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The Influence of Age and Gender on the Effect of Student Absenteeism on Mathematics Performance in the General Foundation Program (GFP)

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Research Article

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Abstract

Background/purpose. Low attendance rates in undergraduate (UG) programs represent a critical issue for higher education institutions (HEIs), as they directly impact both individual and institutional success. This study investigates the influence of moderating variables such as age and gender on the effect of student absenteeism on mathematics performance. If the impact of low attendance on student performance goes unaddressed, it becomes a significant risk to their overall success in the UG program as well as their future career prospects.

Materials/methods. In order investigate the impact of absence on performance on mathematical tests, this study used a quantitative methodology. Data was gathered from 489 GFP students taking a mathematics course. A multiple linear regression (MLR) analysis was conducted to determine whether these independent variables serve as significant predictors of mathematical performance. The Pearson product-moment correlation was used to examine potential relationships between math grades and absenteeism in both males and females across various age groups.

Results. Statistical analysis revealed a strong negative correlation between absenteeism and academic performance. The study reveals that a small group has significantly high absenteeism, and results show the influence of each variable on the effect of absenteeism on performance.

Conclusion. To foster classroom participation, stronger attendance standards or reassessments are necessary. If there are good reasons for absenteeism among age groups, efforts to make hybrid learning more successful should also be considered.

1. Introduction

The general foundation program (GFP) curriculum includes Mathematics, Communication Skills, and Information Technology. Communication Skills have the most teaching hours. However, Mathematics is also essential for undergraduate studies, as it enhances students' problem-solving abilities and helps them develop logical and analytical thinking. Active class participation and physical presence during in-class activities are essential to developing these abilities, which highlights the importance of attendance.

Class attendance is a phenomenon that has been undergoing extensive research for so many years. Some students just show up to class to satisfy the institutions' requirements. On the other hand, consistent attendance achieves several significant outcomes in higher education. By comparing novel concepts, it encourages students to broaden their critical thinking. It plays a vital role in enhancing students' performance through teamwork skills and comprehension of fundamental concepts (Latif Khan et al., 2019). Attending classes enhances class engagement, and studies indicate that class engagement is positively associated with well-being (Boulton et al.,2019).

Student performance in mathematics modules holds great importance for those in the General Foundation Program, as it forms a key pillar of their college education. Since most specializations require a foundational knowledge of mathematics, enhancing students' academic performance in this module is crucial. In this regard, the study intended to find the factors influencing students' academic performance in the mathematics module.

Our objective is to examine whether a relationship exists between absenteeism and performance in mathematics modules and to understand how factors like gender and age may influence this relationship. To achieve this objective, we gathered the necessary data from GFP students during the Fall semester of 2024, following approval from the relevant authorities. We then analyzed the data using various statistical tools and examined the results. The results suggest the following implications: HEIs could implement stricter attendance policies and promote regular participation in mathematics classes; teaching strategies should be enhanced to ensure attendance and active class engagement; and targeted programs should be developed for at-risk students.

2. Literature Review

Numerous studies have been carried out to demonstrate the relationship between student test performance and attendance in class. Generally, it is viewed that exam scores increase with higher class attendance. It was shown that attendance and grades were positively correlated. Students' grades are scaled in proportion to the number of days they attended class (Diab-Bahman et al., 2021)

Though clear evidence shows the possibility of a positive relationship between attendance and academic performance, research shows that absenteeism from lecture attendance is still prominent among students. Several plausible reasons have been identified for this absence. These reasons range from less valid, like staying up late and indulging in various forms of revelry, to more valid, like illness and part-time employment (Majeed et al., 2019). Class timings, particularly early morning classes, can significantly impact attendance. Objective evidence suggests that students often choose to sleep rather than attend classes scheduled early in the morning (Yeo et al., 2023). Attendance is context-dependent and shaped by two sets of factors: university imperatives and the complexities of students' lives. When these factors overlap, they influence the level of student's involvement and commitment to their academic experience (Menendez Alvarez-Hevia et al., 2020).

Radhwan (2024) conducted a study to investigate how a compulsory attendance policy impacts students' academic performance and how it can improve the current policy in the school and higher education sector in the United Arab Emirates. The result of the study showed that attendance policies influenced academic achievement and educational sustainability. Also, Méndez Suárez and Crespo

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Tejero (2021) analyzed the relationship between absenteeism and academic achievement over the course of five years for one degree. According to the study, the impact of absences on academic performance decreased each year, with first-year undergraduates experiencing the most effects.

A recent study among medical students has shown better academic performance related to attendance policy; it showcases that minimizing absenteeism may enhance academic performance (Subramaniam et al., 2013). Students who are more capable, driven, and hardworking generally attend better. Additionally, these students achieve better in academics at the same time. A strong emphasis on attendance and study habits at the beginning of a university journey can help to challenge stereotypical assumptions about attendance and promote positive academic behaviors early on. Over time, as students develop greater independence and autonomy, a more relaxed approach can be adopted in subsequent years to support their evolving self-management skills (Bijsmans & Schakel, 2018).

According to Gul et al. (2016), absenteeism is a growing trend around the world, and their study of medical students shows that 35.86% of absenteeism cases are due to academic reasons, 33.05% are personal reasons, and the rest are due to social reasons. By actively participating in classroom activities, medical students not only enhance their understanding of medical concepts but also cultivate the skills, behaviors, attitudes, and values necessary for a successful medical career. One of the key questions is why absenteeism might impact academic achievement. Students who miss class will simply be deprived of the knowledge and exposure to pertinent content (lectures, practical sessions, clinical skills, etc.) that is necessary for learning to take place (Yusoff, 2014).

Numerous factors, including high school grade, English proficiency, attendance in class, study effort, academic self-efficacy, and family socioeconomic position, were found to be positively correlated with academic performance based on the results of the multivariate regression analysis conducted by Sothan (2018). This study found that both family size and term-time employment negatively impacted academic performance. However, there wasn't enough data to suggest that factors including gender, age, parental participation, parental education, household location, and teaching evaluation could predict academic success. Accordingly, the study found that undergraduate students' academic achievement may be partly predicted by their personal circumstances. However, interest and motivation play a crucial role in minimizing the impact of moderating variables like age, gender, and level of study (Sloan et al., 2019).

Buechele (2020) investigates the relationship between performance and attendance in greater detail, looking at aspects of classroom participation as mediating variables. The findings imply that how students attend class matters more than whether they do. Previous research by Ayodele (2017) identified a significant correlation between class attendance and student's examination scores in science subjects such as organic chemistry. Student achievement is linked with the reasons behind absenteeism, with distinct relationships observed between various causes of absenteeism and academic performance. Research indicates that sickness-related absenteeism negatively impacts students' achievement after reaching the specific threshold. Hancock et al. (2017) found a nonlinear relationship between attendance and academic success. They discovered that whereas extreme absences had a huge and significant impact, modest levels of absences had no effect on the student's average course score.

Similarly, Moores et al. (2019) studied the techniques of attendance control, which were reward-based and punishment-based. He discovered no noticeable difference in attendance rates. Keppens (2023) found a strong link between students' test scores and the consequences of missing class. A study by Bernal-Morales et al. (2015) found that students facing high academic demands experience anxiety and may avoid classes, worsening stress and affecting overall engagement and performance.

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In general, a wide range of factors affect students' attendance in class, and these factors are crucial to obtaining academic success. These elements fall under the category of social-demographic factors like age, gender, etc., which also include things like the lecture schedule, the lecturer's skill level, and comprehension of the lecturer's language. The relationship between absenteeism and performance was found to be subjective. Our study aims to explore the impact of student attendance on their final mathematics performance, considering factors such as age and gender.

2.1. Conceptual framework

Independent variable: The independent variable, "student absenteeism," is measured by the percentage of missed mathematics classes.

Moderating variables: The moderating variables are age and gender. The age classifications are,

- 20 and below
- 21 to 30
- 31 and above

Dependent variable: The dependent variable is academic performance in mathematics, which is measured as the percentage of marks at the end of the semester.

Research hypothesis:

- High levels of absenteeism negatively impact academic performance in mathematics.
- The impact of absenteeism on performance might vary based on the student's age and gender.

3. Methodology

This study adopted a quantitative approach to investigate the effectiveness of absenteeism on performance in mathematics assessments (Fig 1). The data were collected from 489 students studying in the Mathematics 1 and Mathematics 2 modules of the General Foundation Programme in a higher education institution in Oman.

Fig 1. Proposed model for evaluating the impact of attendance on students' grades

In the Mathematics 1 and Mathematics 2 courses, there were 233 and 156 students, respectively. Of these 489 students, 272 were males, while the remainder were females. The duration of the semester was fifteen weeks. Two sessions were dedicated to mathematics modules each week, each lasting two hours. The tutors recorded the students' attendance in each session and encoded it in the ERP system. After receiving ethical approval from the appropriate authorities, we collected data at the end of the semester. This data included details such as students' total marks in these modules, class attendance, age, and gender. The primary variables in this study are the absenteeism rate and mathematics performance, while the secondary variables, such as age and gender, are used for subgroup analysