STUDENT EFFICIENCY: A STUDY ON THE BEHAVIOR AND PRODUCTIVE EFFICIENCY OF COLLEGE STUDENTS AND THE DETERMINANTS OF GPA

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The importance of a college education in the job market has burgeoned in an economy, which has become more and more dependent on information and information literate individuals. Employers and graduate schools alike look at future employees' education record as a tool of measuring academic achievement, work habits and competency in a particular field. A college transcript is often the most influential document future employers have to judge potential employees by. Grade point average (GPA) is supposed to be an accurate reflection of student's overall college career and proficiency in the courses and material taught at college. Naturally a college GPA can be of utmost importance to an undergraduate's future earnings.
Ethel Jones positively correlates GPA to its direct affects on post-graduate income (Jones 1990). The determinants of a student's GPA are therefore key to their future employment, earnings and lifestyle.

However, *GPA*s are not always a student's first priority and higher learning institutions, as well as the professors that teach at those institutions, do not feel it is their job to simply give out high grade point averages. Most colleges and universities see it as their goal to teach and facilitate new ways of thinking. Grades are often not their first priority. "Professors say that too many of their students are too focused on grades rather than on learning" (Jones 1990). Jeffery Young (2002) had similar findings: "Students… are concerned with college as a means to an end—getting into a good graduate school or getting a good job" (5). Furthermore the same study indicated that teachers testified that students calculate their decisions on how much effort to put in, in order to maximize their *GPA*.

There are numerous variables that affect a student's performance through college. The social pressures of college life can be a great strain on a student's time and subsequently on his or her grades as well. Students are left unmonitored, often for the first time in their lives, and left to make decisions under their own volition. They are left with the option to study, go out with friends, drink, or involve themselves in other extracurricular activities. The prioritization of these options directly affects the time spent in school or on schoolwork. Therefore, given a finite amount of time, time spent on each activity takes away from a student's *GPA*.

This study aims to prove that students learn to be more efficient in improving their *GPA* as they progress through college. They learn from experience how much studying, drinking, and class skipping is permissible without having a negative effect on their *GPA*. Students also adjust to their surroundings and learn how to better use the resources around them and become more efficient at scheduling and utilizing their time to maximize their utility.

I. LITERATURE REVIEW

Many economists have studied the effect of a college life on *GPA*. David Romer (1993) looks at attendance rates and concludes that a lower attendance rate does in fact have a negative effect on *GPA*. Garey Durden (1981) conducted a similar study correlating missed classes with knowledge. He concludes that absence does have a negative affect on an economic student's *GPA*, but only if the absence rate is high. Amy Wolaver's (2002) study on the determinants of *GPA* focused on students' alcohol consumption. She concluded that as students drink more, on a monthly basis, there is an increased negative affect on their *GPA*s. While each of the afore

mentioned studies is significant and adds to the theory of student efficiency and learning by doing, each used somewhat unrealistic gauges and samples. Durden and Romer only explored economic students, while Wolaver's gauge of extreme binging was not realistic to an average college student. Neither study accurately portrayed the average college student. However, each of these studies should not be immediately dismissed because they offer statistical proof of correlations that support the theory of efficiency of college students.

Rabi Bhagat (1981) and Julian Betts (1999) and take a broader look at the college student. In considering the determinants of *GPA* Betts looks at family background, high school resources, and peer groups. Betts' research suggests each variable is statistically significant and affects *GPA* as well. Bhagat's study investigated the determinants of *GPA* as well, but focused on researching students' current behavior and study habits. The study followed students through a year time period testing their performance through *GPA* and test scores, while monitoring and controlling their studying styles and learning environments. Bhagat discovers that the greatest correlation comes between satisfaction and performance. Bhagat determines that feedback heavily influences future performance. This parallels Gareth Jones' (1984) findings and concept of task visibility.

Jones argues that if a person does not understand and see the task and result from an action immediately he or she will be more likely to put less effort and time into the activity and hence shirk. Jones concludes that monitoring has a negative affect on shirking. According to Jones "free riding and shirking may be viewed as the outcome of organized production's inability to provide those task conditions that allow individuals to demonstrate their discrete contributions and claim the rewards of improved performance" (Jones 693). He suggests that to improve performance you must encourage performance above the norm, which informal organizations do not. Jones' theory can also be easily applied to the college student.

