A Formal Research Study on Correlating Student Attendance Policies to Student Success

Dr. Donald C. Richter, Eastern Washington University

Dr. Donald C. Richter obtained his B.Sc. in Aeronautical and Astronautical Engineering from Ohio State University, M.S. and Ph.D. in Engineering from the University of Arkansas. He holds a Professional Engineer certification and worked as an Engineer and Engineering Manger in industry for 20 years before teaching. His interests include project management, robotics /automation and air pollution dispersion modeling.

Mr. Jason K Durfee, Eastern Washington University

Jason Durfee is an Associate Professor of Engineering & Design at Eastern Washington University. He received his B.S. and M.S. degrees in Mechanical Engineering from Brigham Young University. He holds a Professional Engineer certification. Prior to teaching at Eastern Washington University, he was a military pilot, an engineering instructor at West Point and an airline pilot. His interests include aerospace, aviation, computational fluid dynamics, professional ethics, and piano technology.

Ms. Doris M Munson, Eastern Washington University

Doris M. Munson is the Systems/Reference Librarian at Eastern Washington University Libraries. She holds a M.L.S. from the University of Washington, Seattle, and a B.S. from Oregon State University, Corvallis.

Prof. Terence Geyer, Eastern Washington University

Terence Geyer is the Director of Distance Education in the Department of Engineering & Design at Eastern Washington University. He obtained his B.S. in Manufacturing Technology and M.Ed. in Adult Education in a specially combined program of Technology and Education at Eastern Washington University. His interests include collecting and re-manufacturing older technologies.

Dr. William R Loendorf, Eastern Washington University

Dr. William R. Loendorf is a full professor emeritus of Engineering & Design at Eastern Washington University. He obtained his B.Sc. in Engineering Science at the University of Wisconsin-Parkside, M.S. in Electrical Engineering at Colorado State University, M.B.A. at the Lake Forest Graduate School of Management, and Ph.D. in Engineering Management at Walden University. He holds a Professional Engineer license and has 30 years of industrial experience as an Engineer or Engineering Manager at General Motors, Cadnetix, and Motorola. His interests include engineering management, technological literacy, improving the competitiveness of American companies, and real-time embedded systems.

©American Society for Engineering Education, 2013

A Formal Research Study on
Correlating Student Attendance Policies to Student Success

Abstract

Three years ago, members of our Engineering & Design Department began a study to determine the effects of class attendance on student success. Engineering technology students today have grown up in a very different environment from the students of 20 years ago. They access information and engage in social contact through digital media and they often have almost instant access to this digital media through portable, wireless devices. There is a thought that with this greater connectivity they may not respond in the same manner to the teaching methods of past generations of students. More specifically, the students of today may not feel the same need to be physically present in their classes in order to be successful. Initial results presented at the American Society of Engineering Education (ASEE) Annual Conference in 2012 determined that attendance correlates with student success and the correlation changes during the progression of a student throughout their undergraduate experience. This paper discusses if there is a significant relationship between student success and different faculty approaches to attendance including incentives for attendance, penalties for lack of attendance, or no requirement at all. The study involves students in programs of Mechanical Engineering, Mechanical Engineering Technology, Manufacturing Technology, Design Technology, Construction Management, and a service course to the general student body. Data comes from four different instructors teaching approximately 20 classes per year ranging from freshman to senior students. Additionally, the study provides the ability to track an individual student over their entire undergraduate education. The correlation between the faculty approach to attendance and success will be discussed in this paper in detail.

Introduction

It is a continuing expectation among educators that students should attend class. It is assumed that a student will not progress in knowledge and understanding of a course topic without being in attendance to benefit from the classroom experience. Previous research performed in conjunction with this project showed a correlation between student attendance in the classroom and their overall grade in the class. This was true for students from freshmen to senior year[10]. This knowledge should not come as a surprise; and yet, even with such knowledge some students still have difficulty staying motivated to attend their college courses. Faculty members struggle with what is the best approach to encourage greater attendance among their students. Is it better to reward a student for attendance? Would the student be more likely to attend if he knew there would be detrimental consequences for missing too many classes? On the other hand, are we doing the students a disservice if they are rewarded for doing what they should be expected to do anyway? In all of this, the ultimate goal of preparing students for the workplace should be paramount.

Conceptual Framework of Student Attendance

In the authors' previous study, it was determined that class attendance was positively correlated with grades for engineering students. Attendance became more important as students moved through the academic curriculum[10]. What is less clear is whether rewarding engineering students for good attendance or punishing them for missing class affects their grades.

Some studies have looked at whether rewards or punishment improves attendance. Most find that attendance goes up when attendance affects grade[11,21,24]. There is some disagreement about whether rewards or punishment works better to improve attendance. There is some evidence that attendance is higher if it is rewarded rather than punishing students for non-attendance[2]. However, the studies did not look at whether the motivations to attend class affected the grades of the students.

There are two sides to the argument. A number of studies have found that rewarding or punishing attendance has little or no effect on grades[2,3,5,12,13,19,20,22,26]. Other studies have found that it does have an effect on grades[14,18,25]. Crede, Roch, Kieszczynka[8] did a meta-analysis of data from three studies and found a small increase in average grades with a mandatory attendance policy and also concluded that attendance policies benefit lower performing students. In addition, several studies indicate that monitoring attendance of first year students improves their academic performance[16,23].

It should be noted that most studies are done for two semesters or less and are often based on classes taught by the same instructor[2,3,5,12,14,19,20,22,25,26]. Also, most studies on the effect of rewarding (carrot) or punishing (stick) attendance behavior have been done in the humanities[13], social sciences[19,26], business[2,5], and economics[7] fields. This study is significant because it covers engineering classes taught over a four-year period by four professors. Two of the professors reward good attendance, one professor punishes poor attendance, and one professor does not have an attendance policy. In all, the database has 2250 entries, of which 1986 have letter grades. All professors taught classes at the 300-level, which accounts for 1252 entries.

Project Design

Since this project involves examining student success and attendance the first requirement was to define what was meant by 'student success'. For lack of any better assessment method it was determined that a student's grade in a course would be the determining factor of their success in that course. Also tracking a student's attendance had to be agreed upon. Although it can generally be assumed that students who miss class for circumstances beyond their control might be impacted by the absence to a lesser or greater extent than those that simply choose not to attend, the decision was made to simply track attendance and not attempt to discern the reason for any absences.

It was also determined that for the results to be more generally applicable to engineering and technology programs and students that a broad selection of courses would need to be included. The courses selected for the study came from the Mechanical Engineering, Mechanical

Engineering Technology, Manufacturing Technology, Design Technology, and Construction Management Technology programs. Additionally, there is data available from a technology course that satisfies a general education requirement at the university so students in this course come from a broad range of majors across campus.

Data from the courses involved tracking each student with a unique student identification number. This number will remain the same for the student across all of the courses. This means that data will be available for the class as a whole and on the individual level and that, changes in a student's attendance pattern throughout their college experience can also be evaluated.

The courses were selected to give a representation of the various class instructional modes seen by Engineering and Technology students (lecture-nonmathematical, lecture-mathematical, lecture/lab, lecture/demonstration). The project is also being conducted using four separate instructors who have agreed to participate in the project research. The use of more than a single instructor is an attempt to enable a more representative sample of the type of instruction that a student experiences during his/her academic career at the university. This use of multiple instructors will also help minimize the effect of a given instructors influence on student success. Among the different instructors, there are also different approaches to attendance. One professor utilizes a requirement for attendance resulting in negative consequences for absences. Another utilizes a reward system. Another tracks attendance but neither rewards nor punishes students based on attendance. This spectrum of approaches to how attendance affects students' grades creates an additional opportunity to research what motivates a student to attend and to be successful.

Data has been gathered starting with the January 2009 term. The research study is currently ongoing. At the end of each quarter, additional attendance information is added to the growing database. Because the database is extensive and spans multiple courses taught by multiple instructors, the researchers have the ability to track an individual student from their first course as a freshman until that student graduates. Currently the database holds over 2,250 entries. The only students not included in the following data are those who dropped out of the courses and those who arranged to receive an incomplete. At the time of this paper, there was not enough data to report on the performance of students who received incompletes.

Following is a description of each class and the mode and method of instruction.

TECH208 Survey of Electricity - is a traditional first lecture/lab course in electronics and electrical circuit analysis. The attendance is taken with a daily sign-in sheet. The course has a two-hour weekly laboratory.

