

Effect of Students' Attendance on their Academic Performance in Some Engineering Courses at the United Arab Emirates University

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Abstract

The correlation between students' attendance and their final grades was studied by many researchers in many universities across the world in a number of specializations. The aim of this study is to investigate the effect of absence on engineering students' performance in general engineering courses and more specifically in fundamental courses that are provided solely by the Mechanical Engineering Department

since there had been a substantial lack of studies involving them. In order to do so, a sample size of over 8000 students from the United Arab Emirates University UAEU was collaborated for this study with a main objective to conclude whether this relationship is significant or not. The data was generally collected over a period of five years, from 2013 to 2018. From the research conducted, the results showed that, students who do not attend class tend to perform worse on exams in engineering. Furthermore, the correlation between the student's class attendance and student's final grade is noteworthy and there is a strong correlation between them. Equally important, such low students' academic performance reflects negatively to the course learning outcomes.

Keywords: engineering students; United Arab Emirates University; student's Absences; grades; academic performance.

1. Introduction

Attendance has always been considered as one of the key factors for student's success. It is almost true that not only for professionals but also for students that "80% of success is in showing up!" [1]. Nevertheless, is it a definite truth that attendance enhances students' performance? If yes, to what degree? Or is it that its effect is not of a huge significance? Also, does the level of influence change based on the location studied? Or does the type of the course matter? Our efforts were poured into obtaining data to investigate this relationship and we attempted to answer all of these questions throughout this paper.

Attendance and grades have always been strongly attached in the minds of many. This belief was put to the test throughout the years by researchers who were eager to know the answer. Hsu and Plunkett [2] from California State University supported the previous claim after investigating it using students' data in introductory programming courses that were taken from an anonymous university. They concluded that there was a strong correlation between attendance and performance. This result was supported by other researchers such as AbuRuz [3] and Fadelelmoula [4] from the field of medicine. AbuRuz [3] findings were from the Applied Science Private University in Jordan; he reached the same conclusion focusing on the field of Nursing. In respiratory care courses Fadelelmoula [4] also found that attendance is a critical factor in the students' learning journey, but he emphasized that there is a need for further research that includes other factors such as CGPA which can be affecting the students' academic performance as well. In the same later field but at Lahore University in Islamabad, Khalid and Mehmood [5] found similar results that were backed up with 69.4% of the collected votes agreeing that absences reduce students' GPA considerably. Furthermore, researchers like Lukkarinen et al. [6] from Aalto Business University in Finland concluded that out of all the three groups they studied, attendance played a significant role in the performance of students in the second group. Their results were obtained after gathering data from classes where the attendance was not obligated and other factors that could affect the grades were controlled. Likewise, Louis et al. [7] ended up with the same outcome while investigating the results of undergraduate psychology-majored students from Australian universities. However, they added that there was a direct effect of the type of the course in determining the grade along with the attendance. For instance, courses that focuses on psychological theories are linked with better grades than those that discusses statistical

methods. Similarly, Leon [8] and Teixeira [9] both robusted the apparent perception of the relationship between absenteeism and grades' using statistics that was taken from business classes. Leon [8] gathered his information from a Macroeconomics course only, whereas Teixeira [9] did expand the study to include Microeconomics, Mathematics, Calculus, and Statistics which were all taken from the university of Porto, Portugal. In addition, Teixeira [9] went as far as quantifying the effect by stating that nonattendance worsens a student's grade by two points in a grading system that goes from 0 to 20. In spite of that, Leon [8] stated that he did not find enough evidences which conclude that the effect of absences propagates on the student's grade over time. Marburger [10] also supports Leon [8] in the sense of that the chance of getting an incorrect answer in the material covered during the student's absence is drastically higher. Other researches like Jones [11], Alghamdi et al. [12], Gump [13] and Davenport [14] are on board with the common results the previously mentioned studies have got.

