Spring 5-19-2017

Inentives and Education: Experimental Evidence from Medellin, Colombia

Theodore D. Wisinski
USF, twisinski5026@gmail.com

Alessandra Cassar
acassar@usfca.edu

Incentives and Education:

Experimental Evidence from Medellin, Colombia

Theodore Wisinski

Adviser: Alessandra Cassar

University of San Francisco

April 2017

Abstract

This research uses an experimental design to investigate how incentive structure influences goal achievement among disadvantaged high school students in Medellin, Colombia. Of particular interest is how treatment effects influence school performance as well as how this may vary with differing key characteristics of the participants. Medellin, Colombia, like much of South America suffers from high levels of inequality in the city proper. Improving educational outcomes in impoverished neighborhoods is essential for the growth of these neighborhoods and the greater community in which they are located. The model used in this experiment is inspired by the Family Independence Initiative (FII). This research finds that conditional incentives in particular play a significant role in determining the achievement of objectives and that those participants in the conditional incentive treatment tend to perform better after the conclusion of the experiment.

1. Introduction

Medellin and Colombia have greatly improved overall welfare measures in recent decades. While Medellin has made great strides in innovation and industry, Colombia's second largest city still suffers from high inequality. The percentage of the population who categorize themselves among the poor has risen in recent years from 12% in 2011 to 19% in 2014 (Medellin Como Vamos, 2014). A large portion of the population remain employed only in the informal sector. The vast majority of the poor reside in smaller neighborhoods within several of the city's 16 communes, many of which with significantly impoverished conditions.

A key determinant of future earnings potential is educational attainment. UNICEF educational statistics estimate overall participation rates for secondary school age children in Colombia to be in the mid-70th percentile. In Colombia, where children are required to complete a 9th grade level, attendance is relatively high for most until the age of 13 when it begins to decline. As children get older, the attendance rate falls from the mid 90's to the lower 80's for 17 year olds (Barrera-Osorio et al. 2011). This estimate is somewhat lower for males and children from poorer communities. This trend is further exacerbated when looking at enrollment and completion for schooling beyond 9th grade. According to information compiled from 2010 Demographic and Health Survey data, upper secondary school completion (10th and 11th grade) is lower than 50% for the population aged 15 to 24 (FHI360, 2017).

The Family Independence Initiative was introduced originally in the United States as an approach that combines goal setting, incentive schedules, and self-help groups to empower families with the means to lift themselves out of poverty. It has shown remarkable results at the community level and it has been replicated across numerous cities. The initiative is built on the principle that individuals can escape poverty by changing their decision making and attitudes, along with accumulating social capital through community interdependence (O'Brien & Stuhldreher, 2011). Furthermore, the success of the model has led to research on its functioning in a scientific matter through a field experiment in Medellin, Colombia (Aguinaga et. al., 2016).

The aforementioned 2013 experiment studies the effects of the FII model (self-alleviation of poverty) in a developing atmosphere (Aguinaga et. al., 2016). The field experiment focused on the business performance and social capital of small business owners that were involved with a micro financial institution (MFI) in Medellin, Colombia. The study finds that the combination of

goals, self-help groups, and an incentive backed reward system for goal achievement provide a significant platform for increasing business performance. This research uses the 2013 study as a template while delving specifically into how incentive effects can be revealed in 9th grade students in schools in disadvantaged neighborhoods. Treatment participants select goals targeted at improving educational performance and attendance in schools, both of which have particular difficulty in maintaining high standards in these areas.

The design of the project consists of developing five different treatments among the selected schools each emphasizing goal-setting, self-help groups, incentives, as well as a combination of these (the FII model) and a pure control group. The schools were chosen based on several criteria: located in Medellin within the greater state of Antioquia, Colombia, enrolling an overwhelming majority of students in the lower three economic strata of seven, and having similar classroom sizes and learning environments. The nature of the project is to implement, among the different treatment groups, a number of sessions where students are required to select a goal for themselves to adhere to or complete within the next two weeks.

The Millennium Development Goals contributed dramatically to the introduction of research into new incentive structures as a way of increasing educational performance in still developing nations. Direct cash transfers have become increasingly popular, especially in Latin America, at reducing poverty through an income supplement while simultaneously seeking to lower the opportunity cost of education for low income families. Oportunidades (now Prospera and formerly Progresa) in Mexico and Familias en Accion in Colombia are two such programs. The inherent trouble in measuring the effects of conditional cash transfers (CCTs) is that they are intrinsically intertwined on the desired outcomes themselves. This makes capturing the effect challenging if the conditions were not enforced.

In this research, with the cooperation of the Antioquia Secretary of Education and the Medellin City Hall, we explore whether incentives add to the achievement level of a list of education based goals and whether our incentive structure and subsequent objective achievement can be associated with higher educational performance. The results indicate that conditional incentive structures have the capability of increasing the likelihood of objective achievement by over six times. Furthermore, achievement conditional incentive structures return significantly positive effects on post-experiment grades relative to those program participants with no conditional incentive component.

2. Relevant Literature

Why Education?

The argument that future earnings potential relies on educational input as an acquired skill (not merely as a signal) has been well researched with varying conclusions as to its actual eminence. We can begin by referring to education as its more esoteric form: human capital. The basis for researching the inclusion of incentives to bolster the decision for further educational attainment stems from the theory of human capital accumulation and its subsequent connection to economic development as a whole.

Lucas (1987) provides a comprehensive starting platform which covers human capital theory as it stood in the late 20th century. Covered in Lucas' review is the amalgamation of breakthroughs by Shultz and Becker, Solow, Cobb and Douglas, Uzawa, and Romer. The consolidated result is the hypothesis that workers will contribute to production with their own labor dependent upon their own skill level. Furthermore, workers will invest in their own skill level based upon the opportunity cost of this investment and the potential returns. In turn, higher skilled workers will better add to the productive output of an economy overall, as well as increase the returns to the physical capital in a society.

Acemoglu and Angrist (2000) take this theory of external returns to human capital to the empirical table with several theoretical positions. At this point, there is little articulation on whether private (internal) or social (external) returns to human capital investment should be larger. If the educational attainment of an individual representing their human capital is implemented more as a means of job signaling, then social returns will be even lower than expected. On the other hand, the lower costs of firm investment due to a higher concentration of human capital in a geographic locale could lead to much higher social returns as well as private returns. Rough estimates for private returns to educational investment may be as high as 10%.

Level of Educational Investment:

In "Human Capital Policy," Carneiro and Heckman (2003) assert that individuals who invest first in human capital face higher costs. One might think of this as an additional amount of social benefits to human capital investment: the lower prices of *future* human capital

investment. While the empirical results testing the social returns to human capital investment tend to be modest, they are most often found to be significantly positive. These higher initial costs are reflective of the barriers to higher education often faced by those in developing countries. These barriers take many forms including discounting returns to education, higher envisioned opportunity costs of not working, and lack of access to collateral or credit for higher education investment.

