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Daulet Moldabayev
*Nazarbayev University*

Joseph A. Menicucci
*Nazarbayev University*

Nidhal Abdulaziz
*University of Wollongong in Dubai*

Sarim Al-Zubaidy
*Nazarbayev University*

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# Attendance, Performance and Culture – Experience of the School of Engineering, Nazarbayev University

DauletMoldabayev[1], Joseph A. Menicucci Jr. [1], NidhalAbdulaziz [2] and Sarim Al-Zubaidy [1+]

[1] School of Engineering, Nazarbayev University

[2] Department of Computer Science and Engineering, University of Wollongong in Dubai

**Abstract.** This paper investigates the relationship between attendance and overall academic performance of students at a newly established research focused university located in Central Asia.Student attendance at Nazarbayev University was noted at every session during the entire inaugural academic year. Final marks for all modules and grade point averages (GPAs) of the students for the fall and spring semesters were analyzed to ascertain the influence of attendance on grades and overall performance of students. Moreover the data sets were separated by gender and also analyzed. The analysis shows that correlation coefficients of attendance data and final marks are positive for thirteen out of a total of fourteen modules. It was observed that attendance data and GPAs have better correlation in the fall semester than in the spring semester. The correlation between attendance and GPA correlation for male students is lower than for female students.

**Keywords:** Attendance, Performance, Correlation, Culture.

### Notations

*X, Y* – data samples, i.e. vectors of numbers

$x_i, y_i$ – the*i*-th components of *X* and *Y* data samples

*n*– size of a data sample, i.e. length of a vector of numbers

$\rho_{XY}$ – correlation coefficient of *X* and *Y*

$\mu_X, \mu_Y$ – arithmetic means of *X* and *Y*

$S_X, S_Y$ – standard deviations of *X* and *Y*

$\sigma_X^2, \sigma_Y^2$ – variances of *X* and *Y*

$H_0$ – statistical hypothesis, null hypothesis.

*t* – the value of *t* statistic

MSD – Modelling and Software Development module

ELDC – Electronic Devices and Circuits module

ESD – EngineeringSystems Design module

## 1. Introduction

In higher education, reasons given by students for non-attendance are: assessment pressures, inconvenient timing of the lecture, poor lecturing, and poor quality of lecture content[1]. Non-attendance can also be due to stress and low motivation[2]. The impact of absenteeism on academic performance, however, has been well documented. For instance, Colby[3] shows a positive relationship of student attendance on performance for a first year undergraduate subject. Several other researchers[4,5,6,7] found a strong correlation between attendance and academic performance. Similarly, Credeet al.[8] conclude that class attendance is the best predictor of college grades than any other. Immerman[9] showed a significant relationship between attendance and performance for adult American Indian students. Romer[10] and Halpern[11]concluded that attendance and academic performance are strongly related in a in a microeconomics course and a course on Airport Business management, respectively.

[+] Corresponding author. Tel.: +7-717-270-6620.
*E-mail address*: *sal-zubaidy@nu.edu.kz.*

However, a weak relationship between student attendance and academic performance was reported by Hammen and Kelland[12]in a human physiology course and by Browne et al.[13] for a microeconomic principles class. Buckles and McMahon[14] reported that attendance did not improve student understanding for classes that uses material covered in reading assignments. Likewise, a Durden and Ellis[15] analysis has found that the effect of classroom attendance on student assessment marks is weak.

A strong link was found between attendance and attainment by Hemers[16] for a first-year bioscience degree; the use of robust and visible attendance monitoring system was therefore recommended. An attendance and performance monitoring system was established at Newcastle University for first year biomedical sciences students that allowed early intervention by academic staff for students with high rates of absence and poor performance. Bevittet al.[17] evaluated the monitoring system and student perceptions were evaluated and found to be positive. Similarly, Newman-Ford et al.[18]evaluated the attendance of 22 first year modules within four separate programmes at the University of Glamorgan, UK, using an electronic attendance monitoring system called UniNanny. The result of the study was in agreement with Colby's finding of the strong correlation between learning event attendance and academic achievement.

Likewise Moor et al.[19] have investigated the importance of class attendance for academic success in an introductory science course; they found that some students who attend class regularly earn poor grades, while other students who seldom come to class had managed to pass. Therefore, they arrived at the conclusion that class attendance enhances, but does not ensure, the probability of succeeding in science classes.

A study of gender differences in undergraduate attendance rates conducted by Woodfieldet al.[20] showed that men have higher absentee rate than women. A number of variables were examined in this study and the attendance rate was the strongest predictor of academic performance. Finally, Finn[21] and Alexander et al.[22] have found that absenteeism is a strong indicator of students likely to drop-out.

