Economics Bulletin

Volume 30, Issue 2

# Does a student's preference for a teacher's instructional style matter? An analysis of an economic approach

Tin-chun Lin
*Indiana University - Northwest*

## Abstract

The hypothesis that a student's preference for a teacher's instructional style indirectly affects a student's grade performance positively and significantly is posed and accepted. In this analysis, one additional higher scale used to indicate student preferences for a teacher's instructional style is estimated to indirectly enhance students' grade performance by 2.302 points; a 1% increase in a student's rating of preference for a teacher's instructional style is estimated to lead to a 1.2039% improvement in a student's grade performance.

I would like to thank the editor, the anonymous referee, and discussants at the ASSA conference in Atlanta for very helpful discussion and advice.

**Citation:** Tin-chun Lin, (2010) "Does a student's preference for a teacher's instructional style matter? An analysis of an economic approach", *Economics Bulletin*, Vol. 30 no.2 pp. 1320-1332.

**Submitted:** Mar 18 2010. **Published:** May 11, 2010.

# I. Introduction

Given teacher and student quality, two important factors primarily determine a student's grade performance: (1) in-classroom effort; and (2) out-of-classroom effort. Note that in-classroom effort is student attendance. A number of studies have broadly investigated the relationship between class attendance and grade performance (e.g., Anikeeff, 1954; Schmidt, 1983; Jones, 1984; Brocato, 1989; Park and Kerr, 1990; Van Blerkom, 1992; Gunn, 1993; Romer, 1993; Durden and Ellis, 1995; Devadoss and Foltz, 1996; Marburger, 2001 and 2006; Rodgers, 2001; Rocca, 2003; Dolton, Marcenaro, and Navarro, 2003; Stanca, 2006; Lin and Chen, 2006; and Chen and Lin, 2008). Although researchers of this topic have adopted different methodologies and data sources, all have arrived at the same result: students' class attendance has a positive effect on grade performance. Many researchers have used student semester-level data, but some have constructed longitudinal data sets to examine the link between exam questions and students' attendance. All have subsequently concluded that the students who attend more lectures receive better grades.

Given the lack of an enforced mandatory attendance policy, students have complete freedom to make their own choice. For that reason, each student may be viewed as an economic individual and students' behavior may be viewed as an economic behavior.[1] Therefore, is it possible that a student's taste/preference for a teacher's instructional style may be one of the primary factors in deciding whether to attend the class? Let's look at an example from the restaurant industry. A diner's decision to dine in the same restaurant again depends mainly on his/her taste/preference for the restaurant's food and servers' service quality. If one of these two factors does not positively impact the diner's taste/preference, the diner may not elect to dine in the restaurant again or very often. Similarly, students' behavior is somewhat like customers' behavior. If the student does not like the teacher's instructional style (i.e., the instructor's instructional style does not satisfy/fit the student's taste/preference), the student may not be very interested in consistently attending class. For that reason, it is possible that attendance may be a function of the student's taste/preference for the teacher's instructional style.

Therefore, in this paper I attempt to test the hypothesis that a student's taste/preference for a teacher's instructional style will indirectly affect the student's grade performance. The idea here is that the student's taste/preference for the teacher's instructional style may be one of the primary factors in deciding whether to attend the class, which will in turn affect his/her grade performance. These are the primary contribution of this paper.

This paper is organized as follows. First, information on a basic framework and data measurement are presented. Second, econometric models are built to test the hypothesis, and empirical results are reported. Finally, conclusions are offered.

---

[1]As long as students are given complete freedom to make their own choice, students will act as economic individuals. This is because students will be able to consider their costs and benefits to make their optimal choices. Thus, as an economic individual, each student will not maximize his/her grade. Instead, each student will maximize his/her profit by choosing an optimal combination of in-classroom effort (denoted as *A*) and out-of-classroom effort (denoted as *L*). The student's profit function is defined as $\pi(A,L) = Y(A,L) - C(A,L)$ , where $Y(A,L)$ is the grade production function and $C(A,L)$ is the cost function. Note that the profit for the student is not necessarily monetary. It can include a student's satisfaction or well-being (i.e., utility). Therefore, if the student wants to receive a higher grade, then the student has to study harder, which means that the student has to pay a higher cost. Due to that reason, an economic individual will respond to this fact via an economic behavior by maximizing his/her profit (i.e., utility) instead of maximizing his/her output production (i.e., grade).

