Evaluation of Cumulative Impacts of the Student Enterprise Program on Academic Achievement

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Introduction

Schools are looking for methods to improve academic outcomes amid increasingly challenging environments. One method gaining recognition is the school-wide positive behavior support system. This method attempts to affect the outputs of the educational process, academic achievement, principally through addressing inputs to the process and improving the school environment. A key component of a positive behavior support system is the articulation of expectations and rewarding students when they meet those expectations. The Student Enterprise Program an economics-based non-curricular incentive program that provides a framework for articulating expectations and rewarding students. The typical implementation in grades three through six provides students with the opportunity to experience the program for consecutive years. One school district's phased-in district-wide implementation of the program provides a natural experiment for examining the extent to which participation in StEP may impact academic achievement and if outcomes are cumulative. The results indicate that participation in StEP may be effective at producing improved test scores by the sixth grade. Results may be cumulative as evidenced by a closing of the gap in scores between treatment and control students for younger grades.

Literature Review

There is a robust literature addressing concerns in primary education, and strategies aimed at improving educational outcomes. Most recently, both positive behavior support systems (PBS) and incentivizing students directly have garnered significant attention as policy makers, educators and constituents seek approaches to improve the educational process and student outcomes. Studies on PBS are multi-year and school wide, suggesting that importance of a consistent and repeated structure (Bradshaw et al., 2010; Lassen et al, 2006; Mass-Galloway et al., 2008; Muscott et al., 2008).

Blonigen et al (2008) notes that PBS programs are "establish the broad, social, cultural and individual behavior supports needed to promote both academic success and prosocial behavior." To achieve these ends, effective PBS systems teach and acknowledge appropriate behavior. Similarly Bradshaw et al (2010) note that effective PBS systems "clearly articulate positive behavioral expectations, [and] provide incentives to students who meet those behavioral expectations". While the two topics, PBS and incentives, have largely been approached separately they are closely related. Incentive programs that target student behavior accord with a principle component of PBS systems, establishing expectations and rewarding students who meet them. In particular, Lassen et al (2006) look specifically at PBS in an urban school environment. They note that the challenges in urban schools, such as persistent poverty, crime, and violence, may impact the effectiveness of PBS programs. Specifically, it may take longer for positive impacts to be realized in the more challenging environments. Their examination of a three-year study found a positive relationship between behaviors and academic achievement, although the magnitudes were small.

In the Economics literature, most recently Fryer (2010) concluded that incentivizing the inputs to the educational production function, such as on-time attendance and good behavior, proved more effective than incentivizing outputs, such as test scores. In contrast, Bettinger (2008) noted modest gains in math scores resulting from a pay for performance model in third through sixth graders. Results from Pitzer (2011 working paper) accord more closely with Fryer (2010) in that the incentives applied to educational outputs were not effective; however, students did respond to the incentives for the educational inputs. Additionally, Pitzer (2011 working paper) posited that a one-year study of third graders may not be sufficient to reflect impacts of participation in StEP, similar to Lassen et al (2006).

The current paper adds to the literature on incentives as a means to promote academic achievement, and further contributes to the literature assessing the efficacy of PBS programs. Additionally, this project further establishes the link between the two topics – PBS and incentives – by demonstrating how an Economics-content based program, designed to provide students with opportunities for learning and practicing basic economic concepts, can provide an effective framework for addressing concerns about academic achievement.

Student Enterprise Program

The Student Enterprise Program (StEP) is a non-curricular incentive program designed to teach students fundamental principles of economics. The core of the program is focused on providing students with opportunities to earn school based money for engaging in behaviors believed to support a classroom environment more conducive to learning: regular, on-time attendance; abstaining from disruptions in class; and being prepared for class, usually having homework completed. Students use these school-based earnings to purchase real goods at a "school store". In this way, StEP functions similarly to other positive behavioral support (PBS) programs.

In addition to reinforcing positive classroom behaviors, StEP seeks to impart knowledge of basic economics to participating students. The PBS aspect is one venue for teaching about economics, in particular learning about earnings, supply and demand, and savings. The school store provides an opportunity for a more sophisticated lesson. In less advanced schools, the "school store" is a mobile unit staffed by employees of the Economics Center, and students experience basic concepts of pricing, savings and choice. In schools whose involvement with the program is more advanced, these school stores are physically located within the schools and run by the students. Students take on roles as "producers", "workers" and "managers". Their

"earnings" are now also tied to their activities within the school store, as opposed to just their behavior within the classroom.