TECH 393 Technology in World Civilization - is a traditional lecture-nonmathematical course. Attendance is taken through the use of a daily roll call. This is necessitated because the class is taught in one location and broadcast by simultaneous interactive television to three additional remote locations. This class is structured as four hours of lecture per week.

TECH 320 Non-Metallics - is a lecture/laboratory mode of instruction. Attendance is taken through the use of a daily sign-in sheet. This class is structured as two hours of lecture and seven hours of lab per week.

TECH 341 Strength of Materials - is a lecture and mathematically intense course. Attendance is taken daily by distributing a roll to the students requiring their signature to be marked as present.

METC 102 Introduction to Engineering Graphics - serves as a pre-college skills course for students that come to the department without any previous high school or employment experience in technical drawings. The class is a lecture format. This class is unique in the study in that the grading is Pass/Fail. Attendance is taken daily by distributing a roll to the students requiring their initials to be marked as present.

METC 110 Engineering Graphics - consists of both lecture and laboratory/demonstration periods. The laboratory/demonstration periods are interspersed with the lecture periods. Attendance is taken daily by distributing a roll to the students requiring their initials to be marked as present.

MENG 217 3-D Parametric Design - consists of both lecture and laboratory/demonstration periods. The laboratory/demonstration periods are interspersed with the lecture periods. Attendance is taken with a daily sign-in sheet.

METC 340 Statics - uses a lecture-mathematical mode of course instruction. Attendance is taken with a daily sign-in sheet.

MENG 382 Fluid Mechanics - uses a lecture-laboratory mode of course instruction. Attendance is taken with a daily sign-in sheet.

MENG 385 Robotics and Automated Systems - uses a lecture-laboratory mode of course instruction. Attendance is taken with a daily sign-in sheet.

MENG 412 Fundamentals of Engineering - uses a lecture mode of course instruction. Attendance is taken with a daily sign-in sheet.

MENG 407 HVAC - uses a lecture-laboratory mode of course instruction. Attendance is taken with a daily sign-in sheet.

By virtue of the course numbering system, it can be seen that the makeup of tracked courses ranges from freshman to senior level. It should be noted that some of these 300-level courses constitute senior-level courses for students in many of the technology programs.

Project Outcomes

This paper follows up on the initial analysis of data that found a correlation between student attendance and academic success. This current analysis was conducted to see if there were any significant differences in student attendance based on the method in which attendance affects the

student's grade in the course. The various instructors contributing data to this project fell into one of three categories when it came to how they used attendance in relation to a student's grade. Those three different methods are listed below.

1. Attendance is rewarded (nicknamed the, "Carrot" approach)
2. Lack of Attendance is punished (nicknamed the, "Stick" approach)
3. Attendance is neither rewarded nor punished (nicknamed the "No Carrot – No Stick approach)

An example of how the Carrot approach is where students that maintain a certain level of attendance are allowed to drop their lowest exam score. The Stick approach could involve reducing a student's grade by a certain percentage based upon their level of attendance. The No Carrot – No Stick approach involves taking attendance but neither rewarding students for attending nor punishing them for not. This method assumes that attendances is its own reward in that students that attend will pick-up the material better and do better on assignments and exams. In order to utilize consistent data from which to draw conclusions it was realized that classes that cross all three different attendance policies occurred only in the 300-level courses. Consequently, only data from the 300-level courses in the attendance database was used in the following analysis. Figure 1, below, shows the results of the data for the 300-level courses in the study with the data divided into specific GPA blocks. The percentage of days a student attended the course is given on the vertical axis of the chart.

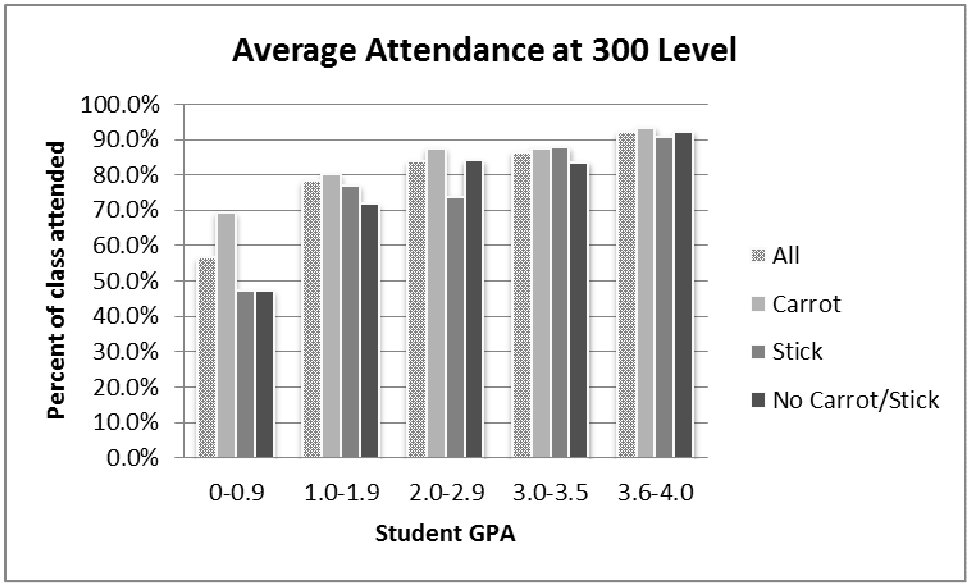

Figure 1. Percent of class attended versus Student GPA

To simplify the analysis the student's final grades were divided into four ranges: 0.0 to 0.9, 1.0 to 1.9, 2.0 to 2.9, 3.0 to 3.5, and 3.6 to 4.0. Average attendance percentages within each GPA grouping were plotted according to the method of attendance category. Anecdotal concepts would seem to favor the Stick method as having the highest percentage of class attendance. However, within the different GPA bands this is not the case. In every case, the Carrot method corresponds with the highest percentage of class attendance. It can also be determined that among students in the highest GPA band that no single method stands out as significantly

different from any other method. At the opposite end of the GPA bands, the Carrot method has the greatest impact on student attendance by a significant amount.

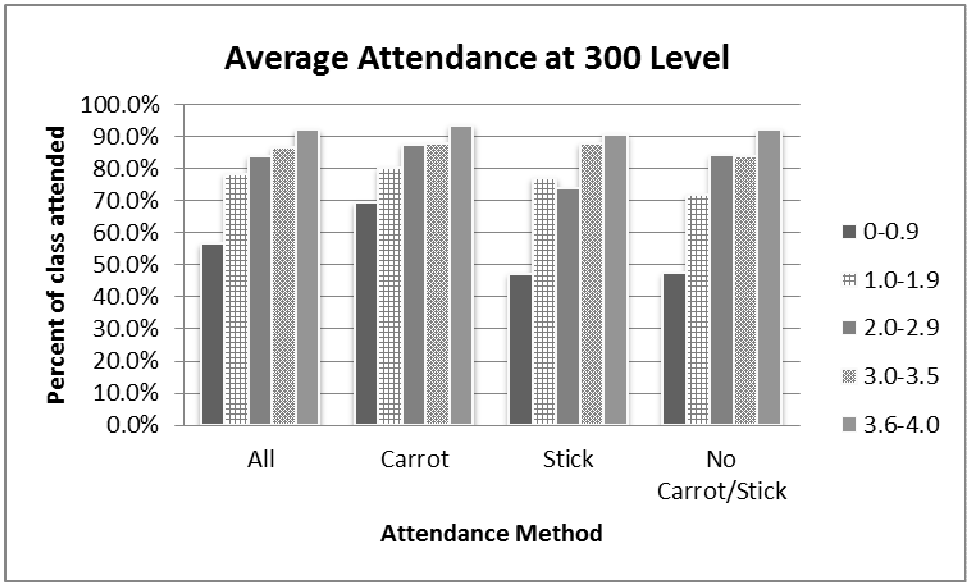

Figure 2. Percentage of class attended versus Attendance Method

Figure 2 takes this same data and presents it with the Attendance Method on the x-axis. Viewing the data in this manner brings out one interesting aspect of student attendance in regards to the Stick method. In all other Attendance Methods, attendance increased with each increasing GPA band, except in the case of the Stick Method. In this method, students in the 1.0 to 1.9 GPA band had greater attendance than the students had in the next higher band but did not achieve the same success in the course as those students. Perhaps this relates to higher student expectations about how big the reward would be for attendance. Students may have thought that they could overcome a larger amount of their shortcomings in the class with the attendance reward than was actually mathematically possible.

