The Effects of Classroom Incentives: Experimental Evidence from Kenya*

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Abstract

We conduct a randomized experiment in 225 low-cost primary schools in Kenya using non-monetary incentives (certificates and badges) based on performance in Math and English. We randomize over 20,000 students to receive either individual-level, class-level, combined, or no incentives. We find that class-level incentives raised test scores by 0.1-0.2 standard deviations (including on non-incentivized subjects), and student and teacher attendance by 14.5% and 6% respectively. Combined incentives are also effective in raising student performance. The effect of individual-level incentives on test scores is statistically indistinguishable from zero.

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1 Introduction

Many students in developing countries lag behind in learning. One strategy to motivate student effort and achievement that has received considerable attention is providing incentives at the individual level. However, overall individual-level incentives for a range of outcomes such as reading books, practicing more, or getting better test scores have shown mixed results on student achievement across different contexts (Kremer et al. 2009, Angrist & Lavy 2009, Fryer Jr 2011, Behrman et al. 2015, Hirshleifer 2015, Jalava et al. 2015, Levitt et al. 2016).

In this paper, we study whether providing non-monetary incentives at the classroom level might be particularly effective and inclusive for students. Non-monetary incentives are relatively low-cost and uncontroversial compared to financial incentives in the education context. If seen as symbols of recognition for students' hard work, they can also help create additional meaning for effort (Cassar & Meier 2018, Riener & Wagner 2019). Classroom-level incentives can unlock positive peer effects within the classroom and incentivize students across the achievement distribution rather than just those at the top who are more likely to be rewarded by individual-level incentives.

We conducted a randomized controlled trial using non-monetary incentives in the form of a certificate and a badge for student recognition at both the individual and classroom levels. The trial was implemented across 225 low-cost primary schools in Kenya associated with Bridge International Academies, with over 20,000 total students.[1] The schools were divided equally into four experimental arms. First, in an individual-level incentives arm, the top 2 students in each class, based on their average Math and English scores, earned the incentive. Second, in a classroom-level incentives arm, all students in the class with the highest average score in Math and English in each school earned the incentive. Third, a combined incentive arm where students who are the top scorers in their class based on their individual average

[1]These schools use highly standardized education with teachers delivering lessons using tablets. For more details on how these schools may differ from public schools please refer to (Gray-Lobe et al. 2022, Romero et al. 2020).

score in Math and English or who belong to the top class in terms of the average Math and English score within each school earned the incentive. Lastly, we have a control arm with no incentives.

We find that students in the classroom-level incentives arm scored 0.13 and 0.16 standard deviations higher than those in the control group for Math and English respectively. Schools in the combined incentives arm scored 0.17 standard deviations higher than those in the control group for Math. We also find evidence of positive spillover effects on subjects not directly incentivized (Science and Social Studies) for the classroom-level and combined incentive arms. The impact of individual-level incentives on all subject scores is statistically indistinguishable from zero. However, we are not sufficiently powered to detect any differences between the treatment effects across any combination of treatment arms.

Consistent with the results on test scores, we find that individual and class-level incentives increase student attendance by 3 and 6 percentage points respectively (6 and 14.5% respectively). Furthermore, we find evidence that classroom incentives also increase teacher attendance by 4 percentage points (6%). Our findings on spillover effects and student and teacher attendance are suggestive of the fact that these effects are not simply driven by teaching to the test and that these may have improved classroom environment through increased student-teacher or peer interactions and greater learning time.

Our paper builds on the large literature exploring performance-based incentives for students. Particularly, we contribute to the strand of research focused on incentives conditioned on test performance, such as those using high school exit and achievement exams in Israel (Angrist & Lavy 2009) and Texas (Jackson 2010); standardized tests for elementary/middle school aged students in India Berry (2015), Kenya (Kremer et al. 2009) and Coshocton, Ohio (Bettinger 2012); as well as assessment tests in India (Hirshleifer 2015), Houston (Fryer Jr 2011) and the Chicago area (Levitt et al. 2016, List et al. 2012). Our paper is distinct in that we focus on non-monetary classroom-level incentives.[2] By addressing this gap in the

[2]Our work is related to Blimpo (2014) that experimented with grouping students into teams of four, and Li et al. (2014) that experimented with pairing up high and low-achieving students. Both papers use

literature, we contribute to the discussion on incentive-based education programs and offer valuable insights for policymakers and educators seeking to improve student achievement.

More broadly, our research relates to the literature focused on improving student outcomes by targeting student or teacher effort and motivation. Recent literature in this field has found mixed evidence on the impact of goal-setting, growth mindset, and grit-related interventions (Islam et al. 2021, Alan et al. 2019, Ganimian 2020). Similarly, the effectiveness of monetary incentives has yielded varying results across different contexts. For instance, financial incentives based on student effort were found to be more effective than those based on output in India (Cassar & Meier 2018). However, in the United States, financial incentives to students based on input or output did not lead to improved student achievement (Fryer Jr 2011). Similarly, the evidence on teacher incentives based on student performance has mixed evidence. For example, while teacher incentives were found to be effective in Tanzania (Mbiti et al. 2019), India (Muralidharan & Sundararaman 2011, Duflo et al. 2012) and Kenya (Glewwe et al. 2010), they did not improve student performance in Uganda (Gilligan et al. 2022) or Pakistan (Barrera-Osorio & Raju 2017). Recent research has also shed light on the influence of classroom norms and peer effects on student investment and effort (Bursztyn & Jensen 2015, Bursztyn et al. 2019, Calvó-Armengol et al. 2009, Li et al. 2014, Blimpo 2014). In line with this, we complement the extensive body of literature on motivating student and teacher effort by examining the effectiveness of classroom-level incentives. Additionally, our experimental design allows us to compare and benchmark the impact of providing class-level incentives to individual-level incentives, contributing to a large body of theoretical and empirical literature on incentive design (Neal 2011, Baker 1992, 2000, Lazear & Rosen 1981), particularly tournament incentives.

Our study has a few limitations. First, we only have data on student test scores and student and teacher attendance from one term.[3] As a result, we are limited to analyzing

monetary incentives and the group is not the whole class.

[3]Our study ended 3 months after launch before the end of the first term due to the start of COVID-19-related school closures.

short-term effects only. Second, in the absence of student survey data, we cannot rigorously speak to potential mechanisms such as student effort, motivation, and peer collaboration that could drive our treatment effects. Lastly, we are not sufficiently powered to reject any differences in treatment effects on test scores for any combination of treatment arms.

The rest of this paper is structured as follows: Section 2 describes the context and study design. Section 3 describes the data and methodology. Section 4 presents the results and Section 5 concludes.

2 Study Design

2.1 Context

As in many other lower-middle-income countries, access to primary education has expanded rapidly in Kenya. Almost all children attend primary school which consists of eight grades, known as standards. The Kenyan school year runs from January to November. According to the Ministry of Education, around 16 percent of primary pupils in Kenya were enrolled in private schools.

Our study was conducted in all primary schools associated with Bridge International Academies in Kenya in the 2020 school year. Bridge International Academies operates a network of low-cost, for-profit primary schools in Kenya. These schools were created to cater to economically disadvantaged populations. Its operating model features centrally-developed, standardized lesson plans which are delivered to teachers using tablet computers. Supervisory staff are trained and closely monitored to promote the use of lesson plans by teachers.[4] At the time of the study, Bridge operated over 200 primary schools spread throughout most of Kenya's 47 counties, with an enrollment of over 20,000 students, accounting for approximately 1 percent of primary enrollments in the country. All students in Bridge Academies

[4]For more details on how teacher characteristics and management may differ from public schools please refer to (Gray-Lobe et al. 2022, Romero et al. 2020).

sit for a mid-term and end-term test every term administered and assessed by Bridge internally.[5] Grades 1 to 3 take classes in Math, English, Kiswahili, and Science, while Grades 4 to 8 take classes in Math, English, Kiswahili, Science, and Social Studies.

2.2 Randomization Design

Schools in our sample were divided equally into the following four arms:

1. Individual-level incentives: The top 2 students in every class based on individual-level average achievement in Math and English earn "Star Pupil" status (described in the following Subsection).

2. Classroom-level incentives: All students in a class who belong to the top class in each school based on classroom-level average achievement in Math and English earn "Star Pupil" status.

3. Both incentives: Students who are among the top 2 scorers in their class based on individual-level achievement or who belong to the top class based on classroom-level average achievement in Math and English within each school earn "Star Pupil" status. Students belonging to either of these groups receive the rewards. If a student belongs to both groups, the rewards are still only given once.

4. Control: No students earn "Star Pupil" status.

Randomization was stratified along the geographic location of the academy (rural, urban, or peri-urban), average pupil teacher-ratio and average score in the national primary school exit exam (KCPE).[6]

The experimental design allows us to test for several theoretical and policy-relevant questions. In particular, the comparison of the individual-level incentive arm with the control group allows us to measure whether recognizing and rewarding individual achievement

[5]Note that the tests are grade-specific and standardized across all Bridge schools.

[6]The randomization was conducted by the authors in STATA using anonymized administrative school-level data shared with us.

through non-monetary incentives is effective in raising student achievement. The classroom-level incentive arm allows us to test whether providing group-level incentives fostering a sense of teamwork and rewarding collective success may work to boost student achievement. Theoretically, if there are complementarities in student effort, we may expect the class-level incentive arm to perform better than individual-level incentives. Additionally, class-level incentives could serve as a signal of a classroom teacher's success relative to others, increasing teacher effort. By having a combined individual and classroom-level incentives arm, targeting both top-performing students and the best-performing classes in Math and English in a school, we can test if there might be complementarities in incentives that reward both the individual and a group. While individual incentives may not be effective in classrooms where norms do not encourage individual effort (Bursztyn et al. 2019), they could improve class norms when combined with classroom incentives particularly when there are strong peer effects and complementarities in student effort (Calvó-Armengol et al. 2009, Li et al. 2014) and/or teacher effort.

2.3 "Star Pupil" Incentive

Students are given this status at the end of each term depending on their school's assigned treatment status. As a "Star Pupil", a student earns the following two benefits[7]:

1. A certificate and recognition for being a "Star Pupil" at a school assembly.

2. A badge that students can wear to school for the first two weeks of the next term.

A poster was also placed in each classroom of the treated schools to remind the students of the conditions to earn the "Star Pupil Award" in their respective treatment groups. Figure A1 presents pictures of the posters, as well as the designs of the certificate and badge.

The costs of the incentives were very low at 7 cents (USD) per badge and 8 cents (USD) per customized certificate.

[7]While recognition through certificates is common in this setting, there is no formal system currently in place with these rewards based on student's performance in each semester.

2.4 Timeline

The experiment launched at the beginning of the academic year in January 2020. On January 6, the academy manager for each school in each treatment arm was informed of their involvement in an "incentives program" and given the details of the program (based on the treatment arm). They were asked to announce the program and its details to all pupils at the first assembly at the start of the term, and to "mention that it will be an honor/prestige to be awarded". Figure 1a presents the email that each academy manager in the individual incentive arm received (emails to the other treatment arms can be found in Appendix Figure A2). At the same time, all teachers were also informed of the program details via their teaching tablet (see Appendix Figure A3). They were informed to "remind pupils every 1-2 weeks about the program, to encourage them to continue working hard", and were reminded again every 2 weeks on their teaching tablet to do so (see Figure 1b).[8]

The students took their Term 1 midterm exams on 12 February 2020. The experiment ended on 20 March 2020 due to school closures in Kenya related to the COVID-19 pandemic before the end of term.

2.5 Fidelity of Marking

To ensure the credibility of the assessment scores and to avoid any unconscious bias due to the teachers marking their own students' scripts, there was a teacher exchange in each school for the marking of the assessments. This ensured that the teachers were blind to the characteristics of the students whose scripts they marked to mitigate any subjective bias resulting from knowing the student.

[8] On 20 January, 3 February, 17 February, 2 March and 16 March 2020.

Dear academy manager,

This year, your academy has been selected to pilot a student incentives program. The program is designed to award certificates and badges to the top-performing pupils each term. We hope that these awards might encourage pupils to work even harder in their studies. At the start of this term, please announce the program to all pupils at the school. Use the assembly to inform pupils that if they work hard and score among the top two in their classes, they could win a 'Star Pupil' badge and certificate at the end of the term. The top 2 pupils in each class will be recognized with this award. Mention that it will be an honor/prestige to be awarded.

This term, you will receive packages with the certificates and badges along with endterm exams. Store these materials in your office. At the end of this term, each teacher must select the 2 pupils in their homeroom class with the highest combined literacy and numeracy score (they can add up literacy + numeracy scores and divide by 2).

