The Prevalence and Impact of Class Absenteeism in Engineering

NAZARBAYEV UNIVERSITY

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1. Introduction

Class attendance has been the subject of a substantial amount of research. One reason for this interest is that academic institutions increasingly seek ways to enhance student success. Institutions have turned their attention to issues that they can address through the implementation of policies, procedures, and/or support services intended to influence academic outcomes. Class absenteeism is one such issue.

The field of engineering, however, is characterized by a scarcity of empirical research on attendance. Studies conducted in this field are overwhelmingly based on simple bivariate analyses and include only a few (often 1 or 2) courses. The present study uses a large and unique dataset (over 14,000 course attendance records tracked electronically) from an elite research university in Kazakhstan. It estimates the prevalence of class absenteeism and assesses its impact on the academic performance of engineering undergraduate students.

2. Attendance Rates in Engineering: Review of Previous Studies

Study	Country / Institutions	Number of Students	Number of Courses	Attendance Rate
Nyamapfene (2010)	UK: 1 institution	43	1	56%
O'Dwyer (2011)	Ireland: 1 institution	128	1	55%
Moldabayev et al. (2013)	Kazakhstan: 1 institution	138	14	80%
Guleker & Keci (2014)	Albania: 1 institution	94	2	79.9%
McCool et al. (2015)	Ireland: 1 institution	1263	18	78.8%
Amoo and Swart (2018)	South Africa: 1 institution	109	7	48% to 55%

Note: This review focuses on studies conducted within the last 10 years.

3. Relationship between Attendance and Performance in Engineering

Study	Country	Number of Students / Number of Courses	Relationship with Performance
Bivariate correlation studies:			
Nyamapfene (2010)	UK	43 students; 1 course	+
Moldabayev et al. (2013)	Kazakhstan	138 students; 14 courses	+
Elmore (2013)	USA	300 students; 2 courses	Insignificant
Guleker & Keci (2014)	Albania	94 students; 2 courses	+
Bennett & Yalams (2013)	Jamaica	24 students; 1 course	+
Basic linear regression studies:			
Purcell (2007)	Ireland	136 students; 2 courses	+
O'Dwyer (2011)	Ireland	128 students; 1 course	+
Amoo & Swart (2018)	South Africa	109 students; 7 courses	+ in first year; insignificant in final year
Multivariate linear regression studies:			
Obeidat et al. (2012)	Jordan	140 students; 3 courses	+
McCool et al. (2015)	Ireland	1263 students; 18 courses	+

Note: This review mostly focuses on studies conducted within the last 10 years.

4. Characteristics of Research on the Impact Attendance in Engineering

- Scarcity of studies on impact of attendance/absenteeism in engineering (Bennett & Yalams, 2013; McCool et al., 2015; Purcell, 2007)
- Existing studies overwhelmingly based on simple bivariate relationships
- Overwhelming reliance on data from one or just a few courses
- Magnitude of the relationship between attendance and performance not specified
- Lack of clarity on whether the impact of attendance differs across student levels

5. Study Purpose and Research Question

Study Purpose: To estimate the prevalence of absenteeism among engineering students and examine how absenteeism impacts undergraduate academic performance?

Basic research questions:
(1) What is the prevalence of class absenteeism among engineering undergraduate students, and does this prevalence vary based on how long the student has been in the program?

(2) Does class absenteeism impact academic performance and, if so, does this impact depend on how far the student has been in the program?

6. Institutional Context

Elite public research university in Kazakhstan

- English-medium instruction
- Founded in 2010
- 8 schools

± 4,800 students
- 15.6% Preparatory
- 61.6% Undergraduate
- 22.6% Graduate

± 470 faculty
- 75% International
- 35% Female

7. Sample and Data

802 Engineering undergraduate students (enrolled between fall 2013 and spring 2016)

14,514 course records (one per student, per course, and per term)
- ✓ Attendance tracked each class session, using magnetic card readers

91 unique courses, accounting for 65% of the Engineering undergraduate curriculum
- ✓ 100% of courses offered from fall 2013 to spring 2015 (two academic years) tracked
- ✓ 77% of courses offered in fall 2015 and spring 2016 (one academic year) tracked