Investigating the low adoption of further human capital investment reveals inconsistent discounting of the present value of future returns to additional schooling, again more likely occurring with students in lower and middle income countries. Many randomized control trials (RCTs) analyzing incentivizing students to increase their consumption of schooling focus on researching how offsetting these costs through scholarships, unconditional transfers, or conditional transfers is likely to increase enrollment. Angrist and Lavy (2002) draw such conclusions from one empirical study on an experiment conducted in Israel on high school matriculation. They also make connections between further barriers to educational investment; many students often face liquidity constraints that may hamper their desired level of educational investment.

Card and Lemieux (2001) also evaluate this theory. Students who are more financially constrained, or are born when there are higher interest rates on borrowing for tuition, face higher costs of schooling. These findings contribute to the perception that investment, and consequently attainment of education, may be very undervalued and quite below a sub-optimal level for societal growth in the long run.

On Incentives:

While increased human capital investment provides the objective half of the experiment, incentivizing this desirable outcome is its counterpart. The question remains, do incentives work? As in many instances of economic debate, the answer is it depends. Alfie Kohn (1993) contributes several theoretical views as to why rewards, as a tool for motivating output (particularly in the workplace), are prone to failure. He argues that while they often elicit increases in objective completion, these results are likely transitory and will disappear as soon as the reward is removed. This pathway to negative effects is what Benabou and Tirole, in "Intrinsic and Extrinsic Motivation," describe as dissonance theory. Dissonance theorists believe that

rewards act as a form of negative reinforcement, especially in the long run (2000). On the other hand, empirical studies often find that, given the nature of the incentive and the conditions of the environment, incentivizing behavior has the capability of eliciting lasting salience in subjects (see next section).

The consensus on incentives is that they can show certain results, depending on what the intended results may be. If the results are short-term accomplishments that make further investment in socially and privately beneficial human capital more probable, then they make a strong case for intervention and possible government policy support.

Intervention Methods and Incentive Structure:

Connecting the way in which incentives are believed to work in the realm of educational outcomes has become slightly more complex than simply offering financial rewards contingent on enrollment in recent years. Although conditional transfers often have the desired effect of increased enrollment (PROGRESA, PANES), perhaps more precise avenues exist which lower the costs associated with implementation by organizations and governments. A main connection that arises in most of the recent literature is the argument that educational performance is a strong indication of educational attainment in the present as well as the likelihood of the decision to further invest in education in the future. Research on student preferences suggests that as students become older, rewards outside of verbal praise for work well done becomes much more desirable (Fefer et. al. 2016).

Attempting to achieve an overall complex outcome over a length of time may prove more difficult for people in general. Rather, more specific tasks that contribute to acquiring the capability to complete the long-term objective prove more effective (Seijts & Latham, 2001). Concerning how best to approach incentive conditionalities for students, Roland Fryer (2010) in "Financial Incentives and Student Achievement", presents evidence that having rewards based on student inputs such as number of books read, attendance, homework completion, and so on bear higher success in improving outcomes than having rewards based on the outcomes themselves. Fryer's theory suggests that students are likely uncertain of their own production function and would benefit from further small scale incentives to bolster their overall school performance which may lead to greater returns in the long run.

While certain social and environmental characteristics can have an impact on students' ability to complete goals (Anderman & Anderman, 1999), past research also supports the idea that increasing performance at a crucial point in the educational career of high school students can still contribute to graduation rates despite preexisting characteristics (Neild et. al., 2008). Therefore, creating a program design focused on having subjects setting smaller objectives repeatedly at such a critical point in time may well contribute to a better educational outcome.

In "The Effect of Performance Based Incentives on Educational Achievement: Evidence from a Randomized Experiment," Levitt, List, and Sadoff propose significant theoretical contributions in its experimental framework (2016). The authors assert that perhaps varying the incentive structure as either fixed rate or lottery may result in one having a more pronounced effect than the other. A second main variation on the model is that the recipient of the incentive matters. The authors postulate that there is an interplay between the effort of both parents and students in achieving certain educational outcomes, and that the merit that each will receive and how transfers are allocated within a family may contribute to the effect the financial incentives have on educational performance. Evidence would suggest that neither of these variations provide differing results within their experiment. This result along with the additional costs associated with this model specification influenced the decision to exclude these factors from the treatment design.

Exploration in the joining of incentives and educational attainment further expands again from Levitt, List, Sadoff, as well from Neckermann. Their results indicate that non-monetary rewards are not as effective as monetary rewards for older students but that in younger cohorts, non-monetary rewards are similarly significant and much cheaper from an implementation perspective. Furthermore, their finding that if rewards are delayed upon completion of the objective, the significance of the incentive on outcomes becomes insignificant. They imply that this result follows the theory that inconsistent and large discounting occurs for students and adolescents in general.

In the Family Independence Initiative, incentives were structured so that families are rewarded for completing any of roughly 50 different financial, social, and education based goals. A key component of this method was that families were able to choose which goals to set for themselves, eliminating a more stringent, restricting pathway to accomplishment (O'Brien & Stuhldreher, 2011). The average increase in income across all demographics was 27% in the

Oakland, California implementation of the FII. The incentive methodology of the FII compliments the findings of Fryer, and it utilizes incentives on inputs as a means to elicit better performance in students, a keystone of the experimental design for which this paper discusses.

3. Experimental Design & Subject Pool:

3.1 Overview

The experiment took place in Medellin, Colombia in the Antioquia province. Seven schools were selected based on similar demographic characteristics, particularly on the economic strata of the enrolled students. Majority of students in all schools fall within strata one and two. Strata range is from zero to six, the higher numbers indicating better economic conditions (Office of the Secretary of Education, Antioquia).

Ninth Grade students were chosen as participants for the study due to the structure of the Colombian education system. Ninth grade (14-17 year olds) is the final year of schooling for the lower secondary level and marks a significant chapter in future education investment. It is also the level for which both attendance rates decrease and matriculation begins to dwindle. Participants would meet with the program implementation team once every two weeks consisting of a baseline survey, five goal setting and follow up survey sessions, and finally several post experiment survey sessions for a total of eight sessions over a two and a half month period.

3.2 Schools

Of the seven schools that were selected, five schools had a single class of ninth graders, one school had two classrooms and the final school had three classrooms of ninth graders. The relatively small amount of ninth grade students per school allowed the inclusion of all eligible children and contributed to the school selection process. A map displaying the location and commune of the institutions within Medellin is available in the Appendix.

Randomization of treatment assignment is done at the classroom level. Classroom level randomization was chosen due to probable spillover between treatments if implemented at the individual level, logistical constraints, and impartiality concerns to the students. In addition, increasing the educational performance of students through incentive introduction proves more effectual when applied to larger, consistent groups (Angrist and Lavy, 2002). Fortuitously, students remained with their respective class cohort throughout their day schedule, minimizing

interaction between the groups in the schools with other classes assigned to a different treatment or control arm. The only remaining stipulation on treatment randomization is not allowing both a Prize and No Prize treatment classroom within the same school. This is purely to maintain fair treatment across all program participants. A chart displaying classrooms' (within each school) assignment to treatment is included in the Appendix.