On the other hand, Bethune et al. [15] found that the relationship between attendance and grades differ slightly after studying data from 30 students in Microeconomics Principle Course at Barton College, North Carolina. Their records suggested that, rather than the attendance being the best predictor of a student's academic marks, its effect was not of large strength. They agreed that the prior success of students was the strongest indicator of their performance. The findings of Benthune et al. [15] were verified by Caska and Prentice [16], from Dublin Business School, who described the attendance as a moderate predictor with a lesser significance than what is perceived. Their research was done on an intermediate level Statistics class and both researchers expressed in their paper that they were not expecting this result. Along with that, at Laureotian University, Gunn's [17] work with a psychology class also suggested that there was a correlation between attendance and performance with a percentage of 43%, yet the degree of its impact is not that clear due to the ambiguous nature of correlation analysis. Moreover, Guleker and Keci [18] studied two Civil Engineering courses (Engineering Economy and Construction Management) at a private university in Tirana, Albania and reach out to similar results as Gunn, but they would not label the relationship as a cause and effect. Their conclusions stem from the fact that there were students with good attendance standing, yet they failed the course. However, their results do suggest that the higher the number of classes the students' attend, the lower is their chance to earn an unsatisfying grade. Adding to the above, Abdi Aden et al. [19] carried out another research in the department of business and accountancy at Simad University in Somalia and their results somewhat match those of Bethune et al. [15], Prentice and Caska [16].

Table 1 A sample of relevant literature work

No.	Paper title	Courses/ Department/ University/ Country	Manuscript's Findings
1	Attendance and Grades in Learning Programming Classes [2]	Introductory of programming, Anonymous university	The study found a negative strong impact of absences on the performance of students in both exams and assignments.

2	Does Excessive Absence from Class Lead to Lower Levels of Academic Achievement? [3]	Nursing department, Applied Science Private University, Amman	A negative significant relationship was found between absenteeism and GPA.
3	The impact of class attendance on student performance [4]	Respiratory Care courses, Medicine College, Almaarefa Colleges, Riyadh, Saudi Arabia	The Author found out that attendance is very crucial in learning and he is pro mandating it.
4	Effects of Absenteeism on Students Performance [5]	Nursing department, Lahore University, Islamabad	69.4% of voters agree that absences affect performance.
5	Relationship between class attendance and student performance [6]	Aalta University of Business, Finland	There is a significant relationship between attendance and performance were the increase of one result in the betterment of the other, but other factors affecting the performance are controlled. Note: The study was done on a class where the attendance was not mandatory.
6	Teaching psychology in Australia: Does class attendance matter for performance? [7]	Psychology department, Australia	It showed that there is a strong relationship between attendance and final grades.
7	The Relation between Absences and Grades: A Statistical Analysis 18 February 2018 [8]	Microeconomics, Macroeconomics, Mathematics, Calculus, and Statistics	It concluded that a unit increase in normalized absences records results in 0.814 units decline in the mean grade of the class.
8	The impact of class absenteeism on undergraduates' academic performance [9]	Macroeconomics course, University of Porto, Portugal	The findings suggest an inverse relationship between absenteeism and grades. It showed that absences do lessens the students' final mark (around 2 points in a 0-20-point grading scheme).
9	Absenteeism and Undergraduate Exam Performance [10]	Microeconomics Course	Both attendance and performance are significantly correlated.

10	Interaction of Absences and Grades in a College Course [11]	Psychology	Absences were inversely correlated with performance.
11	Prevalence, Causes and Impacts of Absenteeism among Medical Students at UQU [12]	Medicine, Umm Al Qura University, Saudi Arabia	The results show the negative relationship between absenteeism and grades.
12	The Cost of Cutting Class: Attendance as a Predictor of Success [13]	General education course, Mid-Western State University	There is a negative inverse relationship between absences and final grades.
13	A Study of the Relationship between Attendance and Grades of Three Business Law Classes at Broome Community College [14]	Business law classes, Broome community college	There is a significant positive correlation between the attendance and academic performance. The outcome of the study indicates a strong influence.
14	Attendance, Grades and Learning in the Microeconomic Principle Course [15]	Microeconomics Principle Course, Barton College, North Carolina	Prior success was found to be the best indicator of the grades and attendance was not on that level. The effect is said to be moderate but important.
15	Assessments, appraisals, attributes and attendance: Predicting statistics goals and grades [16]	Intermediate statistics class, Business department, Irish College	The study found that attendance was not a very strong predictor of grades. The author suggest that it is of a moderate effect.
16	A correlation between attendance and grades in a first-year psychology class [17]	Psychology Department, Laurcntian University	It was found that there is a correlation and it is significant. The more the classes the students attended, the higher their grade became. Also, it was found that 43% is the percentage the attendance plays in the final grade of the student. The influence is said to be moderate since the degree of effect is ambiguous.

17	The Effect of Attendance on Academic Performance [18]	Engineering Economy and Construction Management, Civil engineering department, Private University, Albania	The outcomes suggested that the relationship was not a cause and effect. The effect is closer to moderate rather than strong.
18	The Effect of Student's Attendance on Academic Performance: a Case Study at Simad University Mogadishu [19]	Faculty of Business and Accountancy, Simad University, Mogadishu	There is a positive relationship between student attendance and academic performance. Its strength is moderate.
19	Class Attendance in College: a Meta- Analytic View of the Relationship of Class Attendance with Grades and Students Characteristics [20]	Course/ Department State University of New York, Albany	It was found that there was a solid correlation (0.5) between the two. The conclusion suggests a strong effect.
20	Effect of Class Absenteeism on Grade Performance: A Probabilistic Neural Net (PNN) based GA trained model [21]	Structural system courses,	The paper states that they are strongly correlated and the attendance in the first phase is the one with the most importance.

Table 1 summarize samples of the relevant published manuscripts, the university/department and the place at which the study was conducted, the courses considered, the effect level of absence on the academic performance and a brief finding of the study.

Finally, it was unexpected that most of the studies were done on students enrolled in specific classes, namely business, psychology and medical classes. It is obvious that the researches made on engineering courses are very lacking. So since mechanical engineering is one of the most important majors nowadays especially with the current developments experienced here in the United Arab Emirates, we thought it would be interesting to know how much of an effect the attendance plays on the students' grades.

In the light of the above literature. It is worth mentioning here that and, student absence is not restricted to gulf region only but it is independent of the place. The same study was conducted in different regions and areas globally like in Europe [4, 6, 16, 19], Australia [7], North America [2, 15], and Africa [19] and had extracted similar results. Thus, Absence is not confined to a certain country or region, but instead, is a worldwide phenomenon and is mostly dependent on the nature of the course. The main goal of this work is to convey the importance of the class attendance to UAEU students, which has direct effect on the course learning outcomes, not to change the university's policy.

2. Methodology and Frame Work

The participants of the study were strictly engineering students enrolled in general engineering courses, namely Calculus 1 for Engineering (MATH 1110) and Engineering Economics (GENG 315). Furthermore, the study included shared courses that were taught to Mechanical, Architectural and Civil Engineering students, these are Statics (CIVL 240) and Mechanics of Material (MECH 305). Strictly Mechanical Engineering courses were included as well, namely Manufacturing Process (MECH 306), Dynamics (MECH 310), Applied Thermodynamics (MECH 311), Mathematics for Mechanical Engineers (MECH 384) and Machine Design I (MECH 407). Table 2 presents these courses (30 classes). This, in addition, comprised some summer courses (e.g., Engineering Economics and Mechanics of Material). The percentage of absence per student during a full course of 15 weeks were obtained over a period of five years, from fall 2013 to spring 2018. It is worth mentioning here that, the total number of students involved in this study was 8000.

Table 2 Chosen courses and their description

No	Course	Course Description
1	Calculus 1 for Engineering (MATH 1110)	Engineering college requirement course.
2	Engineering Economics (GENG 315)	General engineering common course.
3	Manufacturing Process (MECH 306)	Mechanical Engineering course
4	Dynamics (MECH 310)	Mechanical Engineering course
6	Applied Thermodynamics (MECH 311)	Mechanical Engineering course
7	Mathematics for Mechanical Engineers (MECH 384)	Mechanical Engineering course
8	Machine Design I (MECH 407)	Mechanical Engineering course
9	Statics (CIVL 240)	Civil and mechanical engineering course.
10	Mechanics of Material (MECH 305)	Civil and mechanical engineering course.

After collecting the data, the percentage of absence with respect to the dismissal policy of United Arab Emirates University of each student was calculated using the formula illustrated below:

$$\% \text{ Absences regarding dismissal} = (\% \text{ Absence in a full course} / 15\%) * 100$$

The 15% is set by the university's attendance guidelines as a threshold for course dismissal. However, the faculty member can still feed the absence of the student even after it exceeds 15%. Thus, some of the data in the graphs below are above 100%.

The data were further investigated and analysed by calculating their mean and standard deviation. Then, graphs were formulated from the analysis which is where our conclusions stem from. It is also worth mentioning that the common courses between the engineering departments consisted of a sample size of

around 8000 students in total whereas the courses that were specifically meant for Mechanical Engineers were significantly smaller with a cluster that contained around 20-60 student per course.

It is worth noting here that, the study has been conducted to investigate if the student's class absence/attendance has an impact on the student academic performance regardless of the Socioeconomic status (SES), ethnicity and age. In this study, a variety of engineering courses, e.g., mechanical engineering courses and common/fundamental courses that are studied by students of other engineering departments.

3. Results and Discussion

The results of our study were summarized in the format of bar charts due to their clarity and simplicity which allows for anyone to extract their own conclusions. They basically represent the averaged percentage of absence of students per grade (ranging from A, A-, ..., F). By taking a glance at the charts, it is noticed that the higher the sample size for the studied courses (Engineering Economics (GENG 315), Mechanics of Material (MECH 305), Calculus I for Engineering (MATH 1110), and Statics (CIVL 240)), the more the results show clearness and consistency in the trends throughout the grade scale. However, when the sample size was smaller like in Manufacturing Process (MECH 306), Applied Thermodynamics (MECH 311), and Mathematic for Mechanical Engineers (MECH 384), the effect of prior success, online tutorials, self-learning and another external factor got emphasized. Yet two courses skewed from this effect even with a smaller sample size such as Machine Design I (MECH 407) and Dynamics (MECH 310). Reasons and assumptions behind this will be discussed later.

Most of the outcomes that were obtained supported the proposed claim which was "the higher the absences of a student, the lower his/her grade became." These findings add robustness to the claim proposed by Hsu and Plunkett [2], AbuRuz [3], and many other researchers who believed in the importance of attendance for the process of learning. Not only that, the fact that this claim was supported by data that was strictly taken from engineering courses imply that absence can be catastrophic specifically in general courses which work as a foundation for all the knowledge that comes afterward.

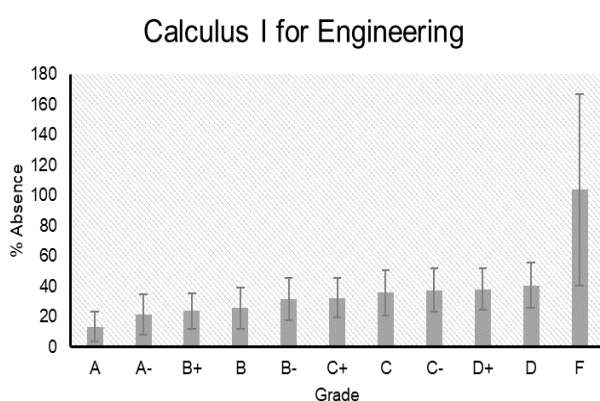


Figure 1. Calculus for Eng. (MATH 1110)