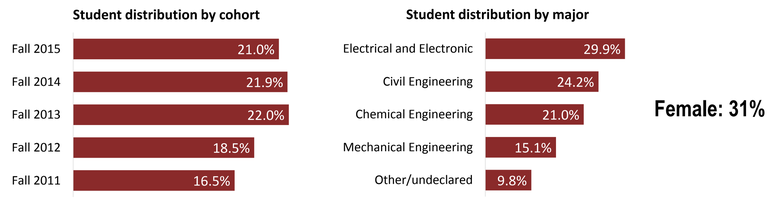
Term class attendance was tracked

Cohort	1st	2nd	3rd	4th	5th	6th	7th	8th
Fall 2011					✓	✓	✓	✓
Fall 2012			✓	✓	✓	✓	✓	✓
Fall 2013	✓	✓	✓	✓	✓	✓		
Fall 2014	✓	✓	✓	✓				
Fall 2015	✓	✓						

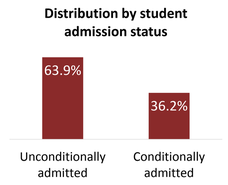
Data transformed from multiple course records per student and per term (**raw dataset**) to one aggregate attendance record per student and per term (**analytical dataset**)

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6	Term 7	Term 8	Total
Raw dataset (multiple course records)	2,414	2,269	2,261	2,283	2,069	2,032	647	539	14,514
Analytical dataset (one aggregate record)	**516**	**504**	**486**	**471**	**436**	**438**	**228**	**264**	**3,343**

8. Sample Description



Female: 31%



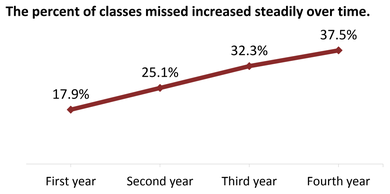
Quantitative background variables	Mean	SD	N
Age at undergraduate admission	18.96	0.64	794
Secondary school GPA (out of 5)	4.96	0.08	788
Overall English (IELTS) test score (out of 9)	6.21	0.57	789
Math Subject Entrance Test score (out of 30)	18.29	3.21	742

9. Overview of Analytical Procedures

- **Absenteeism measure** — For student *i*, compute the % of class sessions missed in course *j* and term *t*. Then aggregate class absenteeism rates across all *j* courses taken by student *i* in term *t*.
- **Absenteeism quartiles** — Classify student *i* into one of 4 absenteeism quartiles based on the student's aggregate absenteeism rate relative to other students in the same cohort and term *t*.
- **Multilevel model (test of interaction)** — Fit multilevel model and test interaction between absenteeism and academic term. Assess model appropriateness using the ICC and the design effect (Peugh, 2010).
- **Visualization of multilevel results** — Use Mitchell's (2012) approach to estimate/present adjusted term GPA as a function of absenteeism and term in the program, after adjusting for background variables.
- **Effect size computation** — Compute Cohen's *d* effect size (Cohen, 1988, 1992; Rosenthal, 1996) to examine the magnitude of the relationship between absenteeism and academic performance.

10. Descriptive Statistics: Absenteeism Rates

The percent of classes missed increased steadily over time.



There was considerable variation by term:

- *Lowest absenteeism*: First term (11.2%)
- *Highest absenteeism*: Eighth term (45.8%)

Corresponds to final or graduation term

11. Multilevel Model Results

	Estimate	SE
Fixed Effects		
Absenteeism quartile 1 (reference)		
Absenteeism quartile 2	-0.12*	0.05
Absenteeism quartile 3	-0.14**	0.05
Absenteeism quartile 4	-0.20***	0.05
Absenteeism quartile 1 x Terms in the program	0.03*	0.01
Absenteeism quartile 2 x Terms in the program	0.01	0.01
Absenteeism quartile 3 x Terms in the program	0.01	0.01
Absenteeism quartile 4 x Terms in the program	-0.03**	0.01
Electrical & Electronic Engineering (Reference)		
Chemical Engineering	0.00	0.02
Civil Engineering	-0.11***	0.02
Mechanical Engineering	0.03	0.03
Undeclared major	-0.14*	0.06
Term credit load >= 15	0.00	0.02
Conditionally admitted student	-0.27***	0.02
Low entry English proficiency (Reference)		
Medium entry English proficiency	0.00	0.02
High entry English proficiency	0.11***	0.03