3.3 Treatments

The experimental design is focused on isolating different treatment effects on objective achievement and post implementation educational performance of the participant groups. Figure 1 describes the different treatment assignments. The column and row headings reflect the components of the aforementioned Family Independence Initiative study.

SHG, or Self-Help Group, refers to the students required to engage in a group style interaction about their selected goals with their peers. More specifically, students share their previous session goal selection and the difficulty or ease with which it was or was not completed. The completion or incompletion of the student's objective was then made known to the entire classroom. This interaction serves as a form of positively framed peer pressure as well as a channel of shared accomplishment.

The Prize row indicates that the receipt of a non-transferrable incentive was awarded conditional on objective completion. The No Prize row participants are given transfer regardless. These two contingencies form a divide between a fully conditional transfer and an unconditional, yet framed transfer. This unconditional transfer differs from being truly unconditional in that it is offered within a school environment in an education based study. The nature of the incentive, forthcoming, also plays into the framing of the unconditional incentive.

The four separate treatment groups within the lower right of the design matrix are all goal-setting treatment groups. Participants that fall into the cell with both Prize and SHG (Treatment V) are the corollary of the FII treatment. The top left cell in the matrix without Prize or SHG creates a form of control group for with which to compare the separate FII inspired components present in the other arms. In addition to these four groups, another control arm was also formed where participants do not set goals, yet receive the transfer nevertheless. All partitions of the experiment, including the control, were given a survey each session with questions as to whether they had completed activities equivalent to the list of goals from which the treatment groups would select.

3.4 Goals

All the possible goals were designed with assistance of the teachers and administrators of the selected schools to be comparable to one another in terms of difficulty while simultaneously aiming to improve problematic performance arenas. A complete list of these objectives can be found in the appendix. Subjects in the four goal-setting arms of the experiment would select a task to be attempted in the two weeks between sessions. Some goals involving a specific, essay related task were only available once, other more general objectives were available for selection repeatedly. One trademark limitation of the goal design was ensuring that the completion of each of the objectives was easily monitored. This is especially valid for the Prize Treatment participants, as they would only receive the incentive upon goal completion.

3.5 The Incentive

The incentive or transfer for this research required a design of its own. In order to ensure that students that received a form of payment were the ones who would benefit, the payment needed to be non-transferrable. This stipulation, as well as other ethical concerns eliminated cash as an option for the program. School administrators suggested a voucher payment that could be redeemed at a school store which provided food and beverages for the students. Every school had one of these tiendas and the vouchers themselves were able to be printed with the recipient's name and Institution on it. Store operators were notified of the number of vouchers that each student received each session so that copies would be refuted.

Each voucher was good for 2,000 COP and 6 of these vouchers were given to students in all of the experiment partitions every session totaling 12,000 COP. For this amount students could obtain several empanadas, bags of chips and sodas. It is roughly equivalent to what $10 USD could buy at a snack store in a United States high school. The enthusiasm at each of the school's when this incentive was announced was clearly palpable. Participants in the treatments conditional on goal completion would receive zero vouchers if their selected objective was not completed. All participants were awarded 4,000 COP for completing the baseline survey. This also served as a means of instilling trust of the payment of promised future transfers and the validity of the vouchers themselves.

3.6 Subject Pool

Total participants with available data are 363. Mean and standard deviation statistics on key characteristics for subjects in the experiment and by treatment group are available in the Appendix. The random assignment at classroom level resulted in a slightly larger control group than any of the treatment arms. Subjects across all treatments were around the age of 15 with only the control group being slightly younger than 15 on average. All treatment arms contained between 40% to 50% female enrollment. All groups reported that, on average, their households were slightly female dominated and had just over 2 school age children per household. Those who only set goals for the experiment with no additional conditions were more likely to report having missed meals in a week. The grading scale in Colombia is from 1 to 5. Lowest Reported Grade and Base Esteem, both on a scale of 1 to 5 were comparable between groups. Lowest Reported Grade represents their worst received grade in the participant's currently enrolled subjects. The Base Esteem represents the average of a combination of 5 different self-esteem oriented questions delivered on the baseline surveys. In summary, the different treatment groups and control are largely indistinguishable on most observable characteristics, as a whole.

4. Model and Hypothesis:

In developing the experiment, the goal was to allow separate analysis of how assignment to different treatment groups that utilize group interaction, conditional incentives, or both may benefit or deter goal achievement and bolster educational output. This research is aimed specifically at evaluating the effect of the conditional incentive aspect and how it pertains to goal achievement and subsequently educational performance.

Model 1:

$$Achievement_{it} = \alpha + \beta_2 Incentive_i + \beta_1 SHG_i + \beta_3 SHG*Incentive + \beta_4 Grades_{iq} + \beta_5 MealsMissed_i + \gamma X_i + \varepsilon_i$$

Where the left hand side variable Achievement represents whether an individual achieved their objective in session t. SHG, Incentive, and SHG*Incentive refer to whether an individual is assigned to the group interaction, receive an incentive only upon completion of their selected objective, or a combination of both of these, respectively. Grades represents an individual's grade average prior to the program implementation (quarters one and two) that is used as a measure of the level of school performance. Meals Missed is a representation of how many meals (less than

3 per day) an individual reported to have missed in a week due to finances. While all participants are in the lower economic strata, this measure provides a more varying, current estimation of how dire their state actually may be. X is a vector of individual covariates that are likely to have some significant contribution to goal achievement. Included are the difficulty of the selected objective (as reported by the students themselves at baseline) Age, Gender, and Self-Esteem estimates. In this model treatment recipients are compared to the control group comprised of individuals who set goals but do not receive additional treatment specification.

Hypothesis 1:

The expectation is that incentives will have a positive effect on an individual's estimated probability of goal achievement. Furthermore, the FII treatment is expected to be the most effective of the treatments in increasing the likelihood of goal achievement. A significant β_3 on the interaction term would indicate that those individuals with both group interactions and conditional incentives fare better at achieving set objectives compared to those with only one or the other. The better performing students pre-implementation are expected to be more likely to achieve their objectives while those which suffer from worse economic conditions will be less likely to be able to reach achievement status for their selected objectives. Subsequent analysis is also conducted on how these variables contribute to post experiment grades or educational output

Model 2:

$$\boldsymbol{PostGrades_{iq} = \alpha + \beta_2 Incentive_i + \beta_1 SHG_i + \beta_3 SHG*Incentive + \beta_4 Grades_{iq} + \beta_5 MealsMissed_i + \gamma X_i + \varepsilon_i}$$

Similar analysis of variables from Model 1, now using post experiment quarter grade data as the dependent variable. In Model 2, treatment individuals are not only compared to those who set objectives but to the pure control group which received the school vouchers without setting goals.

Hypothesis 2:

Conditional incentives will prove to have a positive effect on post program grade average. The overall effect for the group and conditional incentive interaction will be positive as well.