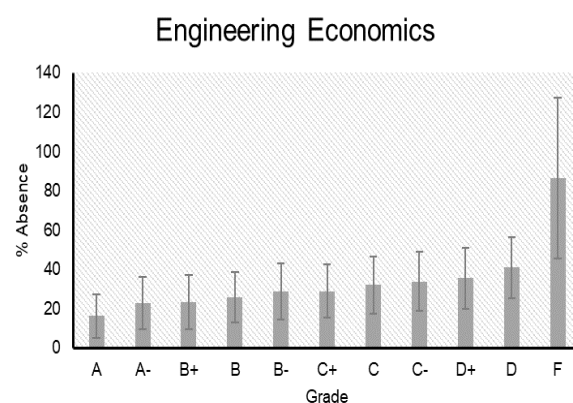


Figure 2. Engineering Economics (GENG 315)

Figure 1 and 2 are for two of the general engineering courses that all engineering students have to take regardless of their associated department. As it was mentioned before, there is a clear increase in the

percentage of average absence as the grade gets lower. Going from 10% absences to 40 % absences, in almost both courses, the grade is lowered from A to D (or F). This is partly due to the absence in the lectures of those courses and missing the discussion, and also due to the current GPA and previous knowledge of the students of the related topics, and the motivation the students have to study those courses. Even though the standard deviation represented by the error bars show a similar trend, it still apparent that there were some data that were further away from the average value and can be considered as outliers. For instance, by looking at the percentage of absence in the F grade in MATH 1110, it is clear that some students got a failing grade with less than 15% worth of absences! (less than 100% Absence in the diagrams). This can be explained by either the lack of motivation to study by the students or that the instructor was not able to explain the course well. However, these outliers were not as frequent and can be disregarded. This comes from the fact that the standard deviation of the other grades is drastically lower. Also, if the highest and the lowest grades were compared for these figures, it would be quite obvious that the difference between the absences is very distinctive and suggest that such courses require commitment in attending lectures in order for the students' grades to be good.

This is probably due to the fact that usually freshmen students are the vast majority of these classes, and they lack the knowledge and the correct strategies of studying which necessitate the assistance of a professor to give them guidance. It is obvious, however, that if the % Absences is more than 100% this means the student grade is (FA) failure due to absence. As for the shared courses with the Civil and Architectural department represented in figure 3 (CIVL 240) and 4 (MECH 305), the charts demonstrate a very similar rise in the absences on the grade scale relative to the previous ones discussed above. Additionally, the deviation of the data from the average value is still low which imply that the data are not as scattered and relatively consistent. For the Statics course, as the absence increased from 10% to 40% the grades were lowered from A to D; where F grade is related to 60% absences or higher. For the Mechanics of Materials course, it is similar to the Calculus course; 40% absences may lead to D or F grade. It is important to note that the sample size for the mentioned courses was by far the largest, so the conclusions obtained from them are more concrete.

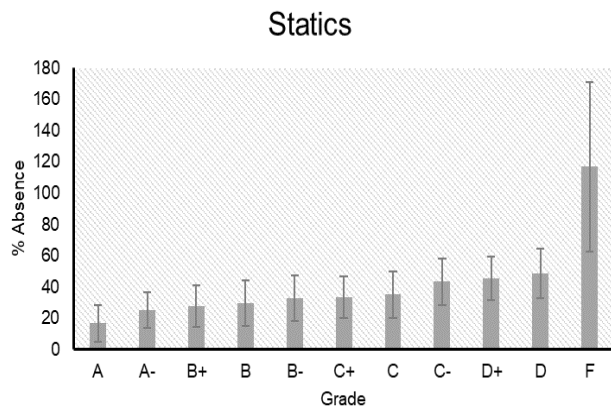


Figure 3. Statics (CIVL 240)

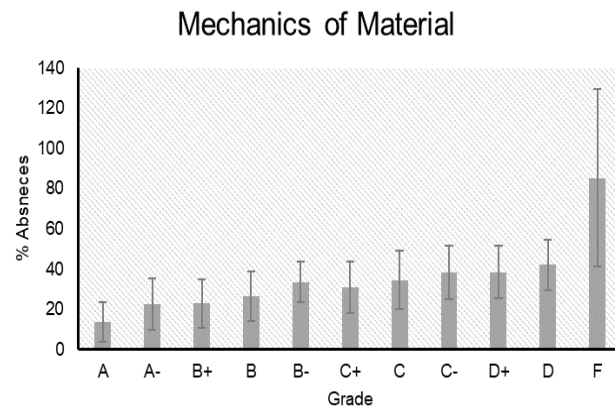


Figure 4. Mechanics of Material (MECH 305)