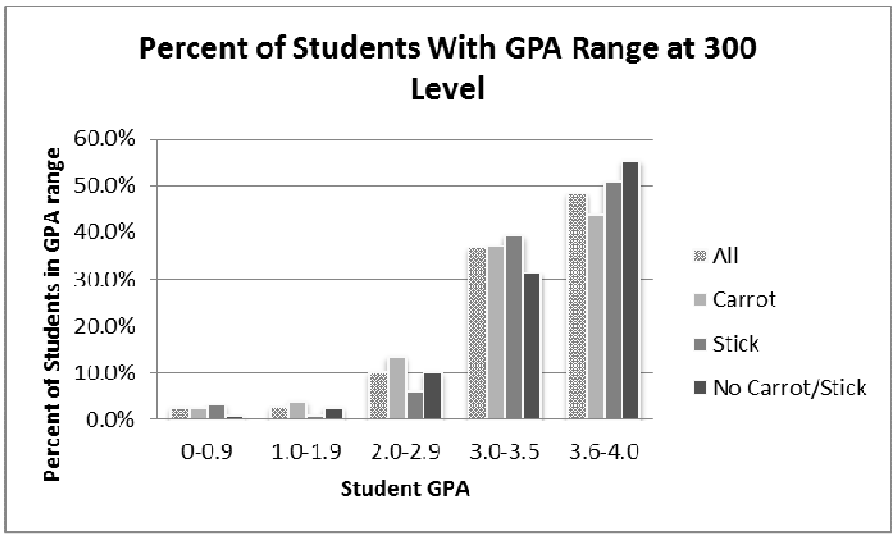

Figure 3. Percentage of students in GPA range versus Student GPA

In Figure 3, the percentage of students that fall into each GPA band is shown. This figure illustrates another interesting aspect related to Attendance Methods. This data shows the highest number of students in the lowest GPA band comes from the Stick method and the lowest number of students in this same failing band comes from the No Carrot/Stick method. No data was available to determine why this might be the case. The No Carrot/Stick method also had the highest percentage of students in the highest GPA band. This seems to indicate that the No Carrot/Stick method correlates with better overall student performance in the course. The Carrot method shows the weakest performance in the highest GPA band among the different methods. Again, perhaps this is due to good habits developed by students in the top GPA band making the concept of a reward less important to their overall success.

In Figure 4, the data is clustered by the type of Attendance Method used.

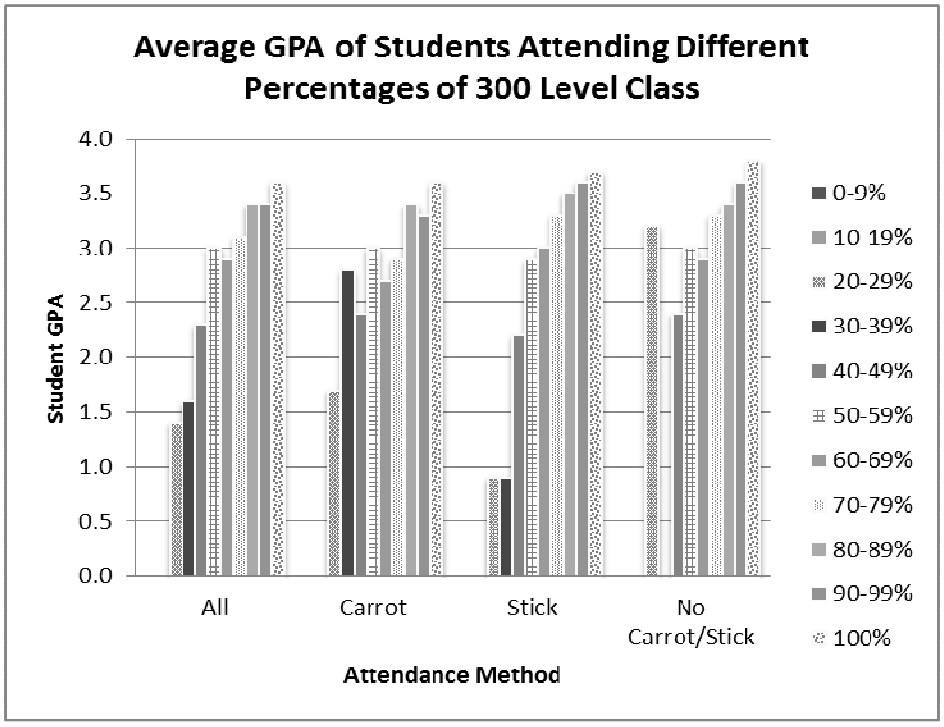

Figure 4. Average Student GPA at different levels of attendance for each Attendance method