5. Results

5.1 Model 1 Estimation

A logit estimation with robust standard errors is chosen to analyze the relationships between the different components of the treatment design and the probability of having achieved the selected goal. Table 2 displays the output. Both Incentives and Self-Help Groups add significant probability to goal completion in all specifications relative to the group who selected goals alone. Conditional incentives in the full model specification (5) return a coefficient of 1.827, significant at the 1% level. If we imagine all other variables non-changing, the resulting odds ratio can be translated as being over six times more likely at having achieved the selected objective if assigned into a treatment arm with the conditional incentive component.

While these effects follow the expectations of the experiment, the Self-Help Group and Incentive components offer no additional marginal effect when combined with one another within the implementation of this experiment. In fact, in the most basic specification of the model with no other variables of interest or controls other than the treatment components, the interaction coefficient indicates a poorer performance than SHG or Incentive components alone. This coefficient becomes insignificant in more inclusive specifications.

When comparing the experimental components in terms of the treatment groups for which they comprise, estimation output becomes more difficult to analyze. A much cleaner visualization of the relationship between the treatment arms and average goal achievement is provided by Figure 3 in the Appendix. This graph tells the same story as the estimation output from Table 2, but from a new vantage point. The treatments with conditional incentives and conditional incentive plus SHG clearly have the highest average achievement at above 70%. The largely overlapping standard error bars on these two measures confirm the insignificant additional effect of the interaction term in the Table 2 estimation. Comparatively, the average achievement for those in the purely goal-setting group is right around 30%.

Of additional interest is how the covariates attached to the Table 2 logit estimation correlate with goal achievement. Age is found to be a consistently insignificant factor for objective achievement. This may be a sign that the incentive structure, or the experiment as a whole could be implemented for different educational age groupings and still prove effective at

eliciting a response. It is one avenue in which further research is required. Additionally, females exhibit a greater proclivity for objective achievement on average in all specifications across all treatments.

Two independent variables of particular interest in these specifications are Grade and Meals Missed. During the baseline survey, students were asked several questions about their household; among them how many meals, if any, they missed in a given week due to financial reasons and whether they felt they were very poor, poor, getting by okay, or rich. The majority of students reported that they were getting by okay despite likelihood of the opposite. As stated previously, the participant schools' strong majority of students come from the lowest economic strata partitions. The reported number of missed meals may provide a more immediate evaluation of their economic hardship. Notably, students that reported to have missed more meals had lower probability of achieving their objective. The marginal effect at the mean of the attached coefficients implies a roughly 3% decrease in goal achievement at the mean due to missing a meal, with many students reporting up to seven missed meals in a given week.

In this research, we use Grade as a representation of overall school performance. This value is calculated for each student as the average of each quarter grade. The quarter grades are also an average calculated from the scores each student earned in ten separate courses in a given quarter. These courses are part of the curriculum at all participating schools and thus offer comparability and consistency across schools. In the Table 2 estimates, we find a positive coefficient on Grade. Analyzing the marginal effects of these logit estimates, we find a roughly 20 percentage point increased likelihood of objective completion at the mean when grade reported is one unit higher. The inclusion of this measure not only permits exploration of the link between achievement and existing level of performance, but is an important control to better estimate the treatment components. To add perspective, the grading scale is from zero to five and the average grade across all participants (Table 1) is 3.46. Specification 5 was retested individually for each treatment group and the significance and direction are maintained in the coefficient for every single iteration. This result is further explored in Figure 4 in the Appendix.

It is noteworthy that in Table 2 specification (5) both the calculated Average Base Esteem and Difficulty of Selection are insignificant determinants of goal achievement. A test to see if these variables still added to the model significance was performed with a negative result. The insignificance of the Difficulty of Selection is of utmost importance as the possible goals were

drawn out to be comparable in difficulty. With moderate variation in goal selection, this can be inferred as resulting objective achievement is not due to students simply selecting easier tasks. After the first meeting for each school, one goal was removed from the list for future selection as it was deemed much too easy relative to the rest.

Figure 4 is a modified, more specific version of Figure 3. The graph continues to display average achievement levels by treatment group, but adds a performance dimension as well. Treatment groups are broken into two categories: passing average or failing average. A student falls into the passing category if the average of all their quarter grades for the school year equals or exceeds a 3.0, and failing otherwise. The goals and SHG arm, while inclusive of students failing specific subjects, had no participants with less than a 3.0 average overall. This graph contributes to the significant findings in that we still see a significantly different and positive effect of the conditional incentives not only on well-performing students, but those who appear to be struggling as well.

5.2 Estimation of Model 2.

Data pertaining to the performance of individuals after the experiment commenced was provided courtesy of the Office of the Secretary of Education of Antioquia and was utilized in the following manner.

Creation of a new panel type dataset was implemented by combining the personal characteristics survey from the experiment itself and the quarterly grades of individual students. As the experiment was implemented at the beginning of the third quarter, the periods for evaluation are only the third and final quarters. An OLS estimation was conducted on model 2 with the quarter grades as the dependent variable and the conditional incentive, SHG, and interaction of these two as the main variables of interest. The model contains the same control variables as the logit estimation from model 1 with the addition of student's average grade before the project implementation. This accounts for students that were already performing well before the project. The output is displayed in Table 3 in the Appendix. Resulting errors are robust to heteroscedasticity.

The presence of the conditional incentive proves significant and positive throughout the various specifications in Table 3 on student grades. The fully specified model coefficient of .033 is significant at the 10%. This coefficient is interpreted as a roughly 1% increase to grades

(considering an average of 3.46 across all subjects). While this effect estimate cannot be readily described as huge, its potential as an educational tool for further incentive design flaunts abundant potential.

An auxiliary regression was estimated with average achievement in place of the experimental components SHG and Incentive. The result was positive and significant in all instances with a coefficient of around .1. The interpretation is that an increase in average achievement rate by .1 can be associated with a .01 increase in grade average In further investigating how school performance may be tied to goal achievement, a non-parametric estimation is conducted. The idea that students are not just divided between those who do well and those who do not, but more realistically lie on a spectrum of performance measures is obvious. These various levels of performance may lead to inconsistencies in the relationship between school performance and goal achievement, and indicates that a logistical or OLS estimation may not reveal underlying relationships.

A Cleveland, or running line least squares estimation indicate a somewhat linear relationship between average achievement and grades even when partitioned into different treatment groups. Looking toward Figure 5, we see that each treatment group shows a slightly positive and relatively steady relationship between third and fourth quarter grades and average achievement rates.. The plausible exception is the goals only treatment section that shows a lull in this positive relationship in the middle range of achievement. These localized results indicate that at exemplary levels of achievement, students tend to have an average grade of around 4.0 compared to males. Through the more modest achievement rates this relationship shows little change. If goal achievement has a similar relationship with grades, regardless of treatment group, then the obvious choice for treatment should be the one that produces the highest achievement average at the lowest cost.