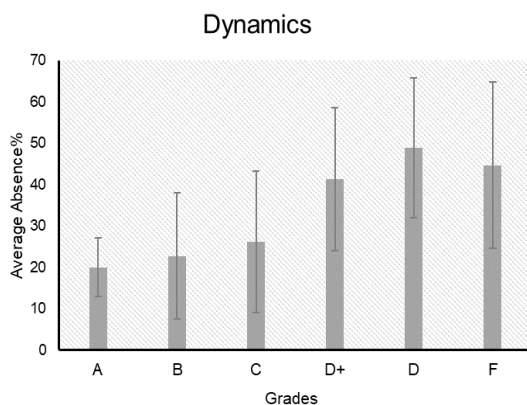


Figure 5. Dynamics (MECH 310)

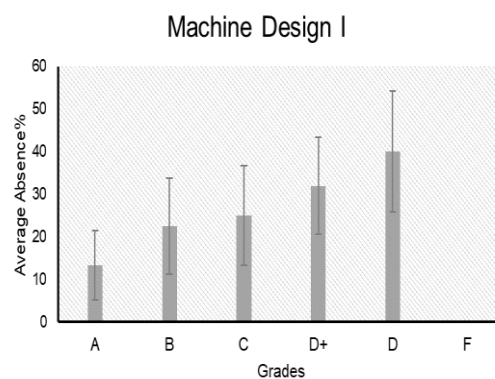


Figure 6. Machine Design I (MECH 407)

As for the Mechanical engineering courses in figures 5 and 6, Dynamics (MECH 310) and Machine Design I (MECH 407) exhibit a similar general trend with a gradual increase accompanied with a decrease between the absences and grades. For the Dynamics course, going from 20% to 50% absences, the grades were lowered from A to D. This can be attributed to the fact that these courses' content cannot be comprehended solely using textbooks or through the students' efforts. So even though the sample size is relatively smaller than the previous data, it still supports the proposed claim that was verified before. Nonetheless, the standard deviation of the data for Machine Design I (MECH 407) is clearly smaller than the Dynamics (MECH 310), which corresponds to a better accuracy for the results obtained from them. This is assumed to be attributed to the nature of the Machine Design course since it includes new Mechanical Engineering concepts that have not been discussed in other courses such as V-belt design, shaft design, power screws and many other topics that the student will be exposed to for the first time.

For the Machine Design-1 course, as the absence increased from 10% to 40%, the grade is lowered from A to D. Any further increase above about 12% absence the grade is lowered than A to any other grade, due to the reason explained before. As for Dynamics, the students do have a prior knowledge of the material through previous physics courses required by the college for all engineering students. This is why some of the students who scored A, have had an absence of 10% or even 20%, as they have prior knowledge of the subjects.

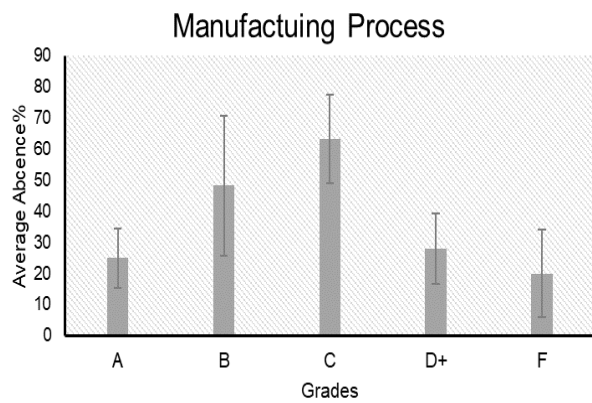


Figure 7. Manufacturing Process (MECH 306)