Then, at the start of term 2, you should organize an assembly during the first week of the term. Each teacher will award a 'Star Pupil' certificate and badge to the top 2 performing pupils. 'Star Pupils' should be allowed to wear their badges to school for 2 weeks. During that assembly, remind pupils that more 'Star Pupil' awards will be given out during the next term.

Please contact customer care if you have any questions or require additional support.

[REDACTED NAME]
Learning Innovation Department

(a) Email to Academy Manager: Individual Incentives

Dear teacher,

Please remind pupils that if they work hard this term and score among the top two in their class, they could earn a 'Star Pupil' certificate and badge at the end of the term.

[REDACTED NAME]
Learning Innovation Department

(b) Tablet Reminder to Teachers – Individual Incentives

Figure 1: Communication with Bridge Staff – Individual Incentives

3 Data and Methodology

3.1 Data and Sample

Our data consists of midterm tests in Term 1 across grades 1-8. We have over 20,000 pupils in our study sample. The sample includes schools in both rural and urban areas. In addition to test scores, we have data on pupil characteristics, and student and teacher attendance.[9] We normalize all test scores within grade. The mean is zero and the standard deviation is 1 in each case.

Appendix Table A1 summarizes the data. In our sample, about 48% of students are female, the average age is 10.2 years, the average years enrolled in Bridge Academies is 2.4, and about 32% live in urban areas.

3.2 Methodology

This study estimates the average treatment effect of each treatment arm relative to the control arm. We estimate the following model at the student level:

$$Y_i = \beta_0 + \beta_1 Individual_i + \beta_2 Classroom_i + \beta_3 Both_i + X_i + \epsilon_i \quad (1)$$

where Y_i is the outcome variable of interest (usually test score) for student i, $Individual_i$, $Classroom_i$, and $Both_i$ indicate the treatment arm, ϵ_i is an error term, and X_i is a vector which may include student i's grade, gender, and an indicator for living in an urban area.

Our object of interest is β_1 which represents the causal impact of individual-level non-monetary incentives, β_2 which represents the causal impact of classroom-level non-monetary incentives, and β_3 which represents the causal impact of both individual-level and classroom-level non-monetary incentives together. All specifications use robust standard errors clustered at the school level.

[9] Teacher attendance is recorded as teachers sign in and out of their tablets for each lesson, as also detailed in (Gray-Lobe et al. 2022).

4 Results

4.1 Balance

First, we show that treatment was balanced across the treatment arms and the control group. We present the results in Table 1.

Table 1: Balance Tests

	(1) Female	(2) Age	(3) Years Enrolled	(4) Urban	(5) 2019 Math Score	(6) 2019 English Score
Individual Incentives	-0.0120	0.0645	-0.0449	0.0408	0.00974	0.0156
	(0.0111)	(0.0508)	(0.132)	(0.114)	(0.0612)	(0.0614)
Classroom Incentives	-0.0173	0.0523	-0.0850	-0.0177	0.00210	-0.0406
	(0.0105)	(0.0479)	(0.116)	(0.109)	(0.0570)	(0.0608)
Both Incentives	-0.00309	-0.0299	-0.107	-0.0536	0.0343	0.0254
	(0.00956)	(0.0397)	(0.102)	(0.111)	(0.0661)	(0.0637)
Observations	20,510	20,300	20,512	20,512	20,588	20,588

Note: This table presents regressions on indicators for each treatment group. The outcome variable in Column 1 is an indicator for females. The outcome variable in Column 2 is student age. The outcome variable in Column 3 is the number of years enrolled. The outcome variable in Column 4 is an indicator of living in an urban area. The outcome variables in Columns 5 and 6 are normalized 2019 end-term Math and English scores. Observations are at the student level. Standard errors are clustered at the school level.

We find that there are no significant differences across treatment groups on key baseline demographic characteristics of students, namely, gender, age, years enrolled at Bridge, and whether they live in an urban area. Additionally, we find that treatment is balanced across last year's end-term Math and English Scores.

4.2 Impact on Incentivized Subject Scores

Table 2 presents the impact of each treatment arm on Math and English test scores which were the incentivized subjects.

We find that classroom-level incentives raised test scores significantly for both Math and English by about 0.13 and 0.16 standard deviations respectively. The treatment that

combined both types of incentives raised scores in Math by 0.17 standard deviations. Our results are robust to grade, gender, and urban controls.[10] The impact of the combined incentives arm on English of 0.12-0.13 standard deviations is not statistically significant at the 5 percent level, but is statistically significant at the 10 percent level controlling for student gender.

The effect of individual-level incentives, although positive and around 0.10 and 0.13 standard deviations for Math and English, is not statistically distinguishable from zero. We also do not have sufficient power to reject homogeneity of effects across treatment arms, i.e. we cannot reject that individual-level incentives are just as effective as classroom incentives, or that combined incentives have a greater effect than either type of incentive in isolation. Appendix Table A3 shows that if we combine all the treatment arms, we see a 0.13 and 0.14 standard deviation effect of having any incentive on Math and English test scores respectively.

[10]We also show robustness to controlling for strata fixed effects in Appendix Table A2.

Table 2: Impact on Incentivized Subject Scores

	(1)	(2)	(3)	(4)
Panel A. Math Scores				
Individual Incentives	0.0990	0.0992	0.0968	0.0997
	(0.0720)	(0.0719)	(0.0719)	(0.0717)
Classroom Incentives	0.129	0.129	0.128	0.127
	(0.0627)	(0.0625)	(0.0623)	(0.0619)
Both Incentives	0.165	0.165	0.168	0.164
	(0.0735)	(0.0733)	(0.0733)	(0.0722)
Comparison P-values				
Ind vs Class	0.6927	0.692	0.6837	0.7262
Ind vs Both	0.4393	0.438	0.4049	0.4464
Class vs Both	0.6431	0.6429	0.6051	0.6208
Observations	20,512	20,512	20,324	20,324
R-squared	0.004	0.004	0.004	0.005
Panel B. English Scores				
Individual Incentives	0.134	0.134	0.137	0.138
	(0.0855)	(0.0853)	(0.0857)	(0.0860)
Classroom Incentives	0.156	0.156	0.158	0.157
	(0.0728)	(0.0726)	(0.0727)	(0.0728)
Both Incentives	0.120	0.120	0.126	0.124
	(0.0753)	(0.0753)	(0.0752)	(0.0745)
Comparison P-values				
Ind vs Class	0.7916	0.7909	0.8004	0.8236
Ind vs Both	0.8664	0.8653	0.8987	0.8696
Class vs Both	0.6159	0.6124	0.6566	0.6431
Observations	20,516	20,516	20,329	20,329
R-squared	0.004	0.004	0.010	0.011
Grade FE		X	X	X
Gender FE			X	X
Urban FE				X

Note: This table presents regressions of normalized test scores on indicators for each treatment group. The outcome variables are Math test scores in Panel A and English test scores in Panel B. Columns 2 to 4 include grade fixed effects. Columns 3 to 4 include gender fixed effects. Column 4 includes a fixed effect for living in an urban area. Observations are at the student level. Standard errors are clustered at the school level.