5.3 Comparing Treatment and Control

In order to argue that it is in fact the combination of goal selection as well as the treatments that contribute to students' achievement, comparisons must be made between those assigned to control versus treatment. A student engaging in selection and attempting completion of an objective cannot be directly compared to a "non-selecting" peer selecting and achieving an objective. So, this analysis required a different approach with respect to the control group. The investigation required all students, every two weeks, to answer whether or not they

had completed tasks equivalent to each one of the objectives regardless of whether they were in treatment or control classrooms.

Combining these survey results with the data describing which goals were selected from by individuals in treatment groups the treated become comparable with the control. A series of logit specifications were run estimating whether individuals answered yes or no to each of these activity questions that correspond to the goals. Table 3 displays these results. The second goal in the experiment had two survey questions that pertained to its completion and so has two was combined into an interaction that would only turn on if both questions were answered in the affirmative. The row labeled "Selected Dependent Variable as Goal" is a binary that is one if an individual selected whatever goal's completion is being estimated in that specific column. We would expect them all to be positive and significant.

Only Selection of Goal 3 lacks positivity in the probability estimation of answering yes to having completed Goal 3. An encompassing translation of these results are that, save for Goal 3 (listed in the appendix), a student in one of the goal selection groups has a higher likelihood of completing a specific goal when selecting it, relative to the control group. . Participants in the control group were still compensated for their participation and, being the only ones not actually checked for completion of objectives, may be more likely to confirm having accomplished an academically positive task. If this is the case, the confirming results of this table may even be somewhat under representative.

6. Conclusion

The framework of the Family Independence Initiative focused on harnessing the power of communities and its members' innate ability to allow people to lift themselves out of poverty. Inspired by the research of Aguinaga et. al.'s work with analyzing the component effects of the FII among entrepreneurs, this research focused on exploring how the FII's unique approach to poverty alleviation could fare in an education centric design. Explicit focus of this contribution is to analyze how incentive structures play into the achievement of educational objectives and what implications these structures have on overall educational performance. Here are the main conclusions:

1) **Students respond to conditional incentives.** The experiment effectively consisted of a purely unconditional transfer, an educationally framed transfer, and

a fully conditional incentive. The conditional form of the incentive fared the best in terms of eliciting objective achievement.

2) **Incentives are effective for many students.** While top performing students tend to have the higher goal achievement rates on average, the above results remain robust across student grades. This is a promising result in that it implies that incentives can elicit positive responses from many different kinds of students.

3) **Incentives and achievement of educational input objectives can improve student performance.** Participants receiving the conditional incentive component of the experiment saw a significant, albeit slight, improvement on grades. This significant result shows promise for future incentive and objective setting research with regards to improving educational performance.

Research is to be conducted on the effects of the program's implementation on school attendance in the near future. The findings of the analysis in this paper highlight probable conduits for increasing educational performance in a developing atmosphere.

References

Aguinaga, P., Cassar, A., Graham, J., Skora, L., & Wydick, B (2016). Raising Achievement Among Microentrepreneurs: An Experimental Test of Goals, Incentives, and Support Groups in Medellin, Colombia. University of San Francisco, CA.

Anderman, L. H., & Anderman, E. M. (1999). Social predictors of changes in students' achievement goal orientations. Contemporary Educational Psychology, 24(1), 21-37.

Angrist, J. D., & Lavy, V. (2002). *The effect of high school matriculation awards: Evidence from randomized trials* (No. w9389). National Bureau of Economic Research.

Barrera-Osorio, F., Bertrand, M., Linden, L. L., & Perez-Calle, F. (2011). Improving the design of conditional transfer programs: Evidence from a randomized education experiment in Colombia. American Economic Journal: Applied Economics, 167-195.

Card, D., & Lemieux, T. (2001). Dropout and enrollment trends in the postwar period: What went wrong in the 1970s?. In *Risky behavior among youths: An economic analysis* (pp. 439-482). University of Chicago Press.

Fefer, S., DeMagistris, J., & Shuttleton, C. (2016). Assessing adolescent praise and reward preferences for academic behavior. Translational Issues in Psychological Science, 2, 153–162. http://dx.doi.org/10.1037/tps0000072

FHI360. (2017, April 12). *Colombia National Education Profile* . Retrieved: Education and Policy Data Center: www.epdc.org/sites/default/files/documents/EPDC%20NEP_ Colombia.pdf

Fryer Jr, R. G. (2010). Financial incentives and student achievement: Evidence from randomized trials (No. w15898). National Bureau of Economic Research.

Moher, C. A., Gould, D. D., Hegg, E. and Mahoney, A. M. (2008), Non-generalized and generalized conditioned reinforcers: establishment and validation. Behav. Intervent., 23: 13–38. doi:10.1002/bin.253

Neild, R. C., Stoner-Eby, S., & Furstenberg, F. (2008). Connecting entrance and departure: The transition to ninth grade and high school dropout. *Education and Urban Society*, *40*(5), 543-569.

O'Brien, R., & Stuhldreher, A. (2011, February). FII Publications. Retrieved from Family Independence Initiative: https://www.fii.org/updates-inspiration/publications

Seijts, G. H., & Latham, G. P. (2001). The effect of distal learning, outcome, and proximal goals on a moderately complex task. Journal of Organizational Behavior, *22*(3), 291-307.

UNICEF 70 Years For Every Child. (2013). [Table Data Concerning Educational Facts May 12, 2016].*State of the World's Children Country Statistics*. Retrieved from http://www.unicef.org/infoby country/colombia_statistics.html#117

Appendix of Tables and Figures:

Schools:
1. I. E. Vallejuelos
2. J.H. Betancur
3. San Francisco de Asis
4. San Juan Bautista
5. Alvaro Marin Velasco
6. Honduras
7. Venezuela

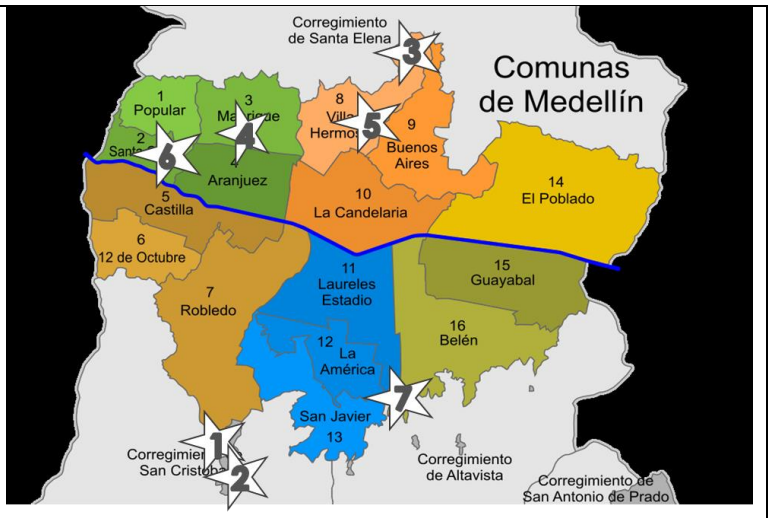

Figure 1: Schools. Location of the seven schools participating in the experiment within the communes of Medellin. Source of original map: Wikipedia. Used with licensed permission

