	(3) Kiswahili	(4) Math	(5) Science	(6) SSRE
Treatment and low representation	0.280***	0.257***	0.131	0.293***	0.159**	0.262***
	(0.044)	(0.061)	(0.101)	(0.077)	(0.073)	(0.064)
Complier	-0.045	-0.020	0.024	-0.041	0.005	-0.121***
	(0.046)	(0.052)	(0.067)	(0.073)	(0.049)	(0.039)
Low representation school	0.074	-0.048	0.195***	-0.047	0.160**	0.067
	(0.068)	(0.058)	(0.046)	(0.087)	(0.080)	(0.092)
Female	-0.136***	0.086**	0.136***	-0.124*	-0.363***	-0.242***
	(0.038)	(0.037)	(0.043)	(0.064)	(0.037)	(0.036)
Age	-0.044**	-0.115***	0.013	-0.011	-0.012	-0.069***
	(0.018)	(0.025)	(0.021)	(0.017)	(0.022)	(0.019)
Years at Bridge	0.048***	0.079***	0.021	0.018**	0.031***	0.041***
	(0.010)	(0.010)	(0.018)	(0.009)	(0.007)	(0.010)
Baseline attendance	0.355***	0.096	-0.079	0.618***	0.332*	0.281**
	(0.098)	(0.134)	(0.111)	(0.087)	(0.181)	(0.112)
N of baseline scores	0.010**	0.014***	0.007	0.007	0.014***	0.002
	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.003)
Placement score	-0.065**	-0.050**	-0.044**	-0.046**	-0.062***	-0.053**
	(0.027)	(0.022)	(0.021)	(0.022)	(0.019)	(0.025)
Control mean	-0.022	-0.041	-0.035	-0.012	-0.021	0.025

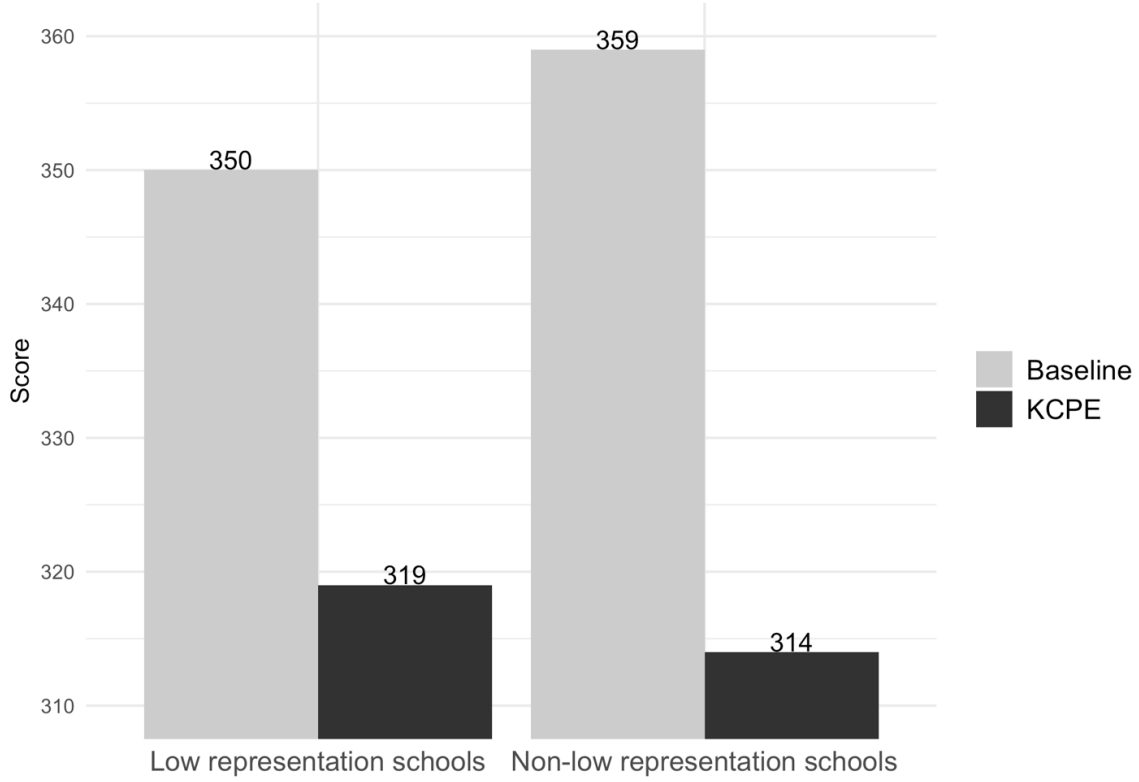
*Note: Each column represents a separate model in which we use the two-stage least squares (2SLS) approach to regress the listed outcome on a binary indicator for symposium attendance, a binary indicator for coming from a low-representation school and an interaction between those two binary variables, controlling for the covariates specified in the table along with the baseline test score for the same subject as the outcome and randomization strata fixed effects. KCPE scores are in standard deviation units. Standard errors are clustered at the randomization-strata level and presented in parentheses. SSRE = Social Studies and Religious Education. Low representation school is defined as having three or fewer students in the analysis sample. Singleton is a binary indicator for being the only student from a school who received a symposium invitation. * p<0.1,** p<0.05,*** p<0.01*