The uniqueness of the current work is being able to examines and analyze the influence of attendance for culturally unified student body on their performance in a newly established university that has the mandate, resources, and political direction to become the flagship of the country and one of the world's leading research universities.

## 1.1. Students' Culture and Communication Styles

Nazarbayev University is now only open to students from Kazakhstan, although an open enrollment plan will eventually be phased in. As such, the cultural background of the student body is fairly uniform. In Kazakhstan, maintaining relationships and honor is very important. It is common for students to greet their friends with a handshake as they enter the classroom--even if they are late to class! We have observed that a number of our students do not directly address concerns, speak in a roundabout fashion rather than a linear fashion, and respond more favorably to gentle probing rather than direct questioning, as suggested by a global etiquette website[23].

Elena Rodriguez-Falcon et al.[24] concluded a survey of an international group of students at Sheffield university for a class of over 250 engineering management students. The study included a qualitative analysis of students' origins and perceptions about what "must be done" and "must not be done" in their society. The Rodriguez-Falcon study highlights the significant cultural differences between the Western mindset and the mindset of students from Asian backgrounds. Specifically, students from numerous Asian countries all listed issues related to respecting authority as very important whereas students from Australia and the United States identified that maintaining positive relationships with their colleagues was much more important. Because the school of engineering and Nazarbayev University are operating on a western module of education, attention is consistently being paid on preventing potential conflicts between the Asian and Western value systems.

## 1.2. Brief Description of the Degree Programmes

The School operates on a European system of higher education, in line with the Bologna agreement, to which Kazakhstan has signed. Hence, it offers 3-year Bachelor of Engineering degree programmes, followed by 2-year Masters of Science programmes. Currently, the School is offering degrees in the following four engineering disciplines: chemical, mechanical, civil, and electrical &electronic engineering.

In 2014, Masters programs will be introduced for further advanced study in the four disciplines. In 2015, teaching of a further three MSc tracks will begin.

### 1.3. International Development of the Curriculum

University College London (UCL) is the strategic partner for the Nazarbayev University School of Engineering. In addition to providing their own perspective, UCL has also engaged with faculty from both the University of Melbourne (MEL) and the Colorado School of Mines(CSM) to gainassistance in developing the scope for the Year 1 design modules and laboratory studies modules. The University of Melbourne combines lectures with workshops in which the students work in teams to undertake tasks that require creative thinking and an interdisciplinary approach. This approach to undergraduate education is not only new in Kazakhstan and central Asia but is also different in approach and learning outcomes.

## 2. A Description of Data

In 2011 the intake of the School of Engineering of Nazarbayev University consisted of 138 students: 88 men and 50 women. Students' attendance was noted at each educational activity (lectures, laboratory works, etc.) for the 2011-12 academic year. In semester 2 students were prompted to choose a department for their future specializations;58 students selected chemical engineering (23 female), 35 selected civil engineering (19), 28 students selected mechanical engineering (3), and 19 students selected electrical & electronic engineering (5). For evaluation purposes, it should be noted that specialization modules such as Introduction to Chemical Engineering, Introduction to Civil Engineering, etc. were attended only by students of relevant department. All other modules were common to all engineering students.

### 2.1. Analysis Methodology

Given the two samples *X* and *Y* of *n* measurements, the sample correlation coefficient can be computed using the formula:

$$\rho_{XY} = \frac{\sum_{i=1}^{n}(x_i - \mu_X)^2(y_i - \mu_Y)^2}{(n-1)S_X S_Y},$$

where the standard deviation $S_X$ and sample mean $\mu_X$ of the sample X are computed as:

$$S_X = \sqrt{\sigma_X^2}, \qquad \text{where}\sigma_X^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \mu_X)^2, \qquad \mu_X = \frac{1}{n}\sum_{i=1}^{n} x_i.$$

The values for$S_Y$ and $\mu_Y$ are calculated in the same fashion.

The correlation coefficient $\rho_{XY}$ always lies in the range$[-1, 1]$. Note that if $\rho_{XY}$= $+1$, this reflects a perfect positive (increasing) linear relationship. If $\rho_{XY} = -1$, this indicates a perfect negative (decreasing) linear relationship.

