

Correlating Course Attendance with Factors of First-Generation Status, Gender, and Economic Status

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Abstract

A few years ago, members of our Engineering & Design Department began a study to determine the effects of class attendance on student success. Today's engineering and technology students 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 and Exposition in 2012 determined attendance correlates with student success and the correlation changes during the progression of a student throughout their undergraduate experience. Results presented at the ASEE 2013 Conference indicated that an instructor's attendance policy did not significantly affect overall attendance rates of students that earned high grades in a course but did affect the students that earned lower grades. This current paper discusses if there is a significant relationship between student attendance and the following three factors: status as a first-generation college attendee, gender, and economic status. Four different instructors have gathered attendance data since 2008 for approximately 20 classes per year ranging from freshman to senior students in programs of Mechanical Engineering, Mechanical Engineering Technology, Manufacturing Technology, Design Technology, Construction Management, Applied Technology, and a service course to the general student body. Additionally, the study provides the ability to track an individual student over their entire undergraduate education. A correlation between student attendance and the student characteristics of first-generation status, gender, and economic status exists and this paper will discuss this in detail.

Introduction

This paper provides results from a continuing research project looking at the effects of student attendance and student success. Previous papers utilizing the data from this project examined the correlation between student attendance and student success and then probed deeper into how this correlation was affected by class standing and the instructor's attendance policy^{10, 28}. Data from the study showed that there was a definite correlation between student attendance and their success in the classroom and that this correlation was true for students from freshman to senior year¹⁰. A second analysis of the data showed that the instructor's attendance policy had a definite affect upon a student's attendance record²⁸. This paper will examine the data further in order to see if a student's status as a first-generation college attendee, gender, or economic statuses have an effect upon their attendance. It is based upon the fundamental belief that attendance in class important for a student to master the material and it is backed by data from the previous two papers. The authors of the study were very interested in finding out if there were any gender-related issues with student attendance. It was also a question if first-generation students that did not come from a family history of college attendance could have some impact on a student's attitude towards attendance. Finally, a student's economic status was also examined to see if this

might have an influence over a student's desire or ability to attend class. Further details on the data and process are given in following sections.

Conceptual Framework of Student Attendance

In one of the authors' previous studies, it was determined that class attendance was positively correlated with grades for engineering students. Attendance became more important as students moved through the academic curriculum¹⁰. The authors study was specific to engineering and engineering technology classes and validated conclusions on more general courses by others^{7,5,9,11,16,21,23,24}. The general findings were also in agreement with Tinto who states that what happens in the classroom is most important to the success of students.²⁸ The authors conclusions were different from others for some general courses that attendance policies do not matter^{1,4,6,17,24}. A previous study by the authors of this paper noted that the individual instructor's attendance policy also had an impact upon a student's attendance²⁷. The conclusion disagreed with a number of studies that found that rewarding or punishing attendance has little or no effect on grades^{2,3,5,12,13,18,19,20,22,26}. However, this was in agreement with some other studies that found that attendance policies do have an effect on grades^{8,14,15,18,25}. These previous studies by others were not specific to engineering and engineering technology courses and the authors study was unique in this respect. The authors decided to look at additional factors such as first-generation students that did not have a family history of college attendance and whether that might have some impact on a student's attitude towards attendance. The Authors also looked at a student's economic status to see if this might have an influence over a student's desire or ability to attend class. Tinto stated that these special types of students typically lack the sort of generation knowledge of what is expected to succeed. This begged the question of whether that difference correlated in different patterns of attendance and ultimately in different levels of success for this particular subgroup compared to the overall population of students taking engineering and engineering technology courses.²⁸

Project Design

This project involves tracking student attendance and student success. The definition of success as used in this study is simply the student's final grade in a course. Because of the difficulty in tracking reasons why students do or do not attend class and in light of confirming data that showed missing class for any reason impacted a student's grade it was determined that data for this research would be tracked simply as a student did or did not attend a class and reasons for an absence were not recorded. Thus, the attendance data is simply recorded as the percentage of days that a student attended a given class.

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 multiple 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 instructor's influence on student success. This paper is not examining the effects of differing attendance policies among different instructors but it should be noted that there is not a single universal policy in use by the courses included in this study. The variation in policies range from some form of academic punishment if students miss too many classes, academic rewards for students that maintain a minimum attendance percentage, and a policy of neither a punishment or a reward for attendance.

Data was 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 data for 2,389 students whose demographics are summarized in Table I. 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.