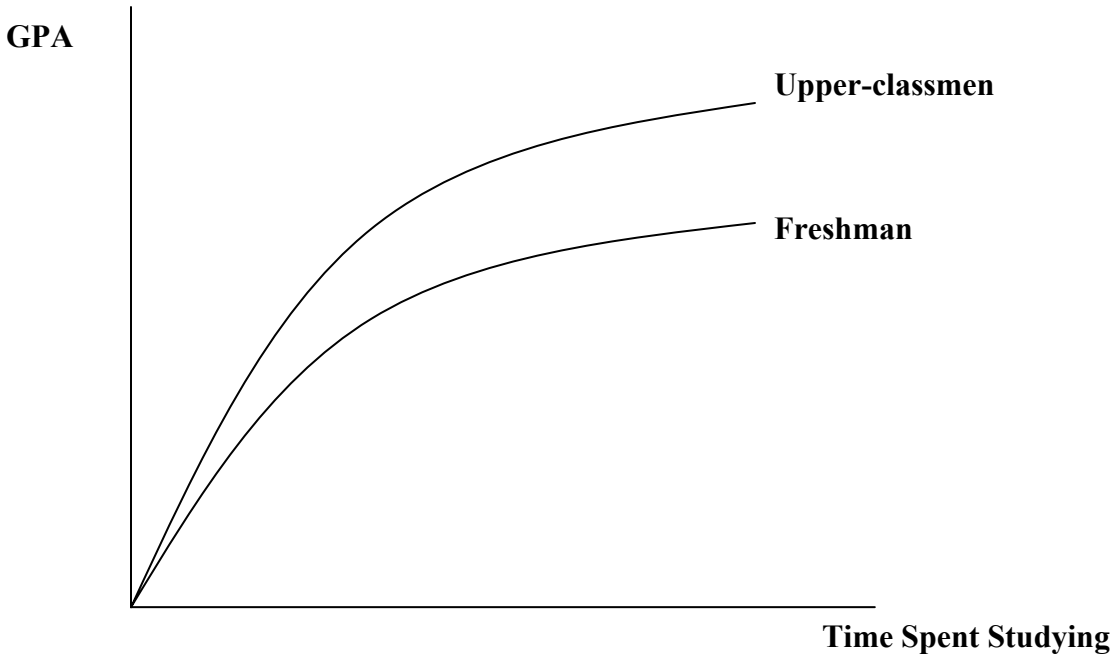
In order to maximize utility, students often attempt to find the best way to shirk through college. Students want to be able to have fun and be sociable without hurting their GPA, just as the worker wants to slack off without losing income. This problem is often referred to as the principal-agent problem. Kathleen Eisenhardt (1989) reviews the theory, concluding that people act in their own self- interest. The principal and agent have two different goals and therefore do not often work in the same direction. In the case of a college student the parent is normally the principal, assuming that he or she pays for college. The dilemma lies in the parents' goals for their child versus the student's goals during their college career.

Monitoring happens in a number of ways. The first way acts like a quota in the job market. Parents can refuse to pay for their child's education if their grades drop below a certain level and if their grades drop too much the college can effectively ask the student not to come back as well. The chief problem with this sort of monitoring is that students are only pushed to a certain level of competency and have very little incentive from the school or from their parents to achieve higher marks than the school or parental acceptance level. However, the most basic form of monitoring and easiest perhaps to monitor and define is phone calls made by a student's parents to the student.

Jones (1990) and other economists have noted that on the job learning makes for more efficient employees. Thus a job that might take a first year employee two hours to accomplish may take an employee with more seniority only one hour to complete. The same theory should hold true for college students. As students learn how to study smarter, establish a wider knowledge base and learn the ropes of college life, they should become more efficient students. Thus less time will be devoted to studying senior year than will be in freshmen year for the same

grade point average. On a graph of time spent studying versus *GPA* (Figure 1) upperclassmen's efficiency can be seen by a curve that increases more rapidly than a freshmen's curve. Therefore, if two students, one freshman and one upperclassman, study the same number of hours the upperclassmen should see a higher *GPA*. If students are assumed to have the same time constraint throughout college, upperclassmen should be more efficient with their time and should thus reap the benefits of their efficiency by having more time to socialize or having to spend less time increasing their *GPA*s.