### 2.2. Student's *t*-test for Two Samples

Student's *t*-test is a statistical hypothesis test in which the test statistic (*t*) follows a Student's *t* distribution if the null hypothesis is supported. Given two data samples *X* and *Y* of size *n*, the *t* statistic is computed as:

$$t = \frac{\mu_X - \mu_Y}{S_{\mu_X - \mu_Y}}, \text{ where}S_{\mu_X - \mu_Y} = \sqrt{\frac{S_X^2}{n} + \frac{S_Y^2}{n}}.$$

$S_{\mu_X - \mu_Y}^2$is an estimator of variance.

Here we use the *t*-test adapted for the case of two samples of equal size but different variances.

The computed *t* statistic follows Student's *t* distribution if the null hypothesis is supported. The degrees of freedom of Student's *t* distribution are evaluated using the formula:

$$d.f. = \frac{(S_X^2/n + S_Y^2/n)^2}{\frac{1}{n-1}((S_X^2/n)^2 + (S_Y^2/n)^2)}.$$

The null hypothesis $H_0$ assumes the equality of the means of two data samples *X* and *Y*.

The *p*-value is the minimum significance value at which the null hypothesis is rejected for the given estimate of the*t* statistic. In this statistical test we use the significance level,$\alpha = 0.05$. Hence, if the *p*-value will be lower than significance level $\alpha$, the null hypothesis will be rejected.

### 2.3. Student t-test Analyses Results

A *t*-test was performed on average attendance and average final marksforall modules. In all of the *t*-tests, the hypothesis of equality of the means of data samples was rejected. The p-values ranged from 2.41E-9 to 0.00012. These resultsindicate that the means of the attendance and final marks samples are not equal. We relate this result to the fact that a strict attendance policy was adopted at Nazarbayev University. According to this policy, students must attend at least 70% of sessions in each module.Graphs of average attendance and average final marks per module for each semester are shown in Figure 1 and Figure 2.

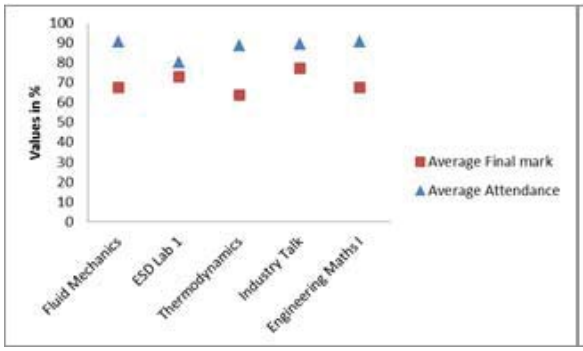


Figure1: Average attendance and average Semester 1

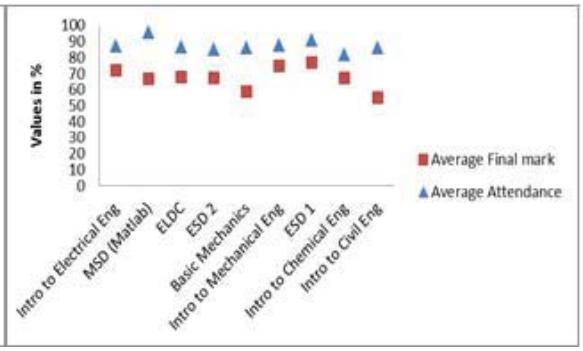


Figure2: Average attendance and average final mark, final mark, Semester 2

## 3. Results

Two data sets (Attendance and GPA, Attendance and Final Marks) were analyzed to determine the correlation between these parameters, if any. Moreover, the Attendance and GPA data set wasalso analyzed by gender. Figure 3 shows the correlation between student attendance and final mark in the first semester of the 2011-12 academic year. The minimum correlation was -0.048 and corresponds to the Fluid Dynamics module. This indicates that the attendance of students did not have a positive influence on their final marks. The highest correlation (0.293) in the first semesterwas in the Engineering Mathematics 1 module. This indicates that there was a positive correlation between students' attendance during the course and their finalmarks.

The positive correlation between attendance and academic performance, expressed by final marks, was more pronounced in semester 2, as shown in Figure 4. The minimum correlation was observed in the Introduction to Electrical Engineering module. However, this discipline-specific course had only 19 students, loweringthe statistical significance of the correlation. Introduction to Mechanical Engineering, Introduction to Chemical Engineering, and Introduction to Civil Engineering were attended by 27, 58 and 35 students, respectively. All other semester 2 modules were common for all engineering students. Correlations observed at these modules are similar to those observed in semester 1. A positive correlation coefficient indicates the existence of a relationship between attendance and final marks.

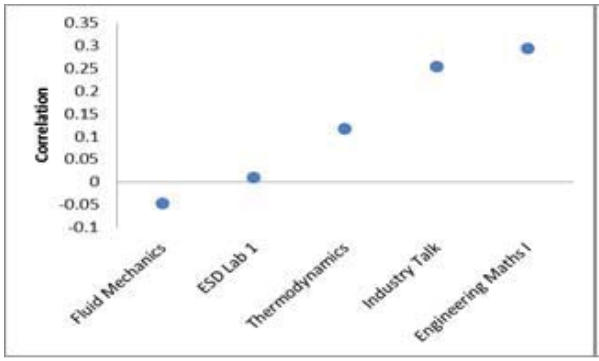


Figure3: Correlation between Attendance and Final Marks, Semester 1

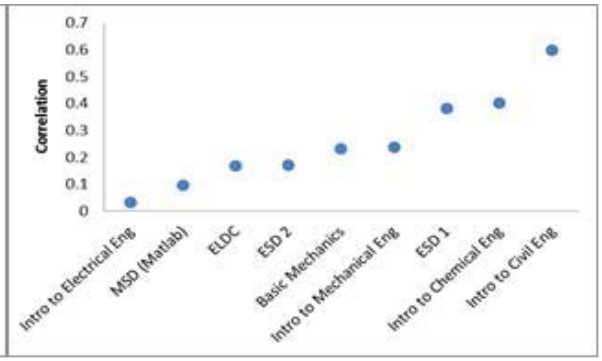


Figure4: Correlation between Attendance and Final Marks, Semester 2

The correlation between student module attendance and their semester 1 course GPAs is shown in Figure 5. These correlations are presented both for overall student performance and also for student performance by gender. The highest correlation is observed for male students' average attendance during semester 1. The

correlations for male and female students do differ significantly. The results generally demonstratea positive correlation between attendance and course GPA.

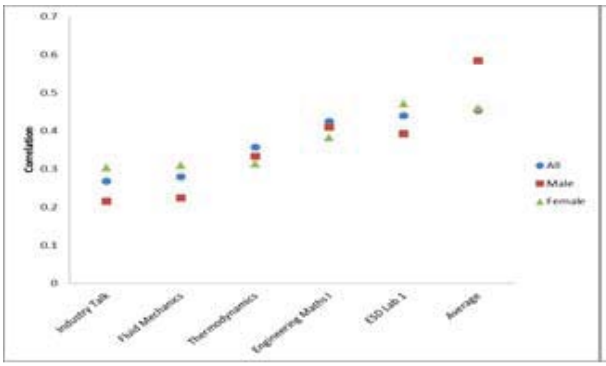


Figure5: Correlation between Attendance and GPA, Semester 1

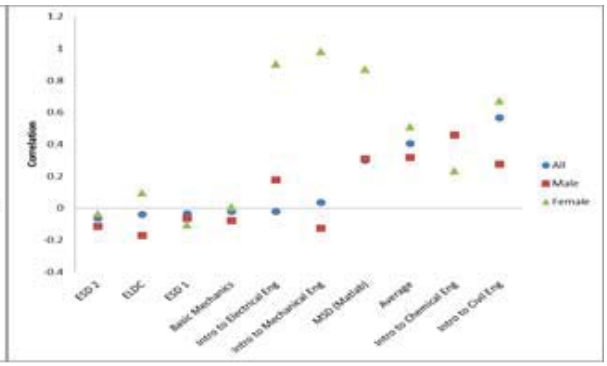


Figure6: Correlation between Attendance and GPA, Semester 2

The correlation between student attendance and semester 2 GPA are presented in Figure 6. These correlations are presented both for overall student performance and also for student performance by gender. The correlation in all common modules, except Modelling and Software Development (MSD), is slightly below zero, which indicates that there was no relationship between attendance and GPA. Note that the high correlation between attendance and GPA for female students in Introduction to Mechanical Engineering can be attributed to small sample size.

## 4. Conclusion

An analysis of data from the first year of the School of Engineering at Nazarbayev University has indicated a strong positive correlation between overall semester GPA and overall student attendance. The correlation coefficient relating attendance and semester GPA was 0.454 for the first semester and 0.403 for the second semester. Interestingly, this correlation (attendance and semester GPA) indicated a stronger correlation for male students as compared to female students in semester 1 (0.584 to 0.460) but the opposite effect in semester 2 (0.317 to 0.507). The correlation between final mark and attendance was course dependent, ranging from -0.048 (Fluid Mechanics) to 0.597 (Introduction to Civil Engineering).

## 5. Acknowledgements

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## 6. References

[1] S. Hunter and J. Tetley. Lectures. Why don't students attend? Why do students attend? *Proc. of HERDSA annual international conference.* Melbourne:Higher Education Research and Development Society of Australia.1999, pp. 1-8. URL: http://www.herdsa.org.au/wp-content/uploads/conference/1999/pdf/Hunter.PDF

[2] R.Kottasz. Reasons for student non-attendance at lectures and tutorials: An analysis. *Investigations in University Teaching and Learning.*2005, **2**(2): 5-21.

[3] J. Colby. Attendance and attainment. *5th ICS-LTSN,Annual Conference*. University ofUlster. 2004.

[4] D. C.Vidler. Curiosity, academic performance, and class attendance. *Psychological Reports*. 1980,**47**(2): 589–590.

[5] J. Brocato. How much does coming to class matter? Some evidence of class attendance and grade performance. *Educational Research Quarterly.* 1989, **13** (3): 2-6.

[6] P. Martinez. Improving student retention and achievement. What do we know and what do we need to find out? London: Learning and Skills Development Agency. 2001.

[7] S.Obeidat,A.Bashir andW. Abu Jadayil. The importance of class attendance and cumulative GPA for academic success in Industrial Engineering classes. *International Journal of Social and Human Sciences*. 2012, **6**: 139-142.

[8] M.Crede, S. G.RochandU. M.Kieszczynka. Class attendance in college: a meta-analytic review of the relationship of class attendance with grades and student characteristics. *Review of Educational Research.*2010,**80**: 272-295.

[9] M. A.Immerman. The relationship between attendance and performance in a remedial mathematics program with American Indian adults. *ERIC Document Reproduction Service No. ED216811*. 1982.

[10] R. Romer. Do students go to class? Should they? *Journal of Economic Perspectives*.1993, **7** (3): 167-174.

[11] N.Halpern. The impact of attendance and student characteristics on academic achievement: findings from an undergraduate business management module. *Journal of Further and Higher Education.*2007, **31**(4): 335-349.

[12] C.S.Hammen andJ.L.Kelland. Attendance and grades in a human physiology course. *Advances in Physiology Education*.1994, **12**(1): 105-108.

[13] N. M.Browne, J.Hoang, M. V.Wheeler andN. Boudreau. The impact of teachers in economic classrooms. *Journal of Economics.* 1991,**17**: 25-30.

[14] S. G.Buckles andM. E.McMahon. Further evidence on the value of lecture in elementary economics. *Journal of Economic Education*. 1971,**2**(2): 138-41.

[15] G. C.Durden andL. V.Ellis. Is class attendance a proxy variable for student motivation in economics classes?: an empirical analysis. *International Social Science Review*. 2003,**78**: 22-34.

[16] E.Hemers. Attendance and attainment are they linked: a study in the first-year of a bioscience degree. *CETL Journal Innovations in Practice.*2010, **2** (2): 93-103.

[17] D.Bevitt, C.Baldwin and J.Calvert. Intervening early: attendance and performance monitoring as a trigger for first year support in the biosciences. *Bioscience Education.*
2010, **15**.URL:http://www.bioscience.heacademy.ac.uk/journal/vol15/beej-15-4.aspx

[18] L.E.Newman-Ford, K.Fitzgibbon, S.Lloyd andS.L.Thomas. A large-scale investigation into the relationship between attendance and attainment: a study using an innovative, electronic attendance monitoring system. *Studies in Higher Education*. 2008, **33** (6): 699–717.

[19] R.Moore, M. Jensen, J.Hatch, I. Duranczyk, S.Staats and L.Koch. Showing up: The importance of class attendance for academic success in introductory science courses. *American Biology Teacher*. 2003, **65**: 325–329.

[20] R. Woodfield, D. Jessop and L. McMillan. Gender differences in undergraduate attendance rates. *Studies in Higher Education*. 2006,**31**(1): 1-22.

[21] J. D. Finn. Withdrawing from school. *Review of Educational Research*. 1989,**59**: 117–142.

[22] K. L. Alexander,D. R. Entwisle and N. S. Kabbani. The dropout process in life course perspective: Early risk factors at home and school. *Teachers College Record*. 2001,**103**: 760–822.

[23] http://www.kwintessential.co.uk/resources/global-etiquette/kazakhstan.html

[24] E.Rodriguez-Falcon, A.Hodzic and A. Symington. Learning from each other: engaging engineering students through their cultural capital. *Engineering Education*. 2011,**6**(2): 29-38.