4.3 Impact on Non-Incentivized Subject Scores

In Table 3, we present the impact of each treatment arm on Kiswahili, Science, and Social Studies test scores. The incentives are not awarded based on scores in these subjects so any impact on these subjects is therefore evidence of spillover effects across subjects.

Table 3: Impact on Non-Incentivized Subject Scores

	(1) Kiswahili	(2) Science	(3) Social Studies
Individual Incentives	0.0724	0.0539	0.0636
	(0.0738)	(0.0845)	(0.102)
Classroom Incentives	0.103	0.131	0.216
	(0.0696)	(0.0761)	(0.0769)
Both Incentives	0.104	0.200	0.225
	(0.0766)	(0.0918)	(0.0916)
Comparison P-values			
Ind vs Class	0.6875	0.3262	0.1245
Ind vs Both	0.6954	0.1203	0.1442
Class vs Both	0.9836	0.4256	0.9129
Observations	20,413	20,250	11,693
R-squared	0.002	0.006	0.010
Grade FE	X	X	X

Note: This table presents regressions of normalized test scores on indicators for each treatment group. The outcome variables are Kiswahili test scores in Column 1, Science test scores in Column 2, and Social Studies test scores in Column 3. All columns include grade fixed effects. Standard errors are clustered at the school level.

For classroom incentives, we find evidence of substantial spillovers for Social Studies as test scores increase by 0.22 standard deviations and this is statistically significant at the 1 percent level. The impact of classroom-level incentives on Science at 0.13 standard deviations is not statistically significant at the 5 percent level but is statistically significant at the 10 percent level. The treatment that combined both types of incentives raised scores in both Science and Social studies by 0.20 and 0.23 standard deviations respectively (significant at 5% level). Although the spillover effect on Kiswahili test scores appears to be positive, we

cannot statistically distinguish this from zero. As before, we lack sufficient power to reject homogeneity of effects across treatment arms, i.e. we cannot reject that individual-level incentives are just as effective as classroom incentives or whether combined incentives are more effective than either of the incentives alone. Appendix Table A3 shows that combining all treatment arms, we also see a treatment effect of 0.13 and 0.18 standard deviations in Science (significant at 10%)and Social Studies (significant at 5%), while the effect on Kiswahili is statistically indistinguishable from zero.

4.4 Impact on Student and Teacher Attendance

In Table 4, we present the impact of each treatment arm on student and teacher attendance. We find that both individual and class incentives raised student attendance by 3 and 6 percentage points respectively (6 and 14.5% respectively). The combined incentive arm also seems to have affected student attendance positively but we cannot statistically distinguish its impact from zero. Looking at the p-values for pair-wise comparisons of treatment arms, we also find that classroom incentives raised student attendance more than individual incentives, and the effect of the classroom incentives is also statistically distinguishable from the combined incentive arm. We cannot however distinguish between the treatment effects of individual incentives and combined incentive arm.

Looking at teachers, interestingly, we find that class incentives raise teacher attendance by 4 percentage points (6%). The impact of individual and combined incentives arm on teacher attendance, however, is statistically indistinguishable from zero. Pair-wise comparisons of treatment arms show that while we cannot rule out differences in treatment effects of individual and classroom incentives, we do find that the classroom incentives arm raises teacher attendance more than the combined treatment arm. One possible explanation is that combining individual and classroom incentives may dilute the significance of the classroom award, which is what matters to the teachers.

Table 4: Impact on Student and Teacher Attendance

	(1)	(2)
Panel A. Student Attendance		
Individual Incentives	0.0265	0.0265
	(0.0129)	(0.0127)
Classroom Incentives	0.0644	0.0644
	(0.0123)	(0.0122)
Both Incentives	0.0168	0.0169
	(0.0131)	(0.0130)
Comparison P-values		
Ind vs Class	0.0024	0.0020
Ind vs Both	0.4632	0.4601
Class vs Both	0.0002	0.0002
Observations	2,335	2,335
R-squared	0.012	0.043
Grade FE		X
Panel B. Teacher Attendance		
Individual Incentives	0.0269	0.0269
	(0.0200)	(0.0165)
Classroom Incentives	0.0438	0.0438
	(0.0192)	(0.0159)
Both Incentives	0.00758	0.00758
	(0.0200)	(0.0169)
Comparison P-values		
Ind vs Class	0.3924	0.2901
Ind vs Both	0.3429	0.2516
Class vs Both	0.0653	0.0262
Observations	2,556	2,556
R-squared	0.002	0.318
Grade FE		X

Note: This table presents regressions of student and teacher attendance on treatment indicators in Panels A and B. The variable labels correspond to the treatment groups. Observations are at the classroom level. Standard errors are clustered at the school level.

4.5 Heterogeneity

We present the results interacting treatment with covariates to explore heterogeneity in Appendix Tables A4-A7.

Looking at heterogeneity with respect to whether the student scored above or below average at baseline (Table A4), we find that the individual and class-incentives treatment arms do not differentially affect students below or above average. However, the combined incentive arm seems to more positively affect students in the upper half of the baseline achievement distribution (this is statistically significant at the 10% level for all subjects except for Kiswahili). As before, we lack the power to distinguish the heterogeneity effects across treatment arms.[11]

Additionally, we find suggestive evidence that class-level incentives are relatively less effective (although still positive on the net) for female students compared to male students in Math and Kiswahili. This heterogeneity pattern continues to hold when looking at the effect of any incentive on Math scores (Appendix Table A9). We do not find any evidence of heterogeneity across students in lower (grades 1 to 4) versus upper (grades 5 to 8) primary and between students who live in urban versus rural areas. This continues to hold when looking at the effect of all treatment arms combined (Appendix Tables A10 and A11).