Figure2: Experimental Design Matrix

Control Groups: *No Goals, No SHG, No Prizes* **Control Group (n=78)* *N=313*		**Self-Help Groups SHG (Social Capital)**	
		No SHG	**SHG**
Individual Incentives	**No Prizes**	***Treatment Group II*** **Goals, No SHG, No Prizes (n=59)**	***Treatment Group III*** **Goals, SHG, No Prizes (n=63)**
	Prizes	***Treatment Group IV*** **Goals, No SHG, Prizes (n=55)**	***Treatment Group V*** **Goals, SHG, Prizes (n=58)**

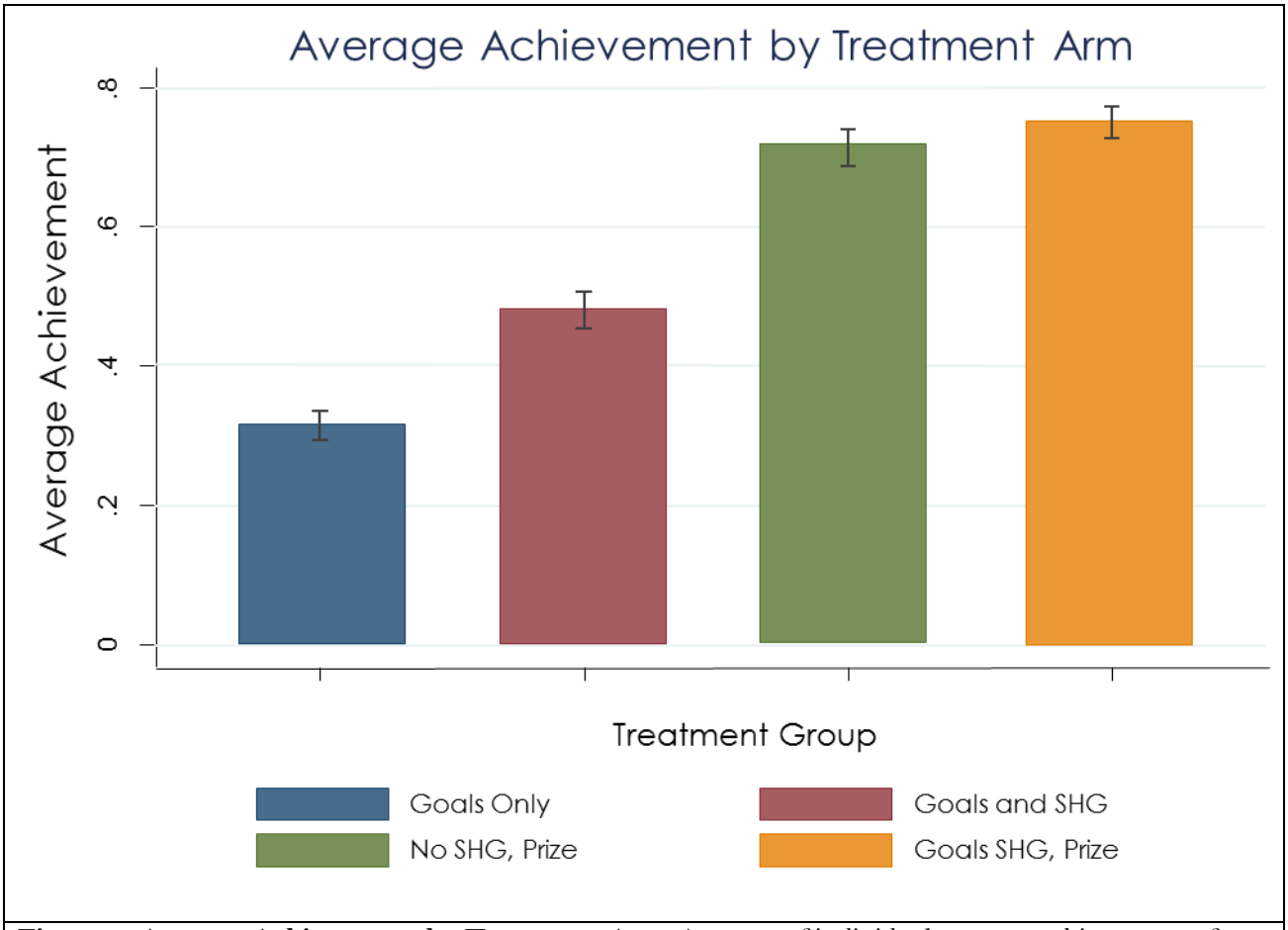

Figure 3: Average Achievement by Treatment Arm. Average of individual average achievement of selected objective by Treatment Group. Standard error bars are displayed.

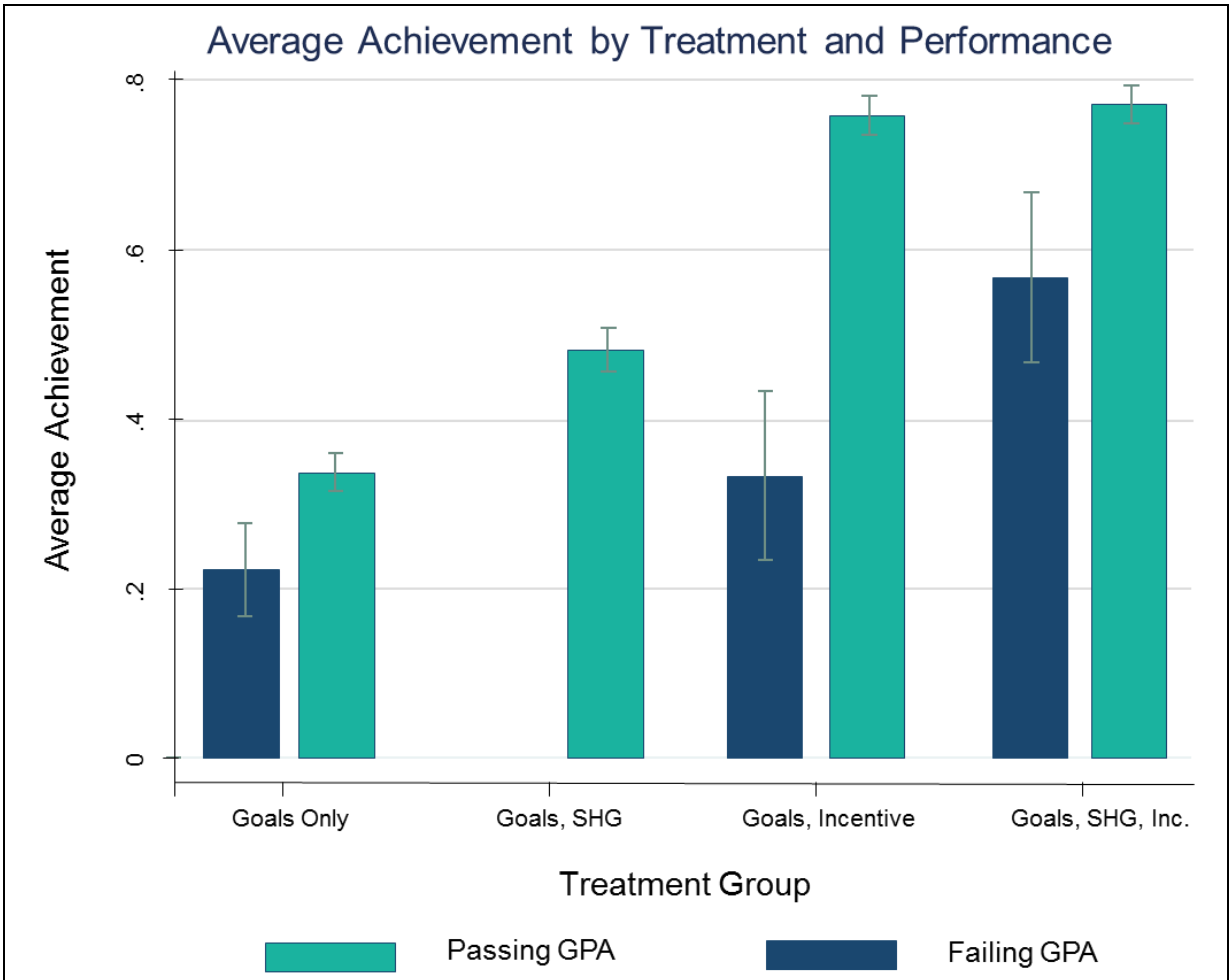

Figure 4: Average Achievement by Treatment & Performance. Average of individual average achievement of selected objective by Treatment Group and school performance. Passing GPA refers to those students with a 3.0 or higher out of 5.0 year average. Failing is below 3.0. Standard error bars are displayed. Goals, SHG treatment, had zero students with below a 3.0 AVERAGE grade, but did have several students with below a 3.0 in specific subjects.

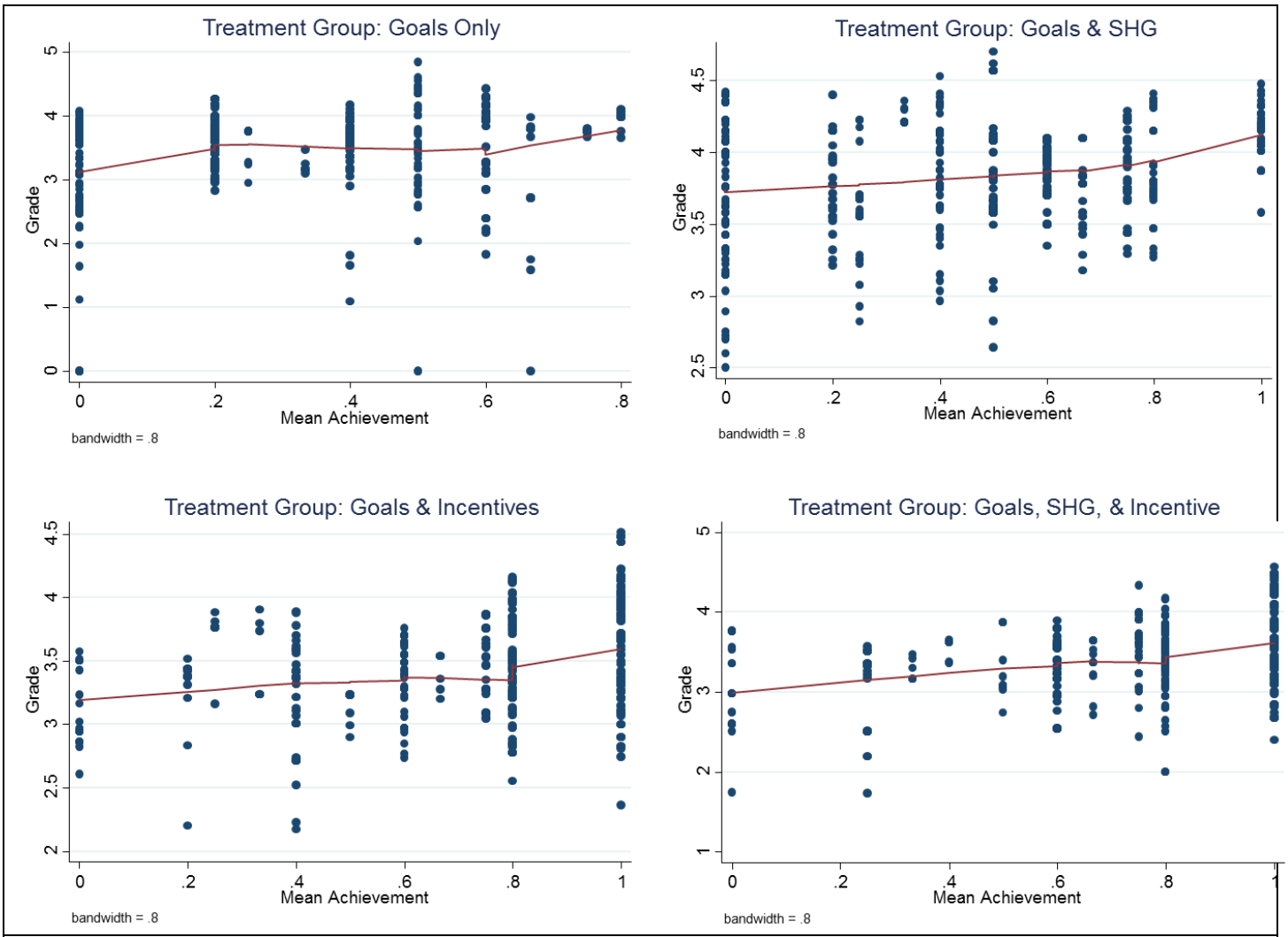

Figure 5: Non-Parametric Estimation of Grades. Independent variable is average achievement of the individual.. Graphical representation is broken down into 4 different treatment groups.