## II. Basic Framework and Data Measurement

***Basic Framework***

A student's preference for a teacher's instructional style may not directly affect the student's grade performance, but it may indirectly affect it. This is because the student's preference for the teacher's instructional style may be one of the primary factors in his/her decision whether to attend the class, which will in turn affect his/her performance. Therefore, based upon this viewpoint, it is assumed that a student's attendance (denote as $A$) is a function of the student's preference for a teacher's instructional style (denote as $P$); that is, $A = A(P)$, and $A'(P) > 0$, $A''(P) \le 0$.

In addition, a student's grade performance (denote as $Y$) mainly consists of the following factors: in-classroom efforts (i.e., attendance $A$), out-of-classroom efforts (denote as $L$), the student's initial quality (denote as $Q$), and other exogenous variables (denote as $\Omega$), such as number of hours employed per week, total credit-hours taken per semester, assistance from professors and/or tutors, mathematical ability, demographic background, textbook review, and so on. Therefore, a student's grade performance function ($Y$) can be written as: $Y = f\left(A(P), L, Q, \Omega\right)$. As a result, the indirect effect of the student's preference for a teacher's instructional style on his/her grade performance (i.e., $\partial Y / \partial P$) can be specified as:

$$\frac{\partial Y}{\partial P} = \frac{\partial f\left(A(P), L, Q, \Omega\right)}{\partial A(P)} \cdot \frac{dA(P)}{dP}. \tag{1}$$

As Equation (1) shows, $\partial f(\cdot)/\partial A(\cdot)$ is the effect of the student's attendance on his/her grade performance; and $dA(\cdot)/dP$ is the effect of the student's preference for the teacher's instructional style on his/her attendance.

Based on the earlier description, we are able to develop a basic framework for a student's grade performance and attendance. The basic framework may be specified as follows:

*Grade Performance = f* (*Student's attendance*, *Student's quality*, *Student's out-of-classroom efforts*, *Student's math background*, *Student's living background*, *Assistance form professors and/or tutors*, *Student's working hours per week*, *Total number of credit-hours taken in a semester*), and

*Student's Attendance = f* (*Student's taste/preference for teacher's instructional style*).

***Data Measurement***

To conduct this experiment, the following four factors need to be held constant. They are:

(1) *Teacher's instructional style*. This study focuses on how each student's taste/preference for his/her teacher's instructional style affects his/her grade performance. Hence, only one teacher can be chosen in order to ensure the same instructional style and to see how different students respond to the same instructional style and in turn respond to their performance.

(2) *Incentive to attend class*. In order to identify the effect of student's preference for teacher's instructional style on attendance, students are given complete freedom to make their own choices to attend class. Thus, there are no mandatory attendance policies, no attendance bonus, and no quizzes. Both mandatory attendance policies and quizzes will enforce students' class attendance while an attendance bonus will encourage students to

attend class. However, they will affect students' economic behavior of attending the class, which means that the effect of student's preference for teacher's instructional style on attendance will not be able to be identified.

(3) *Quality of classroom*. The same classroom is requested for two different sections. The classroom has high-tech equipment, including a computer, an over-head projector, and a chalkboard.

(4) *Same exam for two sections*. The same exam is created for two different sections. In addition, to avoid the *post-exam effect*, only one final comprehensive exam is created (no midterm exams)[2]. This is because some (or many) students' attending behavior after a midterm exam may be affected by their midterm grades. Students who do poorly on a midterm exam might lose their confidence and thus miss class more often, which would lead me more difficult to identify the effect of student's preference for teacher's instructional style on attendance. Moreover, it should be noted that some might argue that grade and attendance are simultaneously determined; that is, grade affects attendance as well as attendance affects grade. I do not agree with this argument. For example, if a professor gives students only one final comprehensive exam (no midterm exams), how can grade affect attendance? One correct argument should be that student attendance after a midterm exam may be affected by that midterm grade, which is called the *post-exam effect*. Therefore, grade and attendance are not simultaneously determined, which means that a simultaneous-equation model is not necessary for this study.