4.6 Discussion

Although we are limited in being able to rigorously investigate the mechanisms driving the treatment impact, our results on teacher and student attendance, together with spillovers across subjects, are suggestive that classroom incentives may have been effective in improving peer effects and classroom environment. In particular, we see that classroom-level incentives improved both student and teacher attendance, and therefore could have increased student-teacher or peer interactions, and learning time. To the extent that there are complementar-

[11] We report results combining all treatment arms and looking at the effect of receiving any incentive in Appendix Table A10.

ities in student (or student-teacher) effort, this is one reason why class-level incentives can be more effective than individual-level incentives. Our results on positive spillovers across subjects and impacts on teacher and student attendance also reassure us that the treatment effects are not simply driven by teaching to the test.

Finally, we note that classroom incentives are highly cost-effective in our context at less than 2 USD per school and just a few cents USD per student.[12]

5 Conclusion

We conducted a randomized controlled trial using non-monetary incentives in the form of a certificate and a badge for student recognition with 225 low-cost primary schools in Kenya associated with Bridge International Academies. The schools were divided equally into four experimental arms. First, an individual-level incentives arm where the top 2 students in every class based on their average scores in Math and English earn the incentive. Second, a classroom-level incentives arm where all students in the class with the highest average score in Math and English in each school earn the incentive. Third, a combined incentive arm where students who are the top scorers in their class based on individual-level scores or who belong to the top class (in terms of average Math and English scores) within each school earn the incentive. Last, a control arm with no incentives.

We find that students in the classroom-level incentives arm scored 0.13 and 0.16 standard deviations higher than those in the control group for Math and English respectively. Schools in the combined incentives arm scored 0.17 standard deviations higher than those in the control group for Math. We also find evidence of positive spillover effects on subjects not directly incentivized for the classroom level and combined incentive arms. The effect of the individual incentives arm on any subject test score is statistically indistinguishable from zero. Overall, our findings suggest that non-monetary class-level incentives can be effective in motivating student performance, and student and teacher attendance.

[12]We report the per-unit costs of the incentive awards in Section 2.

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A Appendix Tables and Figures

Table A1: Descriptive Statistics

Variable	Obs.	Mean	SD	Min	P25	P50	P75	Max
Female	20816	0.481	0.500	0	0	0	1	1
Age	20604	10.2	2.52	3.49	8.04	9.92	12.0	19.8
Years Enrolled	20818	2.43	2.12	0	0.658	1.98	3.99	9.93
Urban	20818	0.323	0.468	0	0	0	1	1
Math Score (Std.)	20512	0	1	-4.94	-0.690	0.0552	0.753	3.47
English Score (Std.)	20516	0	1	-3.75	-0.652	0.128	0.755	3.13
Kiswahili Score (Std.)	20129	0	1	-3.42	-0.645	0.113	0.740	3.13
Science Score (Std.)	20038	0	1	-4.13	-0.699	0.0180	0.742	3.20
Social Studies Score (Std.)	11537	0	1	-3.59	-0.728	-0.0432	0.684	3.60

Note: This table presents summary statistics. There are fewer Social Studies test score observations because only Grades 4 and above take the subject.

Table A2: Impact on Incentivized Subject Scores with Randomization Strata Controls

VARIABLES	(1) Math	(2) English
Individual Incentives	0.0947	0.129
	(0.0635)	(0.0770)
Classroom Incentives	0.130	0.154
	(0.0619)	(0.0749)
Both Incentives	0.188	0.132
	(0.0702)	(0.0706)
Observations	20,512	20,516
R-squared	0.016	0.015
Strata FE	YES	YES

Note: This table presents regressions of normalized test scores on indicators for each treatment group. The outcome variables are Math and English test scores in Columns 1 and 2 respectively. Both Columns include randomization strata fixed effects. Observations are at the student level. Standard errors are clustered at the school level.

Table A3: Impact of Any Treatment

	Math	English	Kiswahili	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Any Treatment	0.133	0.137	0.0946	0.132	0.176
	(0.0521)	(0.0626)	(0.0577)	(0.0684)	(0.0700)
Constant	-0.0965	-0.0993	-0.0687	-0.0957	-0.127
	(0.0408)	(0.0540)	(0.0481)	(0.0583)	(0.0574)
Observations	20,512	20,516	20,413	20,250	11,693
R-squared	0.003	0.004	0.002	0.003	0.006

Note: This table presents regressions of normalized test scores on an indicator combining all the three treatment groups (Individual, Classroom and Combined Incentive Arms). The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. Standard errors are clustered at the school level.

Table A4: Heterogeneity by Achievement Distribution - Above or Below Average

	Math	English	Kiswahili	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Individual Incentives	0.0458	-0.0190	0.0273	0.0267	-0.00516
	(0.0313)	(0.0386)	(0.0320)	(0.0319)	(0.0369)
Classroom Incentives	0.0278	0.0141	0.00592	0.0198	0.0253
	(0.0323)	(0.0370)	(0.0410)	(0.0344)	(0.0343)
Both Incentives	-0.00351	-0.0330	0.00454	-0.0215	-0.0177
	(0.0327)	(0.0394)	(0.0349)	(0.0353)	(0.0396)
Above Avg	1.601	1.597	1.617	1.563	1.542
	(0.0238)	(0.0343)	(0.0254)	(0.0275)	(0.0343)
Individual Incentives * Above Avg	0.00610	0.0677	0.0270	0.0168	0.0787
	(0.0514)	(0.0598)	(0.0471)	(0.0474)	(0.0717)
Classroom Incentives * Above Avg	0.00914	0.0337	0.0499	0.0532	0.0821
	(0.0399)	(0.0485)	(0.0438)	(0.0456)	(0.0497)
Both Incentives * Above Avg	0.118	0.0914	0.0652	0.158	0.135
	(0.0463)	(0.0493)	(0.0470)	(0.0574)	(0.0786)
Constant	-0.873	-0.881	-0.914	-0.826	-0.772
	(0.0174)	(0.0253)	(0.0255)	(0.0218)	(0.0275)
Observations	20,512	20,516	20,413	20,250	11,693
R-squared	0.655	0.665	0.671	0.660	0.654

Note: This table presents regressions of normalized test scores on indicators for each treatment group interacted with an indicator for having an above average baseline score. The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. Standard errors are clustered at the school level.