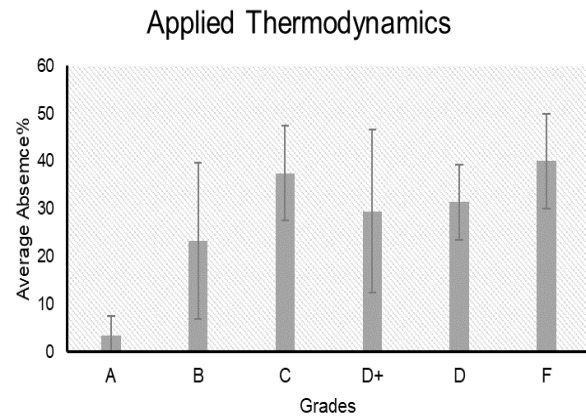


Figure 8. Applied Thermodynamics (MECH 311)

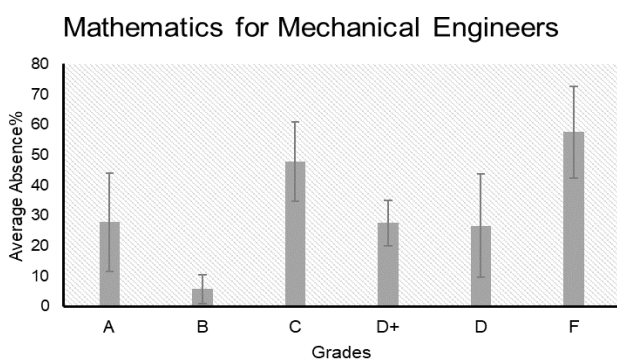


Figure 9. Mathematics for Mechanical Engineers (MECH 384)

On the other hand, Manufacturing Process (MECH 306), Applied Thermodynamics (MECH 311) and Mathematics for Mechanical Engineering (MECH 384) demonstrated in figures 7, 8, and 9, present a higher level of fluctuation in the marks versus the absence percentage. This is applied for the standard deviation of the data as well and that reduces the credibility of the outcomes extracted from these figures since the trend is not coherent nor logical. Also, there is a noticeable variation in the grades B, C, and D. This is most likely to be caused by the insufficient amount of data for these courses. Another reason can be that their contents can be self-taught by the students themselves. For example, MECH 311 and MECH 384 are basically simplified extensions of the courses Thermodynamics (GENG 220) and Differential Equations for Engineering (MATH 2210). As for MECH 306, it is based on manufacturing processes that are of a conventional type that are well studied worldwide and can be explained entirely by textbooks. However, this can also illustrate that, the attendance is not the best representation of a student's performance and other factors like the current GPA and students previous background knowledge may have had an influence just like what was concluded by other researchers like Bethune et al. [15] and Gunn [17], yet that is not very likely since the bigger sample size presented a clearer conclusion. For Applied Thermodynamics and Mathematics for Mechanical Engineers courses, the highest absence is related to the lowest grade.

Moreover, our findings from this study can be superimposed on the results of a number of papers mentioned before. In figure 10, Lukkarinen et. Al [6] showed how the second and third groups are supporting our conclusions. The people with the highest numbers of attendances obtained the highest marks. Also, Leon

[8] and Guleker et. al [18] in figures 11 and 12 respectively, display a scatter plot which shows a decrease of the grade as the percentage of absence increases.