In addition, to obtain individual micro data, a questionnaire was created for use in my two undergraduate classes – Principles of Microeconomics – during the fall 2008 semester. One section began at 10:00am in the morning while the other section began at 2:30pm in the afternoon on Tuesdays and Thursdays. These two schedules were good attendance times for students because they were not too early or too late and not during lunch time. On the day of the final exam, a proctor handed out the questionnaire to each student 5 minutes before the exam began. The total number of participants was 98 students. Although 98 surveys may be a small number, they reflected the variation in the study for three reasons: (1) ages among these 98 students ranged among four different age groups – 10s, 20s, 30s, and 40s – with the youngest being 18 and the oldest, 46; (2) these 98 students were from a number of different majors on campus, such as business, economics, social sciences, humanities, engineering, education, and so on; and (3) the levels of distribution for these 98 students included freshmen, sophomores, juniors, seniors, and graduate students. Moreover, prior researchers, such as Howard and Maxwell (1982), only adopted 83 students in a sample to investigate the relationship between grades and student satisfaction. For that reason, the analysis should be reliable in light of the sample size.

Collecting data for this study was a challenge due to the presence on the survey of a confidential question: "*Do you like the way the instructor teaches*?" In addition, I considered asking students to self-report their SAT scores, exam scores, and number of absences, but felt that doing so might lead to bias. Since some students might have been concerned about possible identification by the teacher or might have been unable to remember their SAT scores, exam scores, and total number of class absences and thus would elect not to respond or would offer inaccurate numbers. To solve the problem, I did not ask students to report their SAT scores, exam scores, and total class absences during the semester on the questionnaire. Indeed, I have all of these data. In order to match these non-self-reported data with the self-reported data, I asked

[2] In addition to the final comprehensive exam, students are given weekly homework assignments.

the proctor to collect each student's response. That is, after students finished, she went to each student to collect the response, row by row and seat by seat. After she collected all responses from students, she handed out the final exam to each student. Students were told to place their answer sheets on their tables (but cover their answers) and then leave the classroom. After all students left, the proctor collected each student's answer sheet, row by row and seat by seat. Consequently, students' responses were still anonymous while I was able to match those non-self-reported data (i.e., SAT scores, exam scores, and total number of class absence) with the self-reported data.

The following variables used in this study led to non-self-reported data:

1. *Attendance record*. I took daily attendance during the entire semester. Each student had an attendance record.
2. *Final exam scores*. I recorded each student's final exam scores, which were used as a proxy for a student's grade performance. The scores were on a 100-point-scale.
3. *SAT scores*. Each student's SAT scores were provided by the admissions office. SAT scores were used to proxy for student quality.
4. *Total credit-hours taken in the semester*. Each student's total credit-hours taken during the semester were obtained from the registrar's office.

In addition to these four variables, ten more variables required student self-reports. These ten variables are described below.

1. *Student's efforts*. Students were asked three questions: (1) *How often did you study for the class*? There were five choices for this question. *1* = I study only 1 day before the test; *2* = I study only 2 – 3 days before the test; *3* = I study only 4 – 5 days before the test; *4* = I study one week before the test; *5* = I study regularly right after the class. (2) *How often did you practice the study-guide before the exam*? On a weekly basis I gave students a study-guide with answers. There were five choices for this question. *1* = I never use the study-guide; *2* = I practice only once before the exam; *3* = I practice 2 times before the exam; *4* = I practice 3 times before the exam; *5* = I practice more than 3 times before the exam. (3) *Did you study the text book*? Set "yes" as 1 and "no" as 0.
2. *Student's math background*. Students were asked two questions: (1) *Have you finished college algebra class*? Set "yes" as 1 and "no" as 0. (2) *Have you finished college calculus class*? Set "yes" as 1 and "no" as 0.
3. *Student's living background*. Students were asked: *Do you have young children* (*below 10 years old*) *living with you*? "Yes" was 1 and "no" was 0.
4. *Assistance*. Students were asked two questions: (1) *How often did you visit the professor for help*? There were five choices for this question. *1* = I have never been to the instructor's office; *2* = I have visited the instructor's office 1 – 2 times; *3* = I have visited the instructor's office 3 – 4 times; *4* = I have visited the instructor's office 5 – 6 times; *5* = I have visited the instructor's office more than 6 times. (2) *How often did you visit the tutor for help*? There were five choices for this question. *1* = I have never been to the tutor; *2* = I have visited the tutor 1 – 2 times; *3* = I have visited the tutor 3 – 4 times; *4* = I have visited the tutor 5 – 6 times; *5* = I have visited the tutor more than 6 times.
5. *Student's working hours per week*. Students were asked to write down the number of hours they work each week.