Appendix Table A5: the effect of symposium attendance on KCPE threshold by school of origin representation (n=957)

	(1) Over 250	(2) Over 300	(3) Over 400
Treatment and low representation	0.035	0.130**	-0.007
	(0.025)	(0.045)	(0.013)
Low representation school	0.026	-0.010	0.003
	(0.022)	(0.049)	(0.009)
Treatment	-0.047**	-0.019	0.002
	(0.017)	(0.026)	(0.008)
Female	-0.009	-0.060	-0.003
	(0.015)	(0.036)	(0.003)
Age	-0.015	-0.013	-0.000
	(0.009)	(0.012)	(0.001)
Years at Bridge	0.010*	0.004	0.001
	(0.006)	(0.010)	(0.001)
Baseline attendance	0.107	0.162**	-0.010
	(0.087)	(0.069)	(0.011)
N of baseline scores	0.003*	0.007**	-0.000
	(0.001)	(0.002)	(0.000)
Placement score	-0.013*	-0.032***	0.004
	(0.007)	(0.009)	(0.004)
Control mean	0.952	0.663	0.010

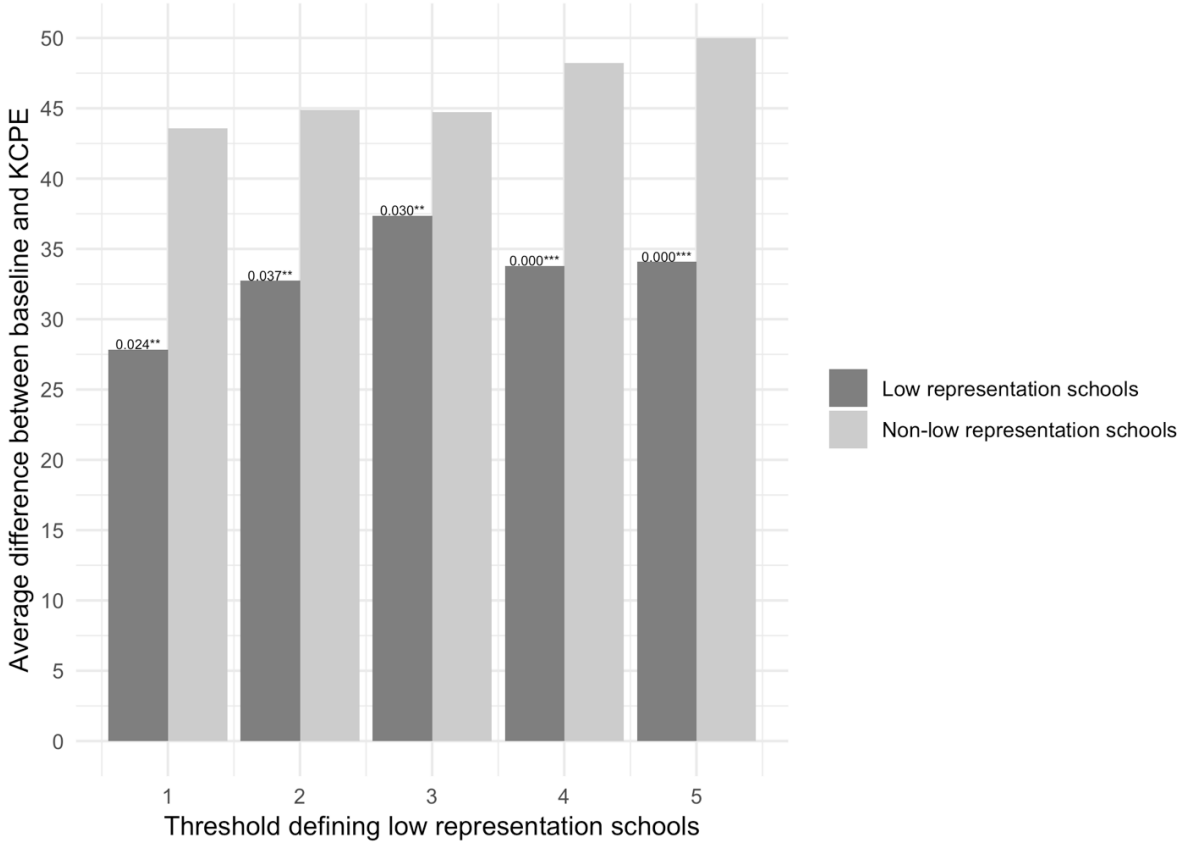
*Note: Each column represents a separate model in which we use the two-stage least squares (2SLS) approach to regress a binary indicator for whether a student scored higher than the specified threshold on the KCPE on binary indicators for attending the symposia and coming from a low-representation school, treatment group assignment, and a binary indicator for coming from a low-representation school, controlling for the covariates specified in the table along with baseline test scores and fixed effects for randomization strata. The coefficients can therefore be interpreted as the change in probability of scoring above a given threshold in percentage point units. Standard errors are clustered at the randomization strata-level and presented in parentheses. Low-representation school is defined as having three or fewer students in the analysis sample. KCPE = Kenya Certificate of Primary Education. * p<0.1,** p<0.05,*** p<0.01*