Table 1: Summary Statistics for Individuals Overall and by Treatment Group

	All	Control	Goals	SHG	Prize	Prize, SHG
Age	15.18	14.96	15.29	15.15	15.17	15.41
	(1.158)	(1.140)	(1.364)	(0.963)	(1.077)	(1.206)
Student Gender	0.49	0.50	0.50	0.55	0.47	0.42
	(0.501)	(0.503)	(0.504)	(0.502)	(0.504)	(0.498)
HH Size	4.86	4.81	5.00	4.53	4.97	5.50
	(1.904)	(1.790)	(2.098)	(1.793)	(1.946)	(2.121)
Percent Female	0.55	0.56	0.53	0.57	0.51	0.52
	(0.208)	(0.197)	(0.179)	(0.234)	(0.220)	(0.202)
HH Children	2.13	2.11	2.19	2.02	2.06	2.56
	(1.136)	(1.138)	(1.283)	(0.969)	(1.099)	(1.338)
Meals Missed	0.69	0.64	1.05	0.90	0.59	0.27
	(1.770)	(1.798)	(2.110)	(2.006)	(1.743)	(0.781)
Base Esteem	3.12	3.05	3.14	3.08	3.14	3.26
	(0.462)	(0.442)	(0.490)	(0.407)	(0.421)	(0.533)
Lowest Grade	2.64	2.69	2.68	2.70	2.61	2.48
	(0.826)	(0.625)	(0.786)	(0.913)	(0.850)	(1.012)
Avg. Grade	3.46	3.63	2.99	3.79	3.45	3.42
	(0.661)	(0.376)	(1.087)	(0.346)	(0.351)	(0.403)
N	363	80	79	74	66	64

mean coefficients; sd in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Logit Estimation of Achievement on Treatments and Covariates

VARIABLES	(1) Achieved	(2) Achieved	(3) Achieved	(4) Achieved	(5) Achieved
Incentive	1.720***	1.866***	1.890***	1.835***	1.827***
	(0.186)	(0.212)	(0.215)	(0.228)	(0.228)
SHG	0.777***	0.539***	0.536***	0.492**	0.465**
	(0.174)	(0.193)	(0.197)	(0.205)	(0.207)
SHG & Incentive	-0.544**	-0.384	-0.361	-0.296	-0.271
	(0.266)	(0.286)	(0.290)	(0.305)	(0.310)
Grade		1.053***	1.001***	1.021***	1.032***
		(0.201)	(0.226)	(0.245)	(0.249)
Meals Missed		-0.160***	-0.154***	-0.138***	-0.132***
		(0.0416)	(0.0416)	(0.0420)	(0.0426)
Age			0.0107	-0.00484	0.0125
			(0.0713)	(0.0755)	(0.0765)
Gender			0.526***	0.520***	0.499***
			(0.148)	(0.163)	(0.163)
Base Esteem				0.256	0.225
				(0.179)	(0.181)
Base Risk				-0.0195	-0.0255
				(0.0447)	(0.0451)
Goal Difficulty					-0.0943
					(0.117)
Constant	-0.742***	-4.359***	-4.618***	-5.129***	-5.153***
	(0.129)	(0.770)	(1.625)	(1.824)	(1.874)
Observations	1,102	1,002	987	900	885

Logit Estimation, Panel Data.

F (Wald- test) reveals Base Esteem, Base Risk and Goal Difficulty add no Significance to the Specification 5

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: OLS Estimation of 3rd and 4th Quarter Grades (Post-Implementation)

VARIABLES	(1) Grades	(2) Grades	(3) Grades	(4) Grades	(5) Grades
Incentive	0.0583***	0.0332**	0.0337**	0.0279*	0.0334**
	(0.0145)	(0.0151)	(0.0151)	(0.0158)	(0.0161)
SHG	0.00431	-0.0249**	-0.0196	-0.0265**	-0.0230*
	(0.0144)	(0.0120)	(0.0125)	(0.0129)	(0.0133)
SHG & Incentive	-0.0161	0.00103	0.00116	0.00699	0.00531
	(0.0199)	(0.0188)	(0.0191)	(0.0200)	(0.0201)
Meals Missed		0.00246	0.00255	0.00220	0.00207
		(0.00258)	(0.00258)	(0.00266)	(0.00264)
Age			-0.0154***	-0.0192***	-0.0190***
			(0.00535)	(0.00551)	(0.00552)
Gender			0.0289***	0.0230**	0.0233**
			(0.0104)	(0.0106)	(0.0107)
Base Esteem				-0.00850	-0.0120
				(0.0108)	(0.0110)
Base Risk				0.00189	0.00187
				(0.00343)	(0.00346)
Goal Difficulty					-0.0335**
					(0.0161)
1st Quarter Grades	1.008***	1.005***	0.984***	0.988***	0.989***
	(0.0103)	(0.0192)	(0.0198)	(0.0213)	(0.0215)
Constant	-0.0907**	-0.0434	0.246**	0.313**	0.357***
	(0.0403)	(0.0761)	(0.121)	(0.130)	(0.132)
Observations	2,904	2,408	2,368	2,192	2,177
R-squared	0.918	0.743	0.743	0.743	0.744

OLS Estimation, Panel Type Data.

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Logit Estimation of Follow-Up Survey Pertaining to Goal Completion, All Individuals

VARIABLES	(1) Goal 1	(2) Goal 2	(3) Goal 3	(4) Goal 4	(5) Goal 5	(6) Goal 6	(7) Goal 7
Dep. Var. as Goal	1.372***	-0.865***	1.035***	2.215***	1.410***	1.991***	2.635***
	(0.230)	(0.321)	(0.299)	(0.237)	(0.247)	(0.227)	(0.300)
Age	-0.0102	0.348***	-0.0751*	0.0464	0.137***	-0.0388	0.0228
	(0.0410)	(0.0784)	(0.0400)	(0.0468)	(0.0399)	(0.0483)	(0.0522)
Gender	-0.158*	0.189	-0.162*	-0.129	-0.323***	-0.280***	-0.313***
	(0.0878)	(0.187)	(0.0870)	(0.101)	(0.0859)	(0.104)	(0.113)
Meals Missed	-0.0182	0.00685	0.00742	0.0380	-0.00671	0.0418	-0.00885
	(0.0245)	(0.0515)	(0.0239)	(0.0267)	(0.0237)	(0.0270)	(0.0316)
Grade	0.523***	-0.141	0.787***	0.159	0.521***	0.0836	0.253**
	(0.101)	(0.189)	(0.0992)	(0.112)	(0.0967)	(0.114)	(0.127)
Constant	-2.156***	-7.703***	-1.312	-2.512***	-4.010***	-0.959	-2.718***
	(0.826)	(1.610)	(0.804)	(0.938)	(0.802)	(0.960)	(1.052)
Observations	2,368	2,368	2,368	2,368	2,368	2,368	2,368

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

1.	For the next two weeks, search for information pertaining to technical or professional careers that you would like to study when you are finished with school
2.	Over the next two weeks, do not miss school and arrive to school before classes begin
3.	Over the next two weeks achieve a score of at least 3.5 on a graded assignment in your weakest subject
4.	Over the next two weeks, search for information pertaining to the risks involved with engaging in unprotected sexual relations and possible transmission of STDs and write full page essay of your findings
5.	Over the next two weeks, actively participate in at least four different classes
6.	Over the next two weeks, search for information pertaining to the inherent risks involved with taking illicit drugs and write a full page essay on your findings.
7.	Over the next two weeks, search for information pertaining to the Saber Test that you will be taking in October and write a full page essay on your findings
8.	Over the next two weeks do not get written up or receive any disciplinary actions

Table 5: List of Goals. Objective list from which students would select to attempt for a two week interval. Numbers 4, 6, and 7 were non-repeatable. Goal 8 was removed from the list after the first session due to the likelihood it was too easily accomplished.