6. *Student's taste/preference for teacher's instructional style.* Students were asked: *do you like the way the instructor teaches*?[3] There were five choices for this question. *1* = No, I strongly do not like; *2* = No, I don't like but not strongly; *3* = I have no comments; *4* = Yes, I like but not strongly; *5* = Yes, I strongly like. Note that this question was asked to determine a student's overall feeling and satisfaction about the teacher's instructional style.

In addition, Table 1 reports the means and standard deviations for all variables used in this study. It should be noted that the grades for the final exam were the original grades without curves. The total number of students in this study was 98. I excluded five students who dropped the class during the semester because they did not answer the questionnaire on the final exam day and did not complete the exam.

## III. Econometric Models and Empirical Results

***Econometric Models***

An examination of the indirect effect of the student's preference for a teacher's instructional style on his/her grade performance requires use of the Two-Stage Least Squares (2SLS) method. Student attendance is estimated in the first stage, and it may be modeled as two types of functions: (1) linear function; and (2) Cobb-Douglas function. Thus, the simple regression models may be expressed as follows.

**Model 1:**

$$ATD = a_0 + a_1 PRE + u_1, \tag{2}$$

**Model 2:**

$$ATD = C_0 \left(PRE\right)^{b_1}. \tag{3}$$

Taking natural logarithms of both sides of Equation (3), the student's attendance function (*ATD*) becomes linear. Hence, the econometric model can be specified as follows.

$$\ln ATD = b_0 + b_1 \ln PRE + u_2, \tag{4}$$

where $\ln C_0 = b_0$, $ATD$ = number of times attended class; $PRE$ = student's taste/preference for teacher's instructional style; and $u_1, u_2$ = stochastic disturbance with a mean 0 and a variance $\sigma^2$.

I save $A\hat{T}D$ and $\ln A\hat{T}D$, the predicted values of $ATD$ and $\ln ATD$ as obtained from the reduced form estimates. Hence, in the second stage the student's grade performance may be modeled as two types of functions: (1) linear function; and (2) transcendental function. These two econometric models may be expressed as follows.

**Model 1:**

$$\begin{aligned} GRD = {} & \alpha_0 + \alpha_1 A\hat{T}D + \alpha_2 SAT + \alpha_3 WHR + \alpha_4 CRD + \alpha_5 FRS + \alpha_6 FRP + \alpha_7 VIP + \alpha_8 VIT \\ & + \alpha_9 KID + \alpha_{10} ALG + \alpha_{11} CAL + \alpha_{12} TEX + \varepsilon_1. \end{aligned} \tag{5}$$

[3]The question may be not quite clearly, because some students might not be so sure what to focus on. Indeed, this question is to find out a student's overall satisfaction for a teacher's instructional style. This could be my fault since I did not create a clear question. Fortunately, the proctor understood the purpose of my research and told students to focus on the overall satisfaction for the teacher's instructional style when some students asked her about it. In addition, one may question me why I did not use the data in the student evaluations questionnaires for analyzing student preference for the teachers' instructional style. This is because the student evaluations questionnaires do not include the information I need, such as student's efforts, student's math background, student's living background, assistance, and student' working hours per week. If I used the data in the student evaluations questionnaires, I would not be able to match it with other data. Therefore, I created my own questionnaires.

**Model 2:**

$$GRD = D_0\left(A\hat{T}D\right)^{\beta_1}\left(SAT\right)^{\beta_2}\left(WHR\right)^{\beta_3}\left(CRD\right)^{\beta_4}\left(FRS\right)^{\beta_5}\left(FRP\right)^{\beta_6}\left(VIP\right)^{\beta_7}\left(VIT\right)^{\beta_8}e^{\beta_9 KID+\beta_{10}ALG+\beta_{11}CAL+\beta_{12}TEX} \quad (6)$$

Taking natural logarithms of both sides of Equation (6), the student's final average grade (*GRD*) function becomes linear. Hence, the econometric model can be specified as follows.