Table A5: Heterogeneity by Student Gender

	Math	English	Kiswahili	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Individual Incentives	0.130	0.126	0.0779	0.0711	0.0390
	(0.0749)	(0.0864)	(0.0769)	(0.0861)	(0.105)
Classroom Incentives	0.166	0.181	0.143	0.156	0.233
	(0.0606)	(0.0722)	(0.0696)	(0.0778)	(0.0801)
Both Incentives	0.179	0.109	0.106	0.194	0.219
	(0.0728)	(0.0789)	(0.0809)	(0.0945)	(0.0969)
Female	0.0300	0.158	0.105	0.00122	-0.0867
	(0.0231)	(0.0235)	(0.0227)	(0.0223)	(0.0337)
Individual Incentives * Female	-0.0636	0.0219	-0.00897	-0.0365	0.0527
	(0.0395)	(0.0493)	(0.0412)	(0.0414)	(0.0547)
Classroom Incentives * Female	-0.0774	-0.0461	-0.0818	-0.0544	-0.0419
	(0.0363)	(0.0342)	(0.0359)	(0.0357)	(0.0465)
Both Incentives * Female	-0.0281	0.0240	-0.00131	0.0114	0.0149
	(0.0389)	(0.0406)	(0.0373)	(0.0353)	(0.0592)
Constant	-0.111	-0.177	-0.120	-0.0962	-0.0859
	(0.0398)	(0.0554)	(0.0497)	(0.0591)	(0.0610)
Observations	20,510	20,514	20,411	20,248	11,692
R-squared	0.004	0.010	0.004	0.006	0.012

Note: This table presents regressions of normalized test scores on indicators for each treatment group interacted with an indicator for female students. The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. Standard errors are clustered at the school level.

Table A6: Impact on Scores (Heterogeneity by Upper (5-8) or Lower (1-4) Grades)

	Math	English	Kiswahili	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Individual Incentives	0.0870	0.0744	0.0765	0.0533	0.152
	(0.0716)	(0.0800)	(0.0819)	(0.0995)	(0.193)
Classroom Incentives	0.0927	0.120	0.0810	0.174	0.411
	(0.0779)	(0.0822)	(0.0864)	(0.108)	(0.177)
Both Incentives	0.140	0.149	0.103	0.207	0.448
	(0.0778)	(0.0824)	(0.0894)	(0.106)	(0.158)
Individual Incentives * Upper	0.0300	0.138	-0.00848	-4.90e-05	-0.123
	(0.100)	(0.106)	(0.103)	(0.0980)	(0.189)
Classroom Incentives * Upper	0.0831	0.0807	0.0483	-0.0948	-0.257
	(0.100)	(0.108)	(0.105)	(0.108)	(0.183)
Both Incentives * Upper	0.0588	-0.0655	0.00460	-0.0167	-0.299
	(0.0926)	(0.0865)	(0.0904)	(0.109)	(0.156)
Constant	-0.0976	-0.100	-0.0690	-0.0951	-0.122
	(0.0406)	(0.0539)	(0.0477)	(0.0581)	(0.0573)
Observations	20,512	20,516	20,413	20,250	11,693
R-squared	0.004	0.005	0.002	0.006	0.012

Note: This table presents regressions of normalized test scores on indicators for each treatment group interacted with an indicator for being in the upper primary grades (Grades 5-8). The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects (and therefore the Upper dummy has been dropped). Standard errors are clustered at the school level.

Table A7: Heterogeneity by Urban/Rural Area

	Math	English	Kiswahili	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Individual Incentives	0.0713	0.110	0.0468	0.0673	0.120
	(0.101)	(0.116)	(0.104)	(0.110)	(0.143)
Classroom Incentives	0.0873	0.101	0.0747	0.0674	0.193
	(0.0723)	(0.0813)	(0.0901)	(0.0931)	(0.106)
Both Incentives	0.156	0.125	0.108	0.219	0.292
	(0.0960)	(0.0924)	(0.102)	(0.116)	(0.120)
Urban Area	-0.122	-0.0821	-0.0880	-0.0749	-0.0173
	(0.0768)	(0.114)	(0.0898)	(0.117)	(0.108)
Individual Incentives * Urban Area	0.0887	0.0723	0.0778	-0.0303	-0.144
	(0.132)	(0.167)	(0.135)	(0.167)	(0.191)
Classroom Incentives * Urban Area	0.127	0.171	0.0843	0.199	0.0688
	(0.140)	(0.168)	(0.138)	(0.162)	(0.141)
Both Incentives * Urban Area	0.00836	-0.0370	-0.0317	-0.0841	-0.224
	(0.129)	(0.151)	(0.132)	(0.178)	(0.162)
Constant	-0.0562	-0.0716	-0.0394	-0.0704	-0.121
	(0.0530)	(0.0654)	(0.0646)	(0.0752)	(0.0781)
Observations	20,512	20,516	20,413	20,250	11,693
R-squared	0.006	0.006	0.003	0.009	0.014

Note: This table presents regressions of normalized test scores on indicators for each treatment group interacted with an indicator for the school being in an urban area. The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. Standard errors are clustered at the school level.

Table A8: Heterogeneity by Achievement Distribution - Above or Below Average

	Math	English	Kiswahili	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Any Treatment	0.0228	-0.0121	0.0119	0.00880	0.00156
	(0.0235)	(0.0305)	(0.0297)	(0.0266)	(0.0310)
Above Average	1.601	1.597	1.617	1.563	1.542
	(0.0238)	(0.0343)	(0.0254)	(0.0275)	(0.0343)
Any Treatment * Above Avg	0.0457	0.0638	0.0483	0.0796	0.101
	(0.0326)	(0.0411)	(0.0335)	(0.0376)	(0.0479)
Constant	-0.873	-0.881	-0.914	-0.826	-0.772
	(0.0174)	(0.0253)	(0.0255)	(0.0218)	(0.0275)
Observations	20,512	20,516	20,413	20,250	11,693
R-squared	0.654	0.665	0.671	0.659	0.654

Note: This table presents regressions of normalized test scores on an indicator combining all the three treatment groups (Individual, Classroom and Combined Incentive Arms) interacted with an indicator for being above average in the baseline achievement distribution. The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. Standard errors are clustered at the school level.