From Figure 4 it can be determined, that all three methods provide similar levels of student attendance at the higher GPA levels. The methods seem to have their greatest differences at the very low end of student GPA. Here we see the Stick method with the smallest amount of student attendance in the lowest GPA levels. The No Carrot/Stick method has an interesting deviation from the others at the lowest end of Student Attendance percentages. There were not an appreciable number of students with this method that fell into the 30 to 39% attendance band. Students in this method showed either a definite low attendance (20 to 29%) or they managed to maintain attendance levels closer to 50% and above.

Finally, as a summary to the data, Figure 5 is presented.

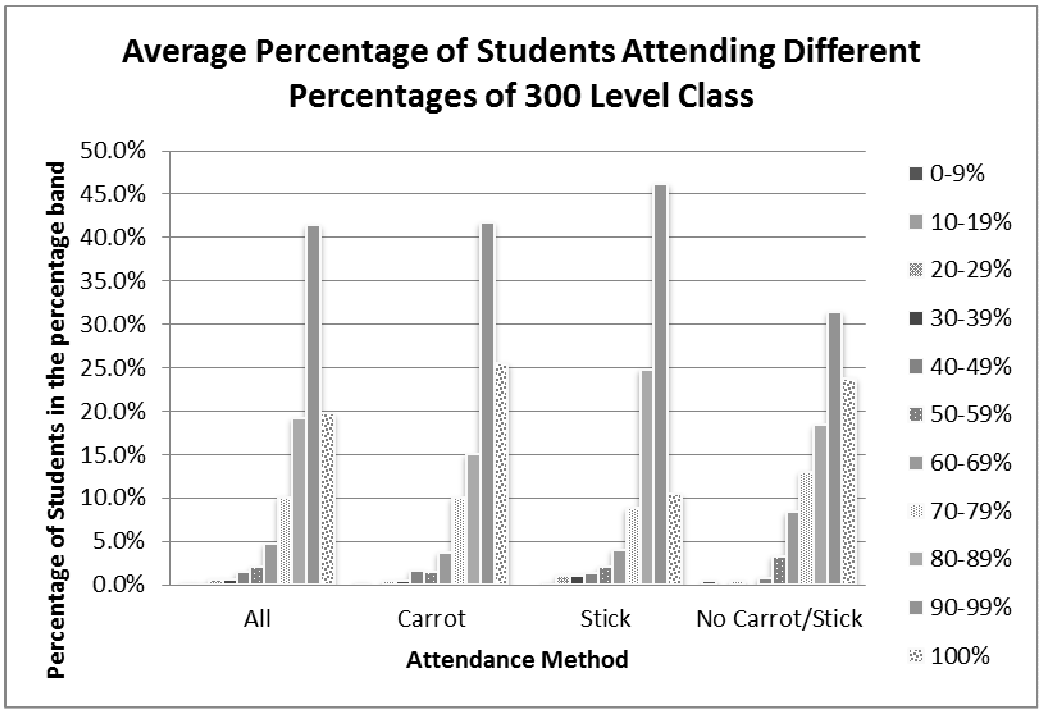

Figure 5. Percentage of Students by percent of classes attended for each Attendance Method

As a final summarization of the data for these 300-level engineering and technology courses used for the study, some interesting aspects of attendance are shown in Figure 5. The Carrot method resulted in the highest number of students with 100% attendance. In order to further analyze this graph, the actual data used in its creation is displayed in Table 1.

	All	Carrot	Stick	No Carrot/Stick
0-9%	0.2%	0.2%	0.0%	0.4%
10-19%	0.1%	0.0%	0.2%	0.0%
20-29%	0.6%	0.4%	1.1%	0.4%
30-39%	0.6%	0.5%	1.1%	0.0%
40-49%	1.4%	1.6%	1.3%	0.8%
50-59%	2.0%	1.4%	2.0%	3.3%
60-69%	4.7%	3.7%	4.0%	8.4%
70-79%	10.1%	10.0%	8.8%	13.0%
80-89%	19.2%	15.0%	24.8%	18.4%
90-99%	41.4%	41.7%	46.2%	31.4%
100%	19.7%	25.5%	10.4%	23.8%
90% and above	61.1%	67.2%	56.6%	55.2%

Table 1.
Percentage of Students by percent of classes attended for each Attendance Method.

The data in Table 1 was utilized to create Figure 5. The first column is the percentage of attendance. The next columns indicate which percentage of students attended class at that level for each attendance method.

In Table 1, an additional final row was included at the bottom that totals the values from the 90 to 99% and the 100% columns. From this final row, it can be seen that the Carrot method not only creates the greatest number of students with 100% attendance, it also maintains the top position in generating attendance levels in the 90% and above level. Student attendance at a 90% and above level is a desirable goal for all college courses. As a result, the Carrot method seems to be the recommended method to generate the best levels of attendance among students in engineering and technology courses at the 300 level.

Project Outcomes, Conclusions and Future Plans

Broad conclusions from the data were limited by only being able to utilize data for 300-level courses in the analysis. By the time students reach their junior-level courses in an engineering and technology program they may already be entrenched in the habits that will determine their success. It would be very useful to do this same analysis for 100 and 200-level courses to see if students that are in their formative stage of a college career respond differently to these different methods.

It can also be stated that it was impossible to eliminate data influences related to specific instructor techniques in teaching and grading. Since each method was assigned to a specific instructor this creates a possible bias to the data. An interesting study would be to have a single instructor teach using all three Attendance Methods in order to remove this bias from the results.

Whether professors should have an attendance policy is also debated. There are some researchers who say an attendance policy is warranted[7,5]. There are others who argue against attendance policies[1,4,6,17,24]. Further, some research states that motivational grading is appropriate in some contexts if instructors use it effectively and appropriately[15]. Further, some conclude “the higher the rate of class attendance, the higher students’ evaluation of the instructor”[9].

Where does all this leave us can be open to debate. The data collected shows a slight bias for the Carrot method of attendance. However, the bigger overarching conclusion is still that attendance in class still matters and is a chief indicator toward student success. Professors should be encouraged to do whatever works for them and their students to increase daily attendance in class.

This is an ongoing study. Additional information will added to the database at the end of each quarter for the next year. The researchers on this project intend to use this data to examine such additional attendance related issues as:

- Does a student’s attendance pattern change as they progress through the major?
- Does success early on lead to greater or less attendance in future courses?
- Is there a correlation between a student’s major and his attendance patterns?

- Does a student's entering SAT score correlate to his attendance behavior?
- Are there differences in attendance patterns among different genders or ethnic groups?
- Are there differences in attendance patterns that affect success for students form first time college families more than others?
- Does the time of year of the course affect attendance (fall, winter, spring)?
- Do students in certain majors have patterns of attendance different from others?
- Does the grading scheme (Pass/Fail vs. number grades) affect attendance?
- Does attendance vary based on the mode of instruction (lecture vs. lab)?
- How does our study relate to others in terms of student programs of study and the size of the project database?
- Does attending the first class have any correlation with the final grade?

These and other aspects related to attendance and student success will be evaluated in the future. Additional data collected from new courses will be incorporated into the project database with each passing quarter and the database will continue to grow. The project team will publish results from future studies in hopes of establishing a useful dialogue in higher education on the aspects of attendance.