$$\ln GRD = \beta_0 + \beta_1 \ln A\hat{T}D + \beta_2 \ln SAT + \beta_3 \ln WHR + \beta_4 \ln CRD + \beta_5 \ln FRS + \beta_6 \ln FRP + \beta_7 \ln VIP + \beta_8 \ln VIT + \beta_9 KID + \beta_{10} ALG + \beta_{11} CAL + \beta_{12} TEX + \varepsilon_2, \quad (7)$$

where $\beta_0 = \ln D_0$, *GRD* = student's final average grade; *ATD* = the number of times of student attendance; *SAT* = total SAT scores; *WHR* = student's working hours per week; *CRD* = total number of credit-hours taken during the semester; *FRS* = frequency of studying for the class; *FRP* = frequency of practicing study guide; *VIP* = frequency of visiting the professor for help; *VIT* = frequency of visiting the tutor for help; *KID* = having kids to live with; *ALG* = finished college algebra class; *CAL* = finished calculus class; *TEX* = study text book; and $\varepsilon_1$, $\varepsilon_2$ = stochastic disturbance with a mean 0 and a variance $\sigma^2$.

***Empirical Results***

The results for Equations (2) and (4) are reported in Table 2. As shown there, student's taste/preference for teacher's instructional style exerted a positive and significant effect on student's attendance at the 1% level. The coefficient of *PRE* is estimated as 1.1216, which is the effect of student's preference for teacher's instructional style on student's attendance, implying that one additional higher scale used by students to rate their preferences for the teacher's instructional style is estimated to increase students' attendance record by approximately 1.1216 times.

In addition, the elasticity of student attendance with respect to student's preference for teacher's instructional style is estimated to be 0.12217. The elasticity is inelastic, implying that a 1% increase in student's rating of his/her preference for a teacher's instructional style is estimated to lead to an increase in student's attendance of 0.12217%.

We now turn to the estimations of student grade performance. The results for Equations (5) and (7) are presented in Table 3. As Table 3 shows, the indirect effect of student's preference for teacher's instructional style on student's grade performance (appeared in the coefficients of $A\hat{T}D$ and $\ln A\hat{T}D$) is positive and significant at the 5% level in Model 1 and the 1% level in Model 2. The coefficient of $A\hat{T}D$ is estimated to be 2.302, implying that one additional higher scale used by students to indicate preference for a teacher's instructional style is estimated to indirectly enhance students' grade performance by approximately 2.302 points. As discussed in Equation (1), the indirect effect consists of two effects: the effect of student's attendance on grade performance (i.e., $\partial f(\cdot)/\partial A(\cdot)$); and the effect of student's preference for teacher's instructional style on attendance (i.e., $dA(\cdot)/dP$). The effect of student's preference for teacher's instructional style on attendance has been estimated to be 1.1246. Thus, the effect of student's attendance on grade performance should be able to be estimated, which is 2.052 (= 2.302/1.1216), meaning that one additional instances of class attendance is believed to improve student grade performance by approximately 2.052 points.

In addition, the coefficient of $\ln \hat{ATD}$ is estimated to be 1.2039. The elasticity is elastic, implying that a 1% increase in student's rating of preference for teacher's instructional style is estimated to lead to an improvement in student's grade performance of 1.2039%. As discussed above, this effect includes two effects, and I have estimated the second effect (the effect of student's preference for teacher's instructional style on attendance), which is 0.12217. Hence, the effect of student's attendance on grade performance should be able to be estimated, which is 9.8543 (= 1.2039/0.12217). The elasticity is elastic, meaning that a 1% increase in student's attendance record is estimated to lead to an increase in student's grade performance of 9.8543%. Obviously, the empirical evidence shows that in-classroom effort (i.e., attendance) is a very important factor in determining a student's grade performance.

Moreover, as expected, student quality (as indicated by SAT scores) exerts a positive and significant effect on grade performance, meaning that student's grade performance is significantly based upon student quality. Additionally, having finished calculus class (i.e., math background) exerts a positive and significant effect on grade performance at the 5% level in Model 1 and 10% level in Model 2. The result implies that understanding calculus is beneficial when learning about economics.

The other variables, such as student's efforts (indicated by frequency of studying for the class and of using the study-guide) and assistance (indicated by frequency of visiting the instructor and tutor for help), also have positive effects on a student's grade performance although the effects are not significant at any level. The findings regarding time spent outside of class are not surprising. This variable commonly appears in the literature as insignificant. Some students are so smart that they can get good grades without spending much time, whereas other students need to spend a lot of time just to get a mediocre grade. Thus, according to the results, if a student missed important information from the class lecture, no matter how hard the student studies, it will be still quite difficult to catch up because the missed material might not be found in the text book and study-guide. Therefore, attendance (i.e., in-classroom efforts) has become an extremely important factor in determining grade performance.