In its typical form, teachers have a good deal of freedom to implement the program in a way that meets their needs. Each student has the opportunity to earn a total of $75 in school money per week, but generally teachers can decide the daily amounts and activities for which students can earn that money; however, the permissible activities are always some subset of attendance, disruptive behavior and preparedness for class. For example, a teacher may emphasize attendance and allocate more possible earnings toward it.

The school district that was the focus of this study has a unique implementation of StEP in that they have gradually phased in a whole-school model. All teachers in grades three through eight now must participate in their implementation of the model. Additionally, the school district does not utilize the "school store" as provided by the Economics Center, but houses their own marketplace within their buildings, which students visit three times per year. Additionally, students produce goods for their marketplace and track profits and losses of their businesses.

The phasing in to all classrooms grade three and above has occurred concurrently with consolidation within the district. School buildings are grade level, as opposed to neighborhood, thus one building will house all of the district's third graders, for example. Thus, this school district has implemented a standardized form of the model, providing continuity for their students across grades.

Data

This study examined academic performance, as measured by standardized reading and math scores, for students in a single public school district within the inner-ring of suburbs. As this school district had been phasing implementation of the positive behavioral support program into all grades over time, the rising eighth graders had their first exposure to the program in the

2009-2010 academic year. Historical data on this group of eighth graders provides the control for the project as they had no experience with the program in their younger years.

The treatment group for the study consists of the third through sixth graders for the 2009-2010 academic year. The critical underlying assumption of the project is that the student's year in school corresponds one-for-one with their exposure to StEP, in other words, that all 6th graders have experienced 4 years of the program; however, the model can account for attrition by including an aggregate measure of student turnover.

The summary statistics below illustrate that there are some systematic differences between the panel of control students, and the pseudo-panel of treatment students. Firstly, the older cohort of control students is generally less likely to be economically disadvantaged, a greater share is non-minority, and a smaller proportion is Limited English Proficiency (LEP) students. In contrast, the control group has higher rates of learning disability.

Student Characteristics								
	Control				Treatment			
	Third	Fourth	Fifth	Sixth	Third	Fourth	Fifth	Sixth
Number of Students	242	263	255	263	241	252	261	24
Demographics								
Female	44.6%	43.56%	46.67%	49.43%	48.55%	56.35%	55.17%	53.36%
American Indian	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
Asian	2.5%	2.3%	2.4%	1.9%	2.5%	0.8%	1.2%	0.4%
African-American	61.2%	61.7%	64.7%	64.3%	68.9%	67.1%	68.2%	71.4%
Hispanic	4.1%	3.4%	3.9%	5.7%	7.9%	6.4%	5.8%	7.6%
White	22.3%	23.5%	21.2%	20.5%	10.0%	15.5%	12.6%	12.6%
Multi	9.9%	9.1%	7.8%	7.6%	10.8%	10.3%	12.3%	7.6%
Limited English Proficiency	4.6%	2.3%	4.3%	4.6%	10.0%	6.4%	5.0%	5.0%
Disability	13.2%	16.7%	16.5%	15.2%	12.5%	13.9%	10.3%	14.7%

Also notable, the school district underwent a period of consolidation, as illustrated by the reduction in the number of schools and teachers. To the extent that this consolidation is present

in the last two years of the panel of control students, and also that the model controls for teacher and school building effects, the analysis accounts for any impacts of this consolidation. Additionally, although economic disadvantage data were not available at the student level, aggregate statistics on the share of such students were available for the school buildings. As indicated in the table, the representation of economic disadvantaged students in the building is significantly higher for the treatment students.