Table A9: Heterogeneity by Female

	Math	English	Kiswahili	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Any Treatment	0.160	0.140	0.112	0.144	0.174
	(0.0516)	(0.0640)	(0.0597)	(0.0694)	(0.0737)
Female	0.0300	0.158	0.105	0.00130	-0.0866
	(0.0231)	(0.0235)	(0.0227)	(0.0223)	(0.0337)
Any Treatment * Female	-0.0560	-0.00230	-0.0329	-0.0259	0.00367
	(0.0292)	(0.0306)	(0.0290)	(0.0284)	(0.0416)
Constant	-0.111	-0.177	-0.120	-0.0963	-0.0859
	(0.0398)	(0.0554)	(0.0497)	(0.0591)	(0.0610)
Observations	20,510	20,514	20,411	20,248	11,692
R-squared	0.004	0.010	0.003	0.004	0.008

Note: This table presents regressions of normalized test scores on an indicator combining all the three treatment groups (Individual, Classroom and Combined Incentive Arms) interacted with an indicator for female students. The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. Standard errors are clustered at the school level.

Table A10: Heterogeneity by Upper (5-8) or Lower (1-4) Grades

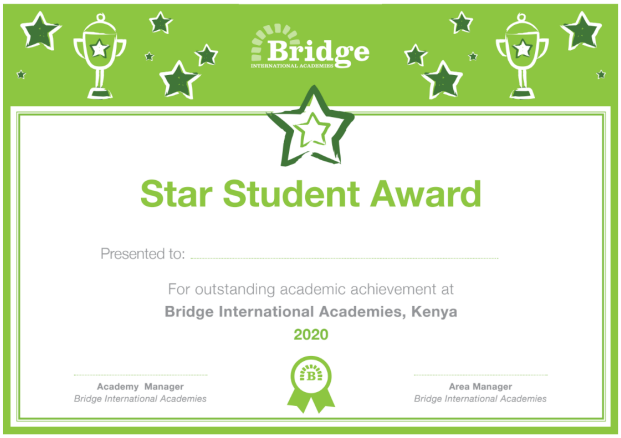
	(1) Math	(2) English	(3) Language	(4) Science	(5) Social Studies
Any Treatment	0.108	0.117	0.0872	0.150	0.352
	(0.0592)	(0.0665)	(0.0714)	(0.0866)	(0.135)
Any Treatment * Upper	0.0590	0.0478	0.0171	-0.0410	-0.235
	(0.0702)	(0.0734)	(0.0795)	(0.0817)	(0.131)
Constant	-0.0976	-0.100	-0.0690	-0.0951	-0.122
	(0.0406)	(0.0539)	(0.0477)	(0.0581)	(0.0573)
Observations	20,512	20,516	20,413	20,250	11,693
R-squared	0.004	0.004	0.002	0.004	0.008

Note: This table presents regressions of normalized test scores on an indicator combining all the three treatment groups (Individual, Classroom and Combined Incentive Arms) interacted with an indicator for upper primary grades (Grades 5-8). The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. The upper dummy is dropped due to the inclusion of grade fixed effects. Standard errors are clustered at the school level.

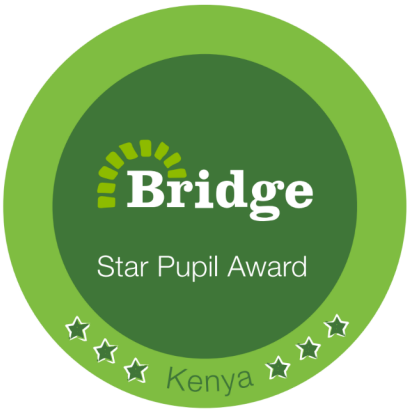
Table A11: Heterogeneity by Urban/Rural Area

	Math	English	Language	Science	Social Studies
	(1)	(2)	(3)	(4)	(5)
Any Treatment	0.108	0.112	0.0795	0.122	0.210
	(0.0675)	(0.0763)	(0.0776)	(0.0876)	(0.0949)
Urban	-0.122	-0.0821	-0.0881	-0.0749	-0.0173
	(0.0768)	(0.114)	(0.0898)	(0.117)	(0.108)
Any Treatment * Urban	0.0726	0.0736	0.0428	0.0264	-0.103
	(0.0998)	(0.132)	(0.107)	(0.137)	(0.131)
Constant	-0.0562	-0.0716	-0.0393	-0.0705	-0.121
	(0.0530)	(0.0654)	(0.0646)	(0.0752)	(0.0781)
Observations	20,512	20,516	20,413	20,250	11,693
R-squared	0.005	0.004	0.003	0.004	0.008

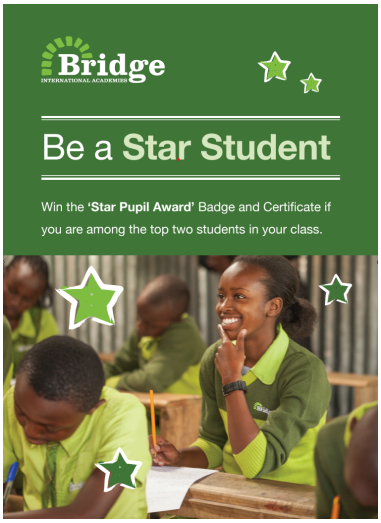
Note: This table presents regressions of normalized test scores on an indicator combining all the three treatment groups (Individual, Classroom and Combined Incentive Arms) interacted with an indicator for the school being in an urban area. The outcome variables are English test scores in Column 1, Math test scores in Column 2, Kiswahili test scores in Column 3, Science test scores in Column 4, and Social Studies test scores in Column 5. All columns include grade fixed effects. Standard errors are clustered at the school level.