Figure 1: Time spent studying versus GPA



II. DATA AND THEORY

In order to test the theory a survey was developed to record students' habits while attending college. Data was collected from a random selection of college students in the student union of Mary Washington College during the Fall 2002 semester. The surveys were administered to random sophomores, juniors and seniors. Freshmen were not included in the survey since they have no college *GPA* or college experience. Questions to cover demographics were included on the survey, asking for age, gender, year in college, and major. To take into account students' perceived scholastic ability out of high school, students were asked their SAT scores. The results of these surveys can be seen on Data Appendix 1.

When students leave home they are left with choices they were not in control of while in high school. In college it is easier for students to both skip class and consume alcohol. On the issue of class, students were asked to choose a range of numbers of classes they skip per week on average. The choices to this question were 0 to 1, 2 to 3, and 4 or more. When asked on average how many alcoholic drinks they consume per week the student was asked to choose between 0 to 4, 5 to 8, 9 to 12, and 13 or more. Next students were asked how many hours they study per week on average. The choices were 0 to 2, 3 to 5, 6 to 7, and 8 or more. The second section

addressed the same questions as above, drinking, studying, and skipping, however, they were asked to answer each for their freshmen year.

The last multiple-choice question students were asked to answer was how often their parents call per month. In this empirical test I was trying to use the number of phone calls a student receives as a measure of monitoring. Parents act as the principal and monitor their children, the agent, through phone calls. The selection for this question was 0 to 1, 2 to 3, 4 to 5, and 6 or more. In conjunction with Jones' theory as parents call more often students' performance should improve.

The last selection of the survey asked students to rank activities and people in their life. This was done so that an average prioritization of students could be achieved and therefore one could hypothesize given the choice between studying and time spent on other activities, which the average student would choose. Students were asked to prioritize the list on a scale of 1 to 6, with 1 being the most important and 6 being the least. The options were friends, grades, learning, family, sports, and job. These items were selected based on the assumption that these are six things that are predominating in a college student's life and take up time most of their time, however, admittedly sports could have been changed to represent all extracurricular activities.

III. EMPIRICAL TEST AND RESULTS

In order to test the data collected I ran two ordinary least squares regressions. The first regression was based on the following function:

(1) GPA=f (age, gender, year in college, SAT score, hours studied, number of classes skipped, number of drinks consumed, number of phone calls from parents).

The second regression used the same demographics along with the same information, only from freshmen year. The coefficients of the resulting regressions are then compared in order to understand the habits and *GPA*s of upperclassmen versus freshmen. The first regression will represent the habits of upperclassmen. The second regression will represent those same students during their freshman year.

The first regression (Table 1) included demographics and current year statistics from all 126-student surveys. The R-squared was low at .242, along with most of the t-statistics. Majorities of the t-statistics were not above the critical-t of 1.296 at a 90% level of significance. However, the Durbin Watson and F-statistic were strong. The Durbin Watson was close to 2 with a value of 1.947. The F-statistic was higher than the critical value of 2.04 with a value of 2.152.

The second regression included the same demographics, but with data from students' freshman year. Table 2 showed a better overall fit with an r-squared of .396 and the F-statistic was significant at 6.178. This means that 39.6% of the data is explained by the variables and they are statistically different than zero. The Durbin Watson remained significant with a value of 2.235. However, many of the t-statistics were still not significant at a 90% level of significance.

Once reviewing the data I noticed that many of the sophomores did not show a change in *GPA*, despite directions to indicate a first semester *GPA* in comparison to cumulative *GPA*. Many sophomores recorded the same *GPA* both their first and second semester freshman year. This would show statistically no change in *GPA*, which is most likely not accurate. Taking this

into consideration I dropped all sophomores from my data. This reduced the sample size to 84, but proved to be useful.

Table 1: Regression 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.227650	1.151196	1.066	0.288
AGE	0.036757	0.048834	0.752	0.453
GENDER	-0.049270	0.104667	-0.470	0.638
SO	0.030272	0.127243	0.237	0.812
SR	0.093964	0.125082	0.751	0.454
SAT	0.000755	0.000393	1.921	0.057
STDY1	-0.104425	0.136809	-0.763	0.447
STDY3	-0.070413	0.107992	-0.652	0.515
STDY4	0.009798	0.115001	0.085	0.932
SKIP1	0.220462	0.104748	2.104	0.037
SKIP3	-0.017277	0.166120	-0.104	0.917
DRINK1	0.129108	0.118147	1.092	0.276
DRINK3	0.100317	0.149869	0.669	0.504
DRINK4	-0.168977	0.140786	-1.200	0.232
PARENT1	-0.283459	0.160732	-1.763	0.080
PARENT3	-0.182977	0.115252	-1.587	0.115
PARENT4	-0.162440	0.110115	-1.475	0.143
R-squared	0.241	F-statistic		2.152
Adjusted R-squared	0.129	Prob(F-statistic)		0.010
Durbin Watson	1.947			