School Level Characteristics								
	Control				Treatment			
	Third	Fourth	Fifth	Sixth	Third	Fourth	Fifth	Sixth
Number of Schools	5	5	1	1	1	1	1	1
Number of Reading Teachers	13	10	5	6	5	5	6	5
Number of Math Teachers	10	8	4	4	5	5	4	3
Percent Performance Indicators Met	61.1%	54.9%	14.3%	28.6%	40.0%	40.0%	33.3%	33.3%
Percent of Students Present less than One Year	5.2%	8.7%	7.7%	4.9%	5.1%	5.1%	4.2%	4.2%
Economic Disadvantage	33.5%	39.4%	32.1%	48.9%	69.80%	62.4%	62.7%	61.5%

Summary statistics on the dependent variables, scaled standardized test scores, indicate that the treatment and control groups have differed in their performance. In particular, in the third and fourth grade it appears that control students generally outperformed treatment students; however the relationship is reversed for fifth and sixth graders. This pattern further suggests that there are likely systematic differences between the control and treatment groups in addition to the demographic data.

Standardized Test Scores								
	Control				Treatment			
	Third	Fourth	Fifth	Sixth	Third	Fourth	Fifth	Sixth
Scaled Scores								
Reading Score	417.9	417.1	399.2	416.4	412.8	414.8	401.9	420.7
Math Score	422.4	417.1	395.9	411.3	410.7	417.3	400.8	416.7

Econometric Model

To examine the impact of StEP on academic achievement, standardized math and reading scores were considered for the full sample. Scaled test scores were normalized such that the coefficient estimates represent standard-deviation impacts on scaled scores. To isolate the incremental impacts of each year of StEP

The following models were estimated, an OLS and mixed Model:

$$Y_{ijkt} = \alpha_0 + \gamma_1 StEP\_Years_{ijkt} + \gamma_2 Treatment_{ijkt} * grade_{ijkt} + \mathbf{\beta X} + School_{jt} + teacher_{kt} + \varepsilon_i \quad (1)$$

$$Y_{ijkt} = \alpha_{0k} + \gamma_1 StEP\_Years_{ijkt} + \gamma_{2k} Treatment_{ijkt} * grade_{ijkt} + \mathbf{\beta X} + School_{jt} + \varepsilon_i \quad (2)$$

Where Y_{ijkt} is the normalized test score of student *i* in grade *j* with teacher *k* during "treatment time" t. The mixed model was estimated to allow the intercept, α_{0k}, and the impact of the interaction term, $Treatment_{ijkt} * grade_{ijkt}$, to vary across teachers. $StEP\_Years_{ijkt}$ is a continuous variable that measures the number of years the student would have experienced StEP. As mentioned previously, this variable is calculated for the pseudo-panel treatment group based on the assumption of no attrition. In other words, for the treatment group we infer their years of exposure to StEP from their grade level.

An interaction term, $Treatment_{ijkt} * grade_{ijkt,}$ is included to control for underlying differences in the pooled sample between the control and treatment groups since they were each observed during different periods, as the summary statistics above suggest that there were some systematic differences between the two periods. Thus the impact of the number of years in StEP will be combination of $\gamma_1 + \gamma_2$. Additionally, school indicators were included to control for any school building level fixed effects. X is a vector of student level characteristics including age at the time of the end-of-year exam, grade, race Limited English Proficiency and disability statuses. The table below contains the results pertaining to the treatment and student-level variables for both the Math and Reading test scores.

To remove the restriction that the number of years in StEP must be defined by the student's grade, the following models, OLS and mixed, for each grade level was separately considered:

$$Y_{ikt} = \alpha_0 + \gamma_1 StEP_{it} + \mathbf{\beta X} + Teacher_{kt} + \varepsilon_i \quad (3)$$

$$Y_{ikt} = \alpha_{0k} + \gamma_1 StEP_{itk} + \mathbf{\beta X} + \varepsilon_i \quad (4)$$

Where Y_{ik} is the normalized test score of student *i* with teacher *k* during "treatment time" t. $StEP_{ikt}$ is a binary variable indicating if the student is part of the "treatment" group as opposed to a continuous variable measuring years of experience. Teacher fixed effects have also been included in the OLS model. The mixed model allows the intercept and impact of the treatment, $StEP_{itk}$, to vary across teachers. X is a vector of student level characteristics including age at the time of the end-of-year exam, gender, race, Limited English Proficiency and disability statuses.