## IV. Conclusion

In this paper, each student is regarded as an economic individual, and thus student behavior is an economic behavior. For this reason, I applied analysis of an economic approach to the issue of student's preference for teacher's instructional style and student performance. I investigated whether or not a student's preference for a teacher's instructional style would affect a student's grade performance. Although a student's preference for a teacher's instructional style may not directly impact a student's grade performance, it may indirectly affect his/her grade performance. This is because the student's preference for the teacher's instructional style may be one of the primary factors in deciding whether to attend the class, which in turn will affect his/her grade performance. In other words, the indirect effect of a student's preference for a teacher's instructional style on a student's grade performance indeed consists of two effects: (1) the effect of a student's attendance on grade performance; and (2) the effect of the student's preference for the teacher's instructional style on his/her attendance. As a result, it was found that a student's preference for a teacher's instructional style will indirectly affect a student's grade performance positively and significantly.

## References


Anikeeff, M. (1954) "The Relationship between Class Absences and College Grades" *Journal of Educational Psychology* **45** (4), 244–49.

Brocato, J. (1989) "How Much Does Coming to Class Matter? Some Evidence of Class Attendance and Grade Performance" *Educational Research Quarterly* **13**(3), 2–6.

Chen, J. and T. F. Lin. (2008) "Class Attendance and Exam Performance: A Randomized Experiment" *Journal of Economic Education* **39**(3), 213–27.

Devadoss, S., and J. Foltz. (1996) "Evaluation of Factors Influencing Student Class Attendance and Performance" *American Journal of Agricultural Economics* **78**(3), 499–507.

Dolton, P., D. Marcenaro, and L. Navarro. (2003) "The Effective Use Student Time: A Stochastic Frontier Production Function Case Study" *Economics of Education Review* **22**(6), 547–60.

Durden, C., and V. Ellis. (1995) "The Effects of Attendance on Student Learning in Principles of Economics" *American Economic Review* **85**(2), 343–46.

Gunn, P. (1993) "A Correlation between Attendance and Grades in a First-Year Psychology Course" *Canadian Psychology* **34**(2), 201–02.

Howard, G. S., and Maxwell, S. E. (1982) "Do Grades Contaminate Student Evaluations of Instruction?" *Research in Higher Education*, **16**(2), 175-188.

Jones, H. (1984) "Interaction of Absences and Grades in a College Course" *Journal of Psychology* **116**(1), 133–36.

Lin, T. F., and J. Chen. (2006) "Cumulative Class Attendance and Exam Performance" *Applied Economics Letters* **13**(14), 937–42.

Marburger, R. (2001) "Absenteeism and Undergraduate Exam Performance" *Journal of Economic Education* **32**(2), 99–110.

Marburger, R. (2006) "Does Mandatory Attendance Improve Student Performance?" *Journal of Economic Education* **37**(2), 99–110.

Park, H., and P. Kerr. (1990) "Determinants of Academic Performance: A Multinational Logit Approach" *Journal of Economic Education* **21**(2), 101–11.

Rocca, K. (2003) "Student Attendance: A Comprehensive Literature Review" *Journal on Excellence in College Teaching* **14**(1), 85–107.

Rogers, R. (2001) "A Panel-Data Study of the Effect of Student Attendance on University Performance" *Australian Journal of Education* **45**(3), 284–95.

Romer, D. (1993) "Do students go to class? Should they?" *Journal of Economic Perspectives* **7**(3), 167–74.

Stanca, L. (2006) "The Effects of Attendance on Academic Performance: Panel Data Evidence for Introductory Microeconomics" *Journal of Economic Education* **37**(4), 251–66.

Van Blerkom, L. (1992) "Class Attendance in an Undergraduate Course" *Journal of Psychology* **126**(5), 487–94.