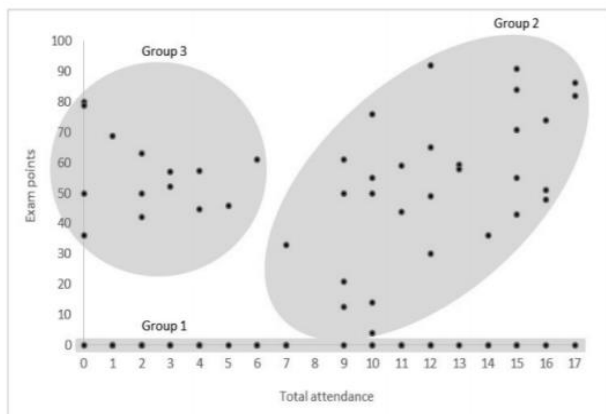


Figure 10. Relationship between class attendance and student performance, Procedia - Social and Behavioral Sciences (Sample Results)

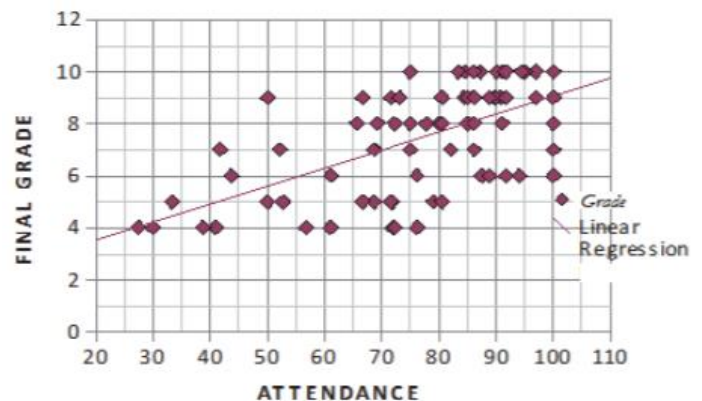


Figure 11. The Relation between Absences and Grades: A Statistical Analysis, MPRA Paner (Sample Results)

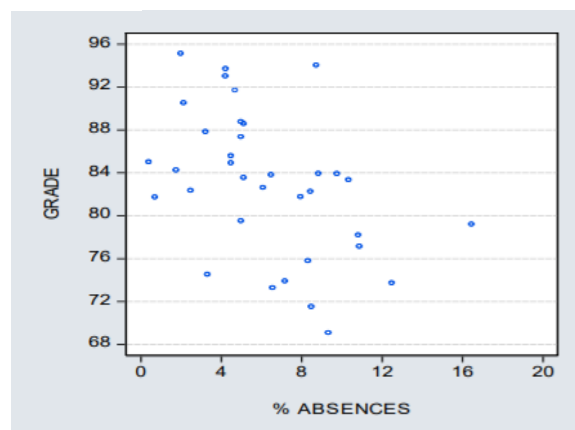


Figure 12. The Effect of Attendance on Academic Performance (Sample Results)

4. Conclusion

In conclusion, this paper aimed to examine the validity of the proposition in the engineering field which states that a student's performance is highly dependent on his/her attendance of classes and lectures. This was done by collecting a sample size of over 8000 students from United Arab Emirates University and extracting information that either supports or negates the claim. At the end, the claim was strongly backed by the data and it became clear that attendance is highly advised for all engineering students which has a crucial effect of the course learning effect and course assessment.

However, there is a need to address the limitations of this study before it is used as a basis for further researches. Firstly, the fact that gender nor age was regarded during the collection of data, the data were combined together in terms of grades only. Also, the availability of online courses, self-motivation, and students' previous success were ruled out due to the large number of data examined through this study do suggest that they contribute to the overall performance of the students.

Response: Foremost, we would like to bring to editor and reviewer attention that, the findings of this study are important for students and teachers alike. The results may be utilized as a motivator for students to attend classes and for teachers to keep in mind the significance of class attendance for course learning outcomes and course assessment alike. For student who cannot or do not wish to attend classes, independent learning may be possible. However, this, indeed, depends on the specific course in question and necessitates substantial maturity, planning, and considerable search for information. This shows the importance of the study. To the best of our knowledge, this study has not been done before in the UAE. The text (abstract, conclusions, and results and discuss section) has been revised to address this point.

5. Declarations:

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Not Applicable

Conflicts of interest/Competing interests

None

Data transparency

Not Applicable

Code availability

Not Applicable

Ethics approval

The manuscript was proofread for the data used and found no errors or ethical wrong.

Consent to participate

Not Applicable

Consent for publication

Not Applicable

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