Results

The estimates of the intraclass correlation coefficients (ICC) for both the reading and math models suggest that variations across teachers are important, although the amount of variation due to teachers is somewhat small.[1] The results for the pooled sample suggest that impacts of StEP on academic achievement may be realized over time, and perhaps that the effects are cumulative. Through the fifth grade, while students in the StEP program have statistically lower standardized test scores in both math and reading the gaps close in each year consistently. A positive effect from StEP appears in the fourth year in the program, or sixth grade. Students in the sixth grade with four years of experience in the program have reading scores between 0.12 and 0.2 standard deviations higher than students with no experience, and math scores that are 0.12 to 0.24 standard deviations greater. If the treatment group represented

[1] ICC is the share of total variation that is due to teachers. It is a measure of the randomness of the intercept and treatment, and thus indicates the need for using a mixed model.

a significantly lower ability level than the control group, then the results indicate that StEP may have been effective at help to close the achievement gap between the two groups.

Pooled Sample Results (t-values in parentheses)				
	Reading		**Math**	
	OLS	**Mixed**	**OLS**	**Mixed**
StEP_Years (γ_1)	0.74***	0.54***	0.75***	0.84***
	(3.4)	(.31)	(5.02)	(4.18)
Treatment*Grade(γ_2)	-0.46***	-0.34***	-0.48***	-0.52***
	(-3.31)	(-2.35)	(-5.07)	(-4.33)
Net Effect of StEP (γ_1+ γ_2)				
Third Grade	-0.64	-0.48	-0.69	-0.72
Fourth Grade	-0.36	-0.28	-0.42	-0.40
Fifth Grade	-0.08	-0.08	-0.15	-0.08
Sixth Grade	0.2	0.12	0.12	0.24
Student Characteristics	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Teacher Fixed Effects	Yes	No	Yes	No
Adj R^2	0.27		0.33	
ICC		0.061		0.077

** Statistically significant at the 5% level
***Statistically significant at the 1% level

When examining individual grades, the results are less consistent across the specifications. The ICC's indicate that teacher variation is not a significant factor for the third and fourth grade reading scores; although teachers appear to be more important for fifth and sixth grade and for math tests in general. The individual models indicated that there was no statistical difference between reading scores for the treatment and control students at each grade level. The OLS math results, however, suggest that the treatment students have significantly higher math scores 0.18 standard deviations greater than the control students. These results further suggest that impacts of StEP might be realized only after repeated exposure to the program. This is reasonable particularly since students are quite young when they begin the program, on average about 9 years old.

Individual Grade Results (t-values in parentheses)								
	Reading				Math			
Impact of StEP	**OLS**	**Adj R^2**	**Mixed**	**ICC**	**OLS**	**Adj R^2**	**Mixed**	**ICC**
Third Grade	0.07	0.22	-0.11	0.026	-0.24	0.27	-0.28***	0.085
	(0.41)		(-0.87)		(-1.95)		(-2.13)	
Fourth Grade	-0.15	0.21	-0.15	0.052	-0.09	0.26	-0.05	0.062
	(-0.96)		(-1.14)		(-0.77)		(-0.48)	
Fifth Grade	0.02	0.38	0.02	0.228	0.08	0.42	0.09	0.205
	(0.24)		(0.24)		(0.93)		(1.04)	
Sixth Grade	0.03	0.31	0.11	0.305	0.18***	0.42	0.18	0.442
	(0.32)		(0.53)		(2.63)		(1.16)	
Student Characteristics	Yes		Yes		Yes		Yes	
Teacher Fixed Effects	Yes		No		Yes		No	

** Statistically significant at the 5% level

***Statistically significant at the 1% level

Conclusion

The results suggest that Student Enterprise Program (StEP) as implemented in this whole school model may be an effective tool to improve academic achievement; however, the results are likely cumulative and possible only realized in a significant way after repeated exposure to the program. This school district's implementation of StEP suggests that it can be used as a positive behavior support (PBS) program to aid academic outcomes. PBS programs have been shown to reduce teacher time on discipline, thus increasing instructional time and also improving the classroom environment for learning, teacher inputs to the educational production function. StEP also incentivizes student inputs to the educational production function, attendance, behavior, and class preparedness. More research is needed to determine the precise relationship between StEP as a PBS and the extent to which the teacher inputs interact with the student inputs for producing academic gains.

The results also suggest that the impact of the program may vary across teachers. This is reasonable as implementation likely differs across teachers. Additionally, teacher effects appear to be more relevant for the math exam, and in the fifth and sixth grades.

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