Appendix Figure A1: mean baseline and final raw KCPE scores by school of origin representation (n=957)



Note: KCPE = Kenya Certificate of Primary Education.

Appendix Figure A2: difference between baseline and final KCPE by school of origin representation, varying the definition of "low representation" (n=478)



Note: This figure was created only using control group. Relevant p-statistic and significance level of difference between low and non-low representation schools for each definition of low representation above bars.

Appendix Table A6: the effect of symposium invitation on total KCPE scores by school characteristics

	(1) Urban	(2) Rural	(3) G8 grades at school	(4) Gap student and school	(5) School enrollment
Interaction	0.066	-0.083	-0.773	0.002	0.000
	(0.12)	(0.11)	(1.07)	(0.00)	(0.00)
Treatment	-0.034	0.026	0.462	-0.727	-0.004
	(0.09)	(0.04)	(0.71)	(0.56)	(0.15)
Low representation school	0.415***	0.383***	0.193**	0.195*	0.366***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Characteristic	0.219**	-0.160*	-1.847*	2.199**	0.001**
	(0.08)	(0.07)	(0.92)	(0.75)	(0.00)
Observations	532	532	709	709	916

*Note: Each column represents a separate model in which we regress the total KCPE score on a binary variable for treatment status, a binary variable for coming from a low-representation school, and an interaction term between treatment status and the variable listed at the top of each model. All models also control for the covariates specified in the table along with baseline test scores and fixed effects for randomization strata. The characteristic row refers to the inclusion of the variable listed on the top of each model as an explanatory variable. Standard errors are clustered at the randomization strata-level and presented in parentheses. Low-representation school is defined as having three or fewer students in the analysis sample. KCPE = Kenya Certificate of Primary Education. * p<0.1,** p<0.05,*** p<0.01.*

Appendix Table A7: balance test between students from low- and non-low-representation schools (n=957)

	Low representation (mean)	Low representation (SD)	N	Non-low representation (mean)	Non-low representation (SD)	N	Low-Non-low	p-value
Female	0.45	0.50	246	0.47	0.50	711	-0.02	0.64
Age	14.53	1.02	246	14.52	1.13	711	0.01	0.93
Years at Bridge	3.52	1.46	246	3.30	1.60	711	0.22*	0.05
Placement score	15.98	4.46	246	16.59	4.69	711	-0.61*	0.08
Baseline attendance	0.90	0.18	246	0.90	0.19	711	0.00	0.84
Share of baseline scores missing	23.36	0.29	246	23.34	0.31	711	0.02	0.42
Baseline English	69.54	6.86	246	70.25	7.75	711	-0.71	0.20
Baseline Kiswahili	63.79	8.02	246	65.77	8.70	711	-1.98***	0.00
Baseline Maths	60.87	12.25	246	64.31	12.77	711	-3.44***	0.00
Baseline Science	80.19	8.43	246	81.04	8.68	711	-0.85	0.18
Baseline SSRE	75.60	7.10	246	77.35	7.41	711	-1.75***	0.00
Baseline Total	350.28	25.42	246	359.19	29.92	711	-8.91***	0.00
Complier	0.97	0.18	246	0.98	0.15	711	-0.01	0.39

*Note: Low-representation is having three or fewer students in the analysis sample. Results robust to including stratum fixed effects * p<0.1,** p<0.05,*** p<0.01.*