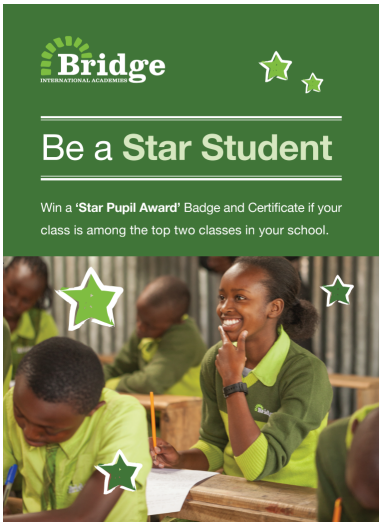
(a) Certificate Design



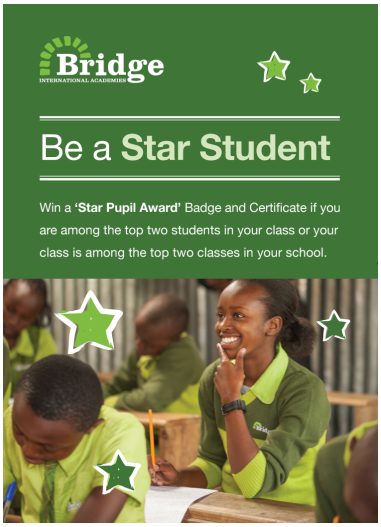
(b) Badge Design



(c) Ind. Incentives Poster



(d) Class. Incentives Poster



(e) Both Incentives Poster

Figure A1: "Star Pupil" Incentives and Posters

Dear academy manager,

This year, your academy has been selected to pilot a classroom incentives programme. The programme is designed to award certificates and badges to the top-performing classroom each term. We hope that these awards might encourage pupils and classrooms to work even harder in their studies. At the start of this term, please announce the programme to all pupils at the school. Use the assembly to inform pupils that if their classrooms work hard, each pupil in their class could win a 'Star Pupil' badge and certificate at the end of the term. All pupils in the top classroom will be recognised with this award. Mention that it will be an honour/prestige to be awarded.

This term, you will receive packages with the certificates and badges along with endterm exams. Store these materials in your office. At the end of this term, you must select the 1 strongest classroom in the academy by their class average achievement in Math and English, by adding all pupils scores in Math and English, dividing then by two and then dividing by the number of students in the class.

Then, at the start of term 2, you should organise an assembly during the first week of the term. You will award a 'Star Pupil' certificate and badge to all pupils in the top performing classrooms. 'Star Pupils' should be allowed to wear their badges to school for 2 weeks. During that assembly, remind pupils that more 'Star Pupil' awards will be given out during the next term.

Please contact customer care if you have any questions or require additional support.

[REDACTED NAME]
Learning Innovation Department

(a) Classroom Incentives

Dear academy manager,

This year, your academy has been selected to pilot a classroom incentives programme. The programme is designed to award certificates and badges to the top-performing pupils and classrooms each term. We hope that these awards might encourage pupils to work even harder in their studies. At the start of this term, please announce the programme to all pupils at the school. Use the assembly to inform pupils that if they work hard in their classes, they could win a 'Star Pupil' badge and certificate at the end of the term. The top 1 pupil from each class AND the top-performing classroom at the school will be recognised with this award. Mention that it will be an honour/prestige to be awarded.

This term, you will receive packages with the certificates and badges along with endterm exams. Store these materials in your office. At the end of this term, each teacher must select 1 pupil in their homeroom class with the highest combined literacy and numeracy score (they can add up literacy + numeracy scores and divide by 2). You must select the 1 strongest classroom in the academy by their class average achievement in Maths and English, by adding all pupils scores in Math and English, dividing then by two and then dividing by the number of students in your class.

Then, at the start of term 2, you should organise an assembly during the first week of the term. Each teacher will award a 'Star Pupil' certificate and badge to the top performing pupil. You will award 'Star Pupil' certificates and badges to the top-performing classroom. 'Star Pupils' should be allowed to wear their badges to school for 2 weeks. During that assembly, remind pupils that more 'Star Pupil' awards will be given out during the next term.

Please contact customer care if you have any questions or require additional support.

[REDACTED NAME]
Learning Innovation Department

(b) Both Incentives

Figure A2: Emails to Academy Managers

Dear teacher,

This year, your academy has been selected to pilot a student incentives programme. The programme is designed to award certificates and badges to the top-performing pupils each term. At the start of this term, the academy manager will announce the programme to all pupils at the school during an assembly. The academy manager will announce that if pupils work hard in their classes, they could win a 'Star Pupil' badge and certificate at the end of the term. The top 2 pupils in each class will be recognised with this award.

During the term, try to remind pupils every 1-2 weeks about the programme, to encourage them to continue working hard. At the end of this term, you will select the 2 pupils in your homeroom class with the highest combined literacy and numeracy score (add up literacy + numeracy scores and divide by 2). At the start of term 2, the academy manager will organise an assembly during the first week of the term. Each teacher will award a 'Star Pupil' certificate and badge to the top 2 performing pupils. 'Star Pupils' should be allowed to wear their badges to school for 2 weeks.

Please meet with your academy manager if you have any questions or require additional support.

[REDACTED NAME]
Learning Innovation Department

(a) Individual Incentives

Dear teacher,

This year, your academy has been selected to pilot a classroom incentives programme. The programme is designed to award certificates and badges to the top-performing classrooms each term. We hope that these awards might encourage pupils and classrooms to work even harder in their studies. At the start of this term, the academy manager will announce the programme to all pupils at the school.

During the term, try to remind pupils every 1-2 weeks about the programme, to encourage them to continue working hard. At the end of this term, the academy manager will select the top classrooms in the academy by their class average achievement in Math and English, by adding all pupils scores in Math and English, dividing then by two and then dividing by the number of students in your class. At the start of term 2, the academy manager will organise an assembly during the first week of the term. They will award a 'Star Pupil' certificate and badge to all pupils in the top 2 performing classrooms. 'Star Pupils' should be allowed to wear their badges to school for 2 weeks.

Please contact customer care if you have any questions or require additional support.

[REDACTED NAME]
Learning Innovation Department

(b) Classroom Incentives

Dear teacher,

This year, your academy has been selected to pilot a classroom incentives programme. The programme is designed to award certificates and badges to the top-performing pupil each term. At the start of this term, the academy manager will announce the programme to all pupils at the school during an assembly. The academy manager will announce that if pupils work hard in their classes, they could win a 'Star Pupil' badge and certificate at the end of the term. The top pupil in each classroom AND the top classroom will be recognised with this award.

During the term, try to remind pupils every 1-2 weeks about the programme, to encourage them to continue working hard. At the end of this term, you will select the top pupil in your homeroom class with the highest combined literacy and numeracy score (add up literacy + numeracy scores and divide by 2). The academy manager will select the top-performing classroom by their class average achievement in Math and English, by adding all pupils scores in Math and English, dividing then by two and then dividing by the number of students in your class. At the start of term 2, the academy manager will organise an assembly during the first week of the term. Each teacher will award a 'Star Pupil' certificate and badge to the top performing pupil. The academy manager will award the certificate and badge to the top-performing classroom. 'Star Pupils' should be allowed to wear their badges to school for 2 weeks.

Please meet with your academy manager if you have any questions or require additional support.

[REDACTED NAME]
Learning Innovation Department

(c) Both Incentives

Figure A3: Tablet Message to Teachers