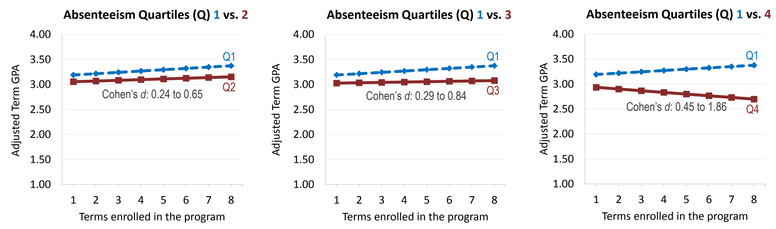
*** p < 0.001; **p < 0.01; *p < 0.05

	Estimate	SE
Fixed Effects		
Math test score <17 (Reference)		
Math test score 17 – 20	0.05*	0.02
Math test score >= 21	0.10***	0.02
Perfect secondary school GPA	0.11***	0.02
Kazakh-Turkish School (Reference)		
Nazarbayev Intellectual School	-0.05	0.03
Math-Physics School	-0.01	0.03
Other types of schools	0.04*	0.02
Male student	-0.06**	0.02
Age at undergraduate admission	-0.04**	0.01
Intercept	4.01***	0.29
Random Effects		
Variance of level 2 intercept	0.0039	0.002
Variance of level 1 residuals	0.2308	0.006

ICC = .02, suggesting that most of the variation in GPA is attributed to differences at the student rather than term level. However, the design effect was 7.9 (greater than the 2.0 value used as rule of thumb), which suggests that multilevel modeling was still needed.

12. Adjusted Term GPA and Effect Size (Based on Multilevel Estimates)

Compared to students in the 1st quartile, students in higher quartiles of absenteeism had significantly lower term GPA. The difference between the 1st and 4th quartile was particularly large.



13. Summary of Findings

On average, Engineering undergraduate students missed 26.6% of the class sessions during the three-year study period (fall 2013 – spring 2016). Previous studies had suggested absenteeism rates ranging from 20% (inferred from Guleker & Keci, 2014; McCool et al., 2015; Moldabayev et al., 2013) to 45% (inferred from Nyamapfene, 2010; O'Dwyer, 2011).

There was considerable variations in absenteeism rates by year and term in the program. Absenteeism was highest among seniors (37.5%) and lowest among first-year students (17.9%). Absenteeism rates were also highest in the final term (45.8%) and lowest in the first term (11.2%). Previous, smaller-scale, studies (E.g., Self, 2012; Fitzpatrick et al., 2011) had also found that seniors had higher absenteeism rates compared to other students.

Consistent with previous studies, we found that absenteeism had an adverse impact on academic performance. Students at the lowest level of absenteeism (Q1) clearly outperformed their counter-parts at higher levels of absenteeism (Q2-Q4).

The present study, however, found that the magnitude of this impact varied with time in the program. Using Cohen's *d* effect size, we found that students in Q1 outperformed those in Q2 by 24% to 65% (Mean = 48%) of a standard deviation, depending on how far they were in the program (first term to graduation term). They outperformed those in Q3 by 29% to 84% (Mean = 62%) and those in Q4 by 45% to 186% (Mean = 127%) of a standard deviation, also depending on how far they were in the program. In general, the difference in term GPA between Q1 and Q2 and between Q1 and Q3 was medium. However, the difference between Q1 (those who missed class the least) and Q4 (those who missed class the most) was very large: 84% to 98% of students in Q4 had a term GPA below the GPA of the average student in Q1.

14. Implications

When attendance/absenteeism is found to impact academic performance, this finding often leads to a debate about whether or not academic institutions should institute mandatory attendance policies. There is no consensus among scholars/practitioners on this issue.

It is important to note that although class attendance is an important factor, it does not necessarily guarantee better academic performance or learning (Newman-Ford et al., 2008). For attendance to provide the 'most academic value,' both the instructor and the student must be 'actively engaged' (Teixeira, 2016). Fitzpatrick et al. (2011) found that key reasons why students typically miss class include: competing time demand from other courses, course assignment overloads, and poor quality of teaching. These absenteeism factors suggest that, ultimately, efforts to minimize absenteeism need to focus on (1) fostering sound pedagogical practices to stimulate student motivation and learning and (2) putting into place support mechanisms (formal and/or informal) to help students cope with barriers to regular attendance.

15. References

References can be found in the scholarly paper (downloadable from the conference website and also available upon request). Contact the author at felly.chiteng@nu.edu.kz for a copy of the scholarly paper.

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