Bibliography

1. Armstrong, J. S., 2012, "Would Mandatory Attendance be Effective for Economics Classes," retrieved December 1, 2012 from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=634127.
2. Beaulieu, R., and Sheffler, D., 1985, "Positive and punitive contingencies and the control of absenteeism." College Student Journal, 19 pp. 242-245.
3. Berenson, S. B., Carter, G., and Norwood, K. S., 1992, "The At-Risk Student in College Developmental Algebra," School Science and Mathematics, 92(2) pp. 55-58.
4. Brewer, E. W., and Burgess, D. N., 2005, "Professor's Role in Motivating Students to Attend Class," Journal of Industrial Teacher Education, 42(23) pp. 23-47.
5. Chan, K. C., Shum, C., and Wright, D. J., 1997, "Class Attendance and Student Performance in Principles of Finance," Financial Practice and Education, 7(Fall/Winter) pp. 58-65.
6. Close, D., 2009, "Fair Grades," Teaching Philosophy, 32(4) pp. 361-398.
7. Cohn, E., and Johnson, E., 2006, "Class Attendance and Performance in Principles of Economics," Education Economics, 14(2) pp. 211-233.
8. Crede, M., Roch, S. G., and Kieszczynka, U. M., 2010, "Class Attendance in College: A Meta-Analytic Review of the Relationship of Class Attendance with Grades and Student Characteristics," Review of Educational Research, 80(2) pp. 272-295.
9. Davidovitch, N., and Soen, D., 2006, "Class Attendance and Students' Evaluation of their College Instructors," College Student Journal, 40(3) pp. 691-703.
10. Durfee, J. K., Loendorf, W. R., Richter, D. C., 2012, "A formal research study on correlating student attendance to student success," 2012 ASEE annual conference program : final conference program and proceedings, June 10-13, 2012, Henry B. Gonzales Convention Center, San Antonio, Texas. Anonymous American Society for Engineering Education, [Washington, DC].
11. Friedman, Paul Rodriguez, Fred McComb, Joe, 2001, "Why Students do and do Not Attend Classes," College Teaching, 49(4) pp. 124.
12. Golding, J. M., 2011, "The Role of Attendance in Lecture Classes: You Can Lead a Horse to Water…," Teaching of Psychology, 38(1) pp. 40-42.
13. Gump, S. E., 2004, "Keep Students Coming by Keeping them Interested: Motivators for Class Attendance," College Student Journal, 38(1) pp. 157.

14. Hancock, T. M., 19__, “Effects of Mandatory Attendance on Student Performance,” College Student Journal, 28(3) pp. 326-329.
15. Immerwahr, J., 2011, "The Case for Motivational Grading," Teaching Philosophy, 34(4) pp. 335-346.
16. King, B. M., Eason, B. L., St. L. O'Brien, Gregory M., 2004, "Effects on Grades of a New University Policy Requiring Faculty to Take Attendance," Journal of the First-Year Experience & Students in Transition, 16(2) pp. 9-18.
17. Kohn, A., 1999, Punished by Rewards: The Trouble with Gold Stars, Incentive Plans, A's, Praise, and Other Bribes, Houghton Mifflin.
18. Kooker, E. W., 1976, "Changes in Grade Distributions Associated with Changes in Class Attendance Policies." Psychology, 13(1) pp. 56-57 .
19. Le Blanc III, H., 2005, "The relationship between attendance and grades in the college classroom," 17th annual meeting of the international academy of business disciplines, Pittsburgh Pennsylvania, 8th April.
20. Marburger, D. R., 2006, "Does Mandatory Attendance Improve Student Performance?" Journal of Economic Education, 37(2) pp. 148-155.
21. Moore, R., 2003, "Attendance and Performance," Journal of College Science Teaching, 32(6) pp. 367.
22. Moore, R., 2005, "Attendance: Are Penalties More Effective than Rewards?" Journal of Developmental Education, 29(2) pp. 26-32.
23. Schneider, K. N., 2002, “This May be College, but We’re Still Taking Attendance,” Chronicle of Higher Education,
24. Self, S., 2012, “Studying Absenteeism in Principles of Macroeconomics: Do Attendance Policies Make a Difference?” Journal of Economic Education, 43(3) pp. 223-234.
25. St. Clair, K. L., 1999, "A Case Against Compulsory Class Attendance Policies in Higher Education," Innovative Higher Education, 23(3) pp. 171-80.
26. Taylor III, L. A., 2012, "Cutting Class Harms Grades," Decision Sciences Journal of Innovative Education, 10(1) pp. 49-61.
27. Wilder, D. A., Flood, W. A., and Stromsnes, W., 2001, “The Use of Random Extra Credit Quizzes to Increase Student Attendance,” Journal of Instructional Psychology, 28(2) pp. 117-120.