Table 2: Regression 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.254897	0.635316	1.975	0.050
SAT	0.001279	0.000480	2.667	0.008
STDYF1	-0.087945	0.133812	-0.657	0.512
STDYF3	0.209412	0.140984	1.485	0.140
STDYF4	0.436727	0.154978	2.817	0.005
SKIPF1	0.148613	0.126303	1.176	0.241
SKIPF3	-0.385570	0.141538	-2.724	0.007
DRINKF1	0.175853	0.164905	1.066	0.288
DRINKF3	0.027219	0.182735	0.149	0.881
DRINKF4	-0.028904	0.169477	-0.170	0.864
PARENT1	-0.097187	0.181346	-0.535	0.593
PARENT3	-0.375108	0.143628	-2.611	0.010
PARENT4	-0.268737	0.126276	-2.128	0.035
R-squared	0.396	F-statistic		6.177
Adjusted R-squared	0.332	Prob(F-statistic)		0.000
Durbin Watson	2.234			

The third regression (Table 3) showed a higher r-squared than the first, but was still low at .250. Few of the variables were significant at a 90% level of significance; most variables had a t-statistic below 2.296. The Durbin Watson remained close to 2 at 1.844. Gender, studying more than 8 hours a week, and parents calling either 0 to 2 times a month or 6 or more were significant according to the t-statistics. However, most of these variables had a high probability value.

The fourth and final regression (Table 4) proved to be the strongest. The r-squared value was the highest at .487, which is strong for a cross sectional data set, indicating 48.7% of the data is explained by the regression. The Durbin Watson was once again strong with a value of 2.256. Parents calling more than 6 times a month, SAT scores, skipping more than 4 classes a week, and studying either 6 to 7 or 8 or more hours a week were all statistically significant with values greater than 1.296. No two variables had a correlation above 0.01, indicating no correlation problems with the data.

Table 3: Regression 3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.722572	1.316485	1.308	0.195
AGE	0.038596	0.057980	0.665	0.507
GENDER	-0.200351	0.112623	-1.778	0.079
SR	0.096389	0.120444	0.800	0.426
SAT	0.000332	0.000410	0.810	0.420
STDY1	-0.151398	0.136598	-1.108	0.271
STDY3	0.064523	0.120322	0.536	0.593
STDY4	0.173557	0.123271	1.407	0.163
SKIP1	0.091581	0.128375	0.713	0.478
SKIP3	-0.129635	0.196126	-0.660	0.510
DRINK1	0.103553	0.123084	0.841	0.403
DRINK3	0.161262	0.150234	1.073	0.286
DRINK4	0.037947	0.146798	0.258	0.796
PARENT1	-0.231448	0.162273	-1.426	0.158
PARENT3	-0.035324	0.116492	-0.303	0.762
PARENT4	-0.188585	0.121760	-1.548	0.126
R-squared	0.249942	F-statistic		1.510644
Adjusted R-squared	0.084488	Prob (F-statistic)		0.126129
Durbin Watson	1.844476			

Table 4: Regression 4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.736127	1.733970	0.424	0.672
AGE	0.020582	0.075863	0.271	0.787
DRINKF1	0.054432	0.194338	0.280	0.780
DRINKF3	-0.184434	0.216641	-0.851	0.397
DRINKF4	-0.119825	0.200878	-0.596	0.552
GENDER	0.009888	0.149563	0.066	0.947
PARENT1	-0.032328	0.211958	-0.152	0.879
PARENT3	-0.200689	0.161689	-1.241	0.218
PARENT4	-0.266572	0.155657	-1.712	0.091
SAT	0.001389	0.000564	2.461	0.016
SKIPF1	0.094107	0.150998	0.623	0.535
SKIPF3	-0.566748	0.171487	-3.304	0.001
SR	-0.017570	0.168874	-0.104	0.917
STDYF1	-0.010943	0.158777	-0.068	0.945
STDYF3	0.284010	0.201209	1.411	0.162
STDYF4	0.579633	0.177946	3.257	0.001
R-squared	0.487	F-statistic		4.308
Adjusted R-squared	0.374	Prob(F-statistic)		0.000
Durbin Watson	2.256			

However, it is the signs and magnitudes of the variables that are important to the question at hand.

The two equations that come from the above regressions (Table 3 and Table 4) are:

Current*GPA*= C+*AGE*(.039)-*GENDER*(.200)+*SR*(.096)+*SAT*(.0003)-*STDY1*(.151) +*STDY3*(.065)+*STDY4*(.174)+*SKIP1*(.092)-*SKIP3*(.130)+*DRINK1*(.104) +*DRINK3*(.161) +*DRINK4*(.038)-*PARENT1*(.231)-*PARENT3*(.035)- *PARENT4*(.189)

Freshmen*GPA*= C+*AGE*(.021)+*GENDER*(.010)-*SR*(.018)+*SAT*(.001)- *STDYF1*(.011)+*STDYF3*(.284)+*STDYF4*(.580)+*SKIPF1*(.094)- *SKIPF3*(.567)+*DRINKF1*(.054) *DRINKF3*(.184)-*DRINKF4*(.120)- *PARENT1*(.032)-*PARENT3*(.201)-*PARENT4*(.267)

In order to analyze the changing habits of college students as they progress through college all of the insignificant coefficients, with t-statistics lower than 1.296, should be ignored. This leaves the coefficients found in Table 5 in bold. The data proved to be most significant in the areas of skipping class, studying and contact with parents. Skipping proved to have a negative correlation when students skip 4 or more classes per week. In both the regression including the entire pool of data and the regression with sophomores dropped there was a negative coefficient with a strong t-statistic. According to Regression 2 skipping 4 or more classes causes a decrease in *GPA* by 0.386. According to Regression 4 this number is higher at -0.567. Both statistics suggest that as freshmen skip more classes there is a greater negative affect on their *GPA*.

Regression 3 and 4 both produced strong t-statistics for studying 8 or more hours per week. These regressions showed that freshmen that study more reap greater benefits from the study time. A freshman studying 8 or more hours a week will see a 0.580 increase in *GPA* while an upper classman studying the same amount of time will only increase their *GPA* by 0.174. Perhaps the difference lies in the fact that freshmen have just come from high school. In high school there are often more daily deadlines, so every night is spent doing work. When students come into college they follow this same pattern and study more, and get more out of it. As time progresses and they do not see immediate results, they decrease their study time.

Table 5: Summary Table

Variable	Regression 1	Regression 2	Regression 3	Regression 4
Constant	1.227650	1.254897	1.722572	0.736127
AGE	0.036757	N/A	0.038596	0.020582
Gender	-0.049270	N/A	**-0.200351***	0.009888
SAT	**0.000755***	**0.001279***	**0.000332***	**0.001389***
Senior Year	0.093964	N/A	0.096389	-0.017570
Drink 0 to 4	0.129108	0.175853	0.103553	0.054432
Drink 9 to 12	0.100317	0.027219	0.161262	-0.184434
Drink 13 or more	-0.168977	-0.028904	0.037947	-0.119825
Skip 0 to 1	**0.220462***	0.148613	0.091581	0.094107
Skip 4 or more	-0.017277	**-0.385570***	-0.129635	**-0.566748***
Study 0 to 2	-0.104425	-0.087945	-0.151398	-0.010943
Study 6 to 7	-0.070413	**0.209412***	0.064523	**0.284010***
Study 8 or more	0.009798	**0.436727***	**0.173557***	**0.579633***
Parents call 0 to 1	**-0.283459***	-0.097187	**-0.231448***	-0.032328
Parents call 4 to 5	**-0.182977***	**-0.375108***	-0.035324	-0.200689
Parents call 6 or more	**-0.162440***	**-0.268737***	**-0.188585***	**-0.266572***
*Significant coefficients in bold.				

In all of the regressions the coefficients were negative for parents calling and most all of the t-statistics were significant. This was a surprising piece of data. Eight of the twelve coefficients for parents calling throughout the regressions were statistically significant. This may indicate that parents call more when their child needs calling more often. In other words parents stay in touch more with students who struggled through high school and need more frequent monitoring or students that are struggling in their current classes.

None of the coefficients for student drinking came out to be significant, although the signs of the coefficients are consistent and tell a story of their own. Three of the four regressions give a negative coefficient to drinking 13 or more drinks per week. The magnitudes of these signs were greater for freshmen as well. While drinking has a negative affect on *GPA* throughout all the students, freshmen's *GPA* is hit harder. This indicates that upperclassmen become more efficient in their drinking as well. Upperclassmen learn how and when to drink in moderation. Students may not change the amount they drink as they progress through college, but they do change *how* they drink.

While each of the regressions ran demonstrated student behavior and the consequences of that behavior on *GPA* no data was more telling than the actual averages between freshmen and upperclassmen. Not only do the averages give an idea of what the sample size consists of, but also it shows trends in students' progression through school. The average *GPA* for freshmen was

2.78, while the upperclassman average was higher at 2.95. The biggest difference between freshmen and upperclassmen, other than *GPA*, was the amount of classes skipped per week. Of the students studied 20.63% said they skipped 4 or more classes a week their freshman year. Only 8.63% currently skip the same amount. This again suggests that students learn which classes they can get away with skipping. There are also a higher percentage of freshmen that drink 13 or more drinks a week. Of the 28.57% students who drank 13 or more their freshmen year, only 23.02% say they currently drink the same amount. The percentage of students who drink 0 to 4 increases by approximately 3% as student's progress through school.

Table 6: Priorities

Priority	**Average Ranking**
Friends	2.41
Grades	3.15
Learning	3.19
Family	2.01
Sports	5.05
Job	5.18

When prioritizing (Table 6) friends, grades, learning, family, sports, and job friends and family ranked the highest. Family averaged 2.01 and friends averaged 2.41 in ranking. The least important to most students was sports and job, both ranking around 5. Grades and learning ranked almost equally at 3.15 for grades and 3.19 for friends. This indicates that to many students' grades and learning are third and fourth on their list of priorities. Friends and family are more important to students than grades. This shows that grades are not the only thing students are here to maximize. With a choice between studying and socializing with friends many will choose to be with friends.

IV. CONCLUSION

Economists often make the assumption that people act rationally and try to maximize utility. College students are no different. As students progress through their college career they learn from their mistakes and successes and become more efficient. Whether it is how much alcohol to drink on a school night or how many hours to study for an exam, upperclassmen have proved they are more efficient. As Raelin stated, "Besides classroom instruction, the other predominant mode of developing…[is] through experience" (1997 574).

Outside of the classroom students find themselves on their own, often for the first time in their lives. They are left with the freedom of choice. Often their primary choice is between grades and social activities. Of all the students surveyed 66% prioritized friends over grades. When left with the choice of studying for a better grade or spending time with friends, two thirds of those surveyed valued time spent with friends over time spent on increasing *GPA*.

This study was done based on a survey of 126 Mary Washington students, which many may argue is somewhat inaccurate in that it relies on people to estimate and remember data from as far back as 3 or 4 years. The answers are left to the memory of those taking the survey. However, the survey does capture a trend. The survey asked students to choose from a range of

answers, which leaves room for mistakes in memory. Specific numbers would be less accurate. This survey does confine the trends of freshmen compared to upperclassmen in whether they drink, study, or skip more now or when they were freshmen. Students are more likely to remember things in proportion of more and less currently. Through the use of multiple-choice questions using ranges I was able to better accurately capture the trends of a college student's career.

There is room for further development in this field. This study examined only a random sample of Mary Washington College students and does not assume the conclusions hold true for all college students. A closer following of students throughout their college career in a variety of colleges would be most accurate. There is also the idea of learning ability, which was not studied in detail in this paper. Another possible perspective on the subject would involve students' preferences of classes. A study investigating the type of classes students were taking freshman year compared to their current year, for example classes in versus out of their major, would prove to be useful in the field of education.

Attending college after high school is becoming more and more standard and necessary for future employment success. Parents send their children off to college in hopes of improving their child's future. To secure this improved future the students are the only ones who can save themselves. Simply going to college is not enough to get into a graduate school or obtain a good job. While students of every class are faced with time issues as they progress through college they do become more efficient. This study suggests strong trends in a correlation between student behavior and *GPA* and more importantly seniority. It can be concluded that students become more efficient in actions that affect their *GPA* as they progress through college. While more research could and should be done to further substantiate these empirical findings they do support economic theory and could be very helpful to students and teachers alike.

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ENDNOTES

[1] This study would not be possible without the patience and immeasurable assistance of Ryan Findley.