Table 1: Means and standard deviations of variables used

| Variables | Mean | Standard Deviation |
|---|---|---|
| Student's taste/preference for teacher's instructional style | 3.65789 | 1.31857 |
| Average exam grade (scores) | 74.7342 | 12.7288 |
| Living with children | 0.253158 | 0.432683 |
| Number of working hours | 28.5474 | 15.1178 |
| Number of credit-hours taken during the semester | 11.6526 | 3.32869 |
| Finished college algebra class | 0.736842 | 0.442683 |
| Finished calculus class | 0.336842 | 0.475138 |
| Total SAT scores | 1062.37 | 158.970 |
| Number of attendance during the semester | 27.2947 | 3.33860 |
| Frequency of studying for the class | 2.56842 | 1.22607 |
| Frequency of practicing the study guide before the exam | 3.70526 | 1.17486 |
| Study text book | 0.357895 | 0.481924 |
| Frequency of visiting the professor for help | 1.18947 | 0.588809 |
| Frequency of visiting the tutor for help | 1.38947 | 0.948624 |
| Satisfaction with teacher's lecture organization | 4.29474 | 1.01974 |
| Satisfaction with teacher's communication skills | 3.53684 | 1.17429 |
| Satisfaction with teacher's lecture preparation | 4.57895 | 0.723157 |
| Satisfaction with teacher's enthusiasm for teaching | 4.42105 | 0.905996 |

Table 2: Estimates of $ATD$ and $\ln(ATD)$

| Explanatory Variables | **OLS** Explained Variable: $ATD$ (1) | **OLS** Explained Variable: $\ln(ATD)$ (2) |
|---|---|---|
| Constant | 23.2722*** (26.65) | 3.1536*** (23.93) |
| $PRE$ | 1.1216*** (4.89) | |
| $\ln(PRE)$ | | 0.12217*** (4.63) |
| $R^2$ | 0.198 | 0.181 |
| $\overline{R}^2$ | 0.190 | 0.173 |
| $F$-Statistics | 23.93 | 21.47 |
| Sample Size | 98 | 98 |

(t-value) *** Denote statistical significance of the $t$-statistic at the 0.01 level. $PRE$ = student's taste/preference for the teacher's instructional style.

Table 3: Estimates of $GRD$ and $\ln(GRD)$

| Explanatory Variables | **2SLS** (1) | (2) |
|---|---|---|
| | Explained Variable: $GRD$ | Explained Variable: $\ln(GRD)$ |
| Constant | -29.29 (-1.11) | -3.020*** (-2.75) |
| $A\hat{T}D$ | 2.302** (2.11) | |
| $\ln(A\hat{T}D)$ | | 1.2039*** (3.15) |
| $SAT$ | 0.030861*** (3.25) | |
| $\ln(SAT)$ | | 0.4579*** (3.16) |
| $WHR$ | -0.10856 (-1.28) | |
| $\ln(WHR)$ | | -0.00588 (-0.43) |
| $CRD$ | 0.0347 (0.09) | |
| $\ln(CRD)$ | | 0.02197 (0.37) |
| $FRS$ | 0.839 (0.78) | |
| $\ln(FRS)$ | | 0.03608 (0.85) |
| $FRP$ | 0.306 (0.30) | |
| $\ln(FRP)$ | | 0.01617 (0.36) |
| $VIP$ | 1.185 (0.51) | |
| $\ln(VIP)$ | | 0.01170 (0.17) |
| $VIT$ | 1.631 (1.12) | |
| $\ln(VIT)$ | | 0.03510 (0.72) |
| $KID$ | -0.976 (-0.37) | -0.00898 (-0.22) |
| $ALG$ | 1.791 (0.67) | 0.02718 (0.68) |
| $CAL$ | 5.516** (2.23) | 0.06805* (1.82) |
| $TEX$ | -1.500 (-0.59) | -0.00429 (-0.11) |
| $R^2$ | 0.468 | 0.4678 |
| $\overline{R}^2$ | 0.394 | 0.3937 |
| $F$-Statistics | 6.30 | 6.302 |
| Sample Size | 98 | 98 |

(t-value) *** Denote statistical significance of the $t$-statistic at the 0.01 level;** Denote statistical significance of the $t$-statistic at the 0.05 level; * denote statistical significance of the t-statistic at the 0.1 level. $GRD$ = student's final average grade; $ATD$ = the number of occasions of student attendance; $SAT$ = total SAT scores; $WHR$ = student's working hours per week; $CRD$ = total credit hours taken during the semester; $FRS$ = frequency of studying for the class; $FRP$ = frequency of practicing study guide; $VIP$ = frequency of visiting the professor for help; $VIT$ = frequency of visiting the tutor for help; $KID$ = having kids to live with; $ALG$ = finished college algebra class; $CAL$ = finished calculus class; $TEX$ = study textbook.