Table 1 Demographic Summary of the Students in this Study

	Male	Female	Subtotal	Male	Female	Subtotal
First Generation						
Pell Grant	502	88	590	85%	15%	63%
No Pell Grant	281	66	347	81%	19%	37%
Subtotal	783	154	937	84%	16%	
Non-First Generation						
Pell Grant	550	58	608	90%	10%	42%
No Pell Grant	711	133	844	84%	16%	58%
Subtotal	1261	191	1452	87%	13%	

The majority of the study group is male which is typical of the majors involved in this study. A slightly higher percentage of the first generation students are female than for the group as a whole which may be a result of some of the outreach efforts to attract women to into STEM fields. First generation students are more likely to receive Pell Grants which is expected based upon parental income differentials between those who did and did not attend college.

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 407 HVAC - 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.

The makeup of tracked courses ranges from freshman to senior level, as shown by the course numbers. Although 300-level courses typically imply a junior-level course, for some students in many of the technology courses these constitute senior-level work.

Project Outcomes

This paper follows up on the initial analysis of data that found a correlation between student attendance and academic success and a following analysis that examined the complexities of instructor attendance policies on student attendance. This current analysis was conducted to see if there were any significant differences in student attendance based on the following three criteria:

1. Student Gender
2. First-Generation Status (Whether a student is the first individual in their family to attend college)
3. Economic Status

A student's gender comes from data volunteered by the student at the time they apply for admission to the university. First-Generation status comes from admissions paperwork submitted by the students. The declaration of First-Generation status is voluntary on the part of the student. The examination of Economic Status involved dividing the data into two parts: students that were receiving Pell grants and those that were not. This can be a bit of an over simplification about how the finances of a student can affect their attendance but it was the only track able data available to the study.

The Effects of Gender

Figure 1 shows the correlation between student percentage of attendance and the final grade that they received in the course. The data in this plot continues to support the conclusions from the first research paper even as additional data points are added to the database after each academic year. However, unlike the original study, this time the data is broken out by gender.

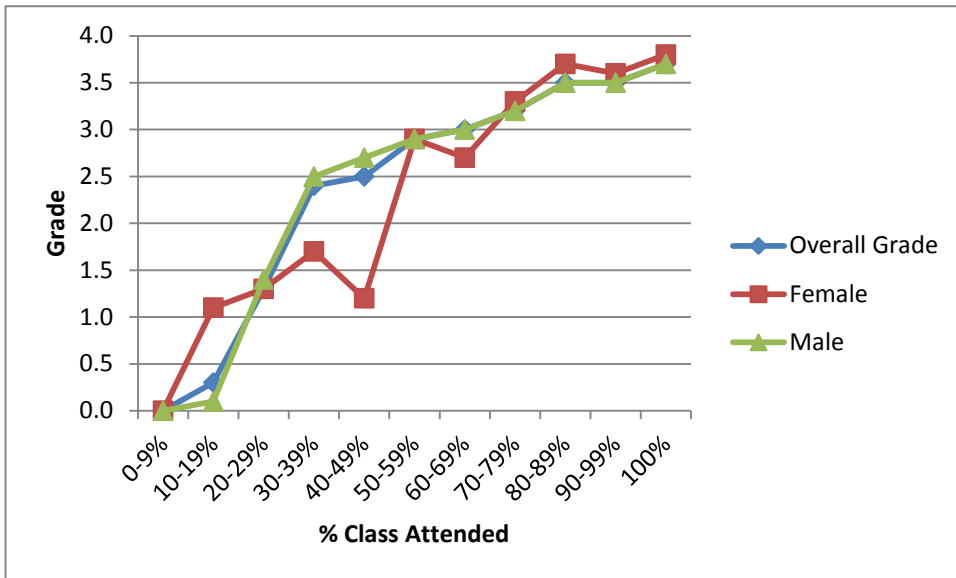


Figure 1, Final Course Grade versus Attendance by Gender

For students getting passing grades (a GPA of 2.0 or greater) it can be seen that there is not a significant difference in the correlation between attendance and course grade related to gender. However, for students that are receiving failing grades the gender difference is significant. Female students in the 40-49% attendance group received grades below passing whereas males in the same attendance category managed to achieve passing grades. The situation is reversed in the very poor attendance category (10-19%) where the female students were able to achieve a much higher grade than their male counterparts. Why this occurred is not readily known.

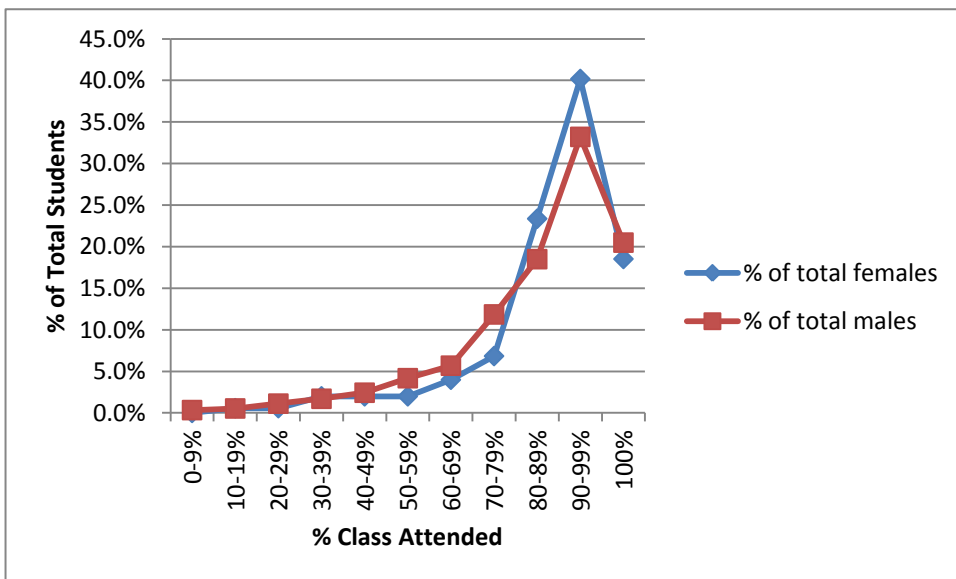


Figure 2, Attendance Percentage in relation to total student population

Figure 2 shows the rate of attendance in relation to the total population of students. The data supports the impression that the majority of students do attend with decent regularity. There is a 6% difference between males and females at the peak of the graph (90-99% attendance) but

overall there doesn't seem to be a large variance between the attendance of males versus females in the courses. The overall percentage of attendance by gender is shown in the following table.

Table 2, Summary of Student Attendance by Gender

%Attendance	Overall	Male	Female
All Students	82.5%	82.1%	85.2%

The data indicates that attendance by female students is slightly higher than for males but attendance rates don't seem to vary greatly based upon gender.

The Effects of First-Generation Status

Figure 3 provides context to this section by allowing us to view how first-generation students performed in class. Figure 3 shows that the class performance of First-Generation students correlated with all other students in the class with the same attendance.

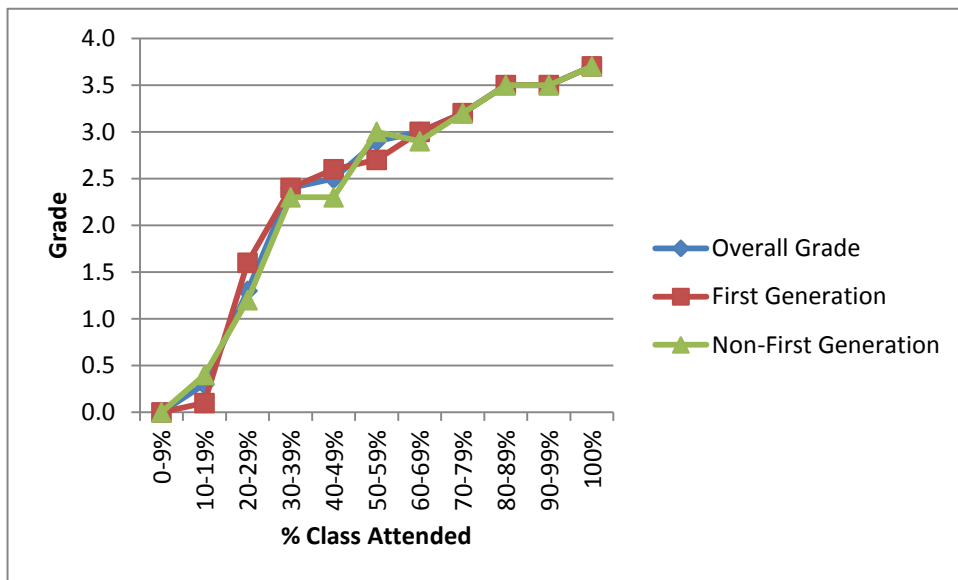


Figure 3, Final Grades for First-Generation versus Non-First Generation students

The chart indicates that a First-Generation student will perform similarly to a non-First-Generation student with similar attendance. The next question would be to compare the attendance rates between these two groups. The following table shows this data.

Table 3, Summary of Student Attendance by First-Generation Status

%Attendance	Overall	Male	Female
All Students	82.5%	82.1%	85.2%
First-Generation	80.6%	80.1%	83.6%
Non-First-Generation	83.7%	83.3%	86.6%

The data in the table shows a consistent 3% lower attendance rate among First-Generation students compared to non-First-Generation students. The data was next divided along gender lines and plotted in Figure 4.

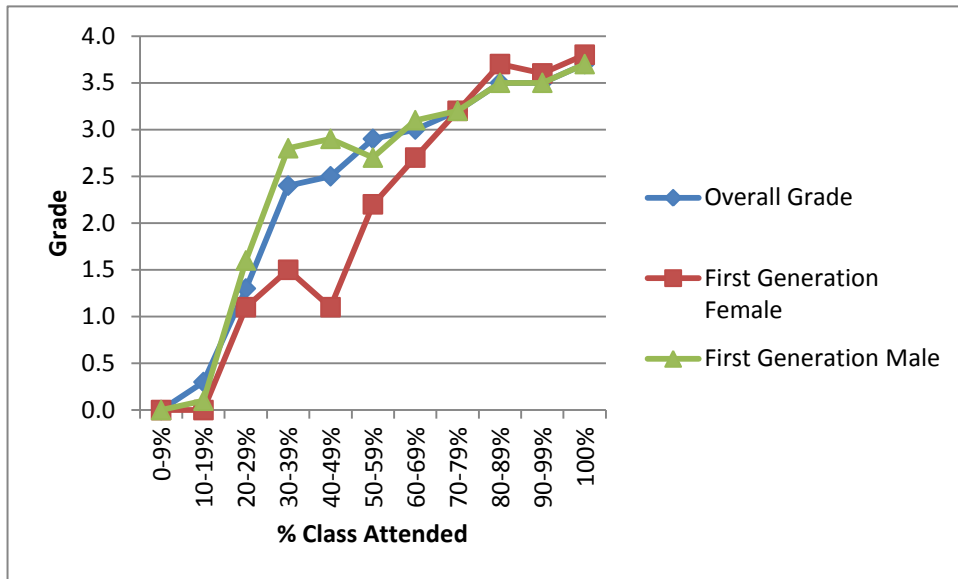


Figure 4, First-Generation data sorted by gender

This data corresponds with the data from the previous section on Gender. It shows that female First-Generation students in the 40-49% attendance bracket did not perform as well in class as their male counterparts which is the same effect as seen in Figure 1 for female vs. male students.

The Effects of Economic Status

The next Figure shows similar data but divided by student Economic Status.

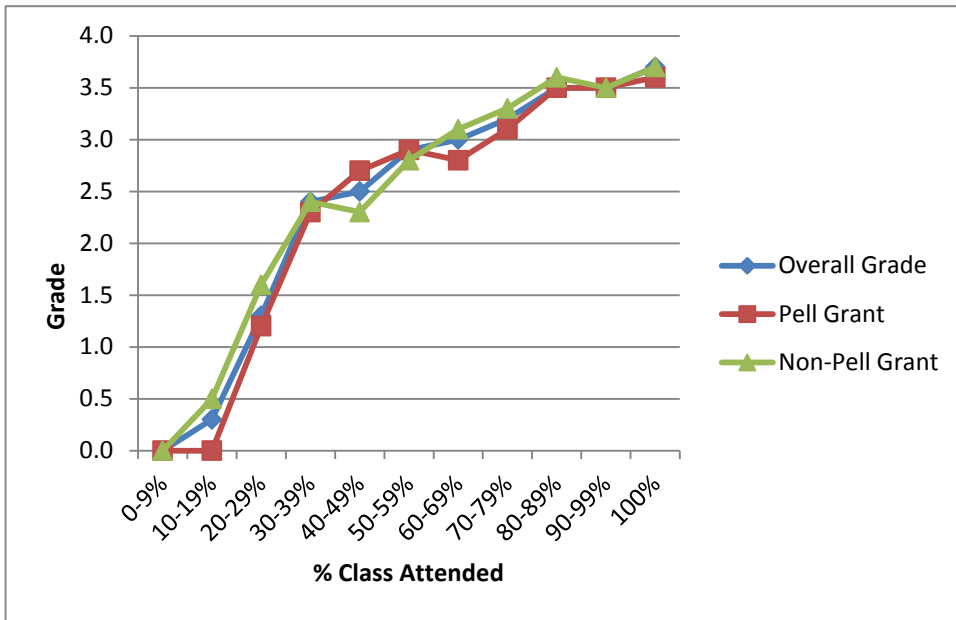


Figure 5, Student Performance by Economic Status

Figure 5 shows similar performance regardless of Economic Status for students as long as they have similar attendance as other students. Table 4 shows the overall attendance percentages divided by Economic Status.

Table 4, Summary of Student Attendance by Economic Status

%Attendance	Overall	Male	Female
All Students	82.5%	82.1%	85.2%
Pell Grant	81.6%	81.3%	84.1%
No Pell Grant	83.4%	82.9%	86.1%

This indicates that students on Pell Grants averaged 2% lower on their attendance than students not on Pell Grants and this deficit was similar for male and female students. Finally, Figure 6 separates Economic Status by student gender.

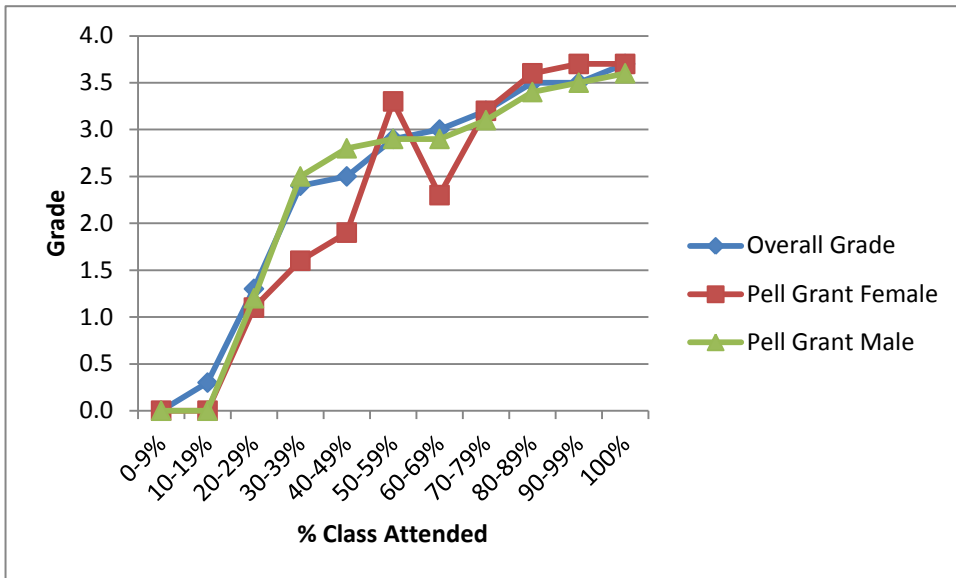


Figure 6, Pell Grant students separated by gender

Figure 6 shows little difference for Pell Grant students based on gender for the lower attendance and lower grades and also the higher attendance and higher grade students. The middle range of attendance and final grade is where gender seems to make a significant difference.

Project Outcomes, Conclusions and Future Plans

The following conclusions were derived from the data:

1. Their continues to be a strong correlation between attendance and success.
2. Gender does not seem to make a difference on that strong correlation except for the middle range of attendance and performance. Why there are discrepancies based on gender in this mid-range is not understood at this time.
3. Female students have a slightly higher attendance percentage but not significantly so.
4. The success that student's experienced in their courses was mostly independent of First-Generation and Economic statuses. In other words, students with the same attendance performed similarly regardless of these two categories.
5. There was a slightly lower attendance rate among First-Generation students (-3%) and among students on Pell Grants (-2%).
6. First-Generation status does not seem to make a difference on that strong correlation except for the middle range of attendance and performance when divided by gender. Why there are discrepancies based on gender in this mid-range is not understood at this time.
7. Economic Status follows the same pattern, namely that attendance correlates strongly to success, and that gender only seems to create separation in the data in the middle range of grades and attendance percentage.

In deriving conclusions from the data it is important to remember some limitations of the data. First, there is the very simple definition of Economic Status. Using the simple fact of whether or not a student is on a Pell grant cannot completely capture the impact of personal finances on a student's ability to succeed in college. Second, in order for the university to know if a student is a First-Generation college attendee requires that student to self-report this information.

Consequently, there may be some First-Generation students that are not accurately categorized in the data. Finally, the data has yet to be examined to develop any theories as to why data separated by gender shows the variations in the middle grades and middle attendance percentage. Females continue to be a smaller percentage of students in the Engineering and Technology programs and perhaps this is a function of the smaller sample size for female students.

This is an ongoing study. Additional data continues to be added to the database at the end of each quarter. The engineering and technology programs have grown at our institution and this has resulted in the hiring of additional faculty. These additional faculty members were recently added to the study and should result in a large increase in the rate of data gathering. 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 ethnic groups?
- If a single instructor used two different attendance policies for two different sections of a course would there be a detectable difference in student success?
- 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 day-of-class have any correlation with the final grade?
- Does the time of day that a class is offered have a measured affect on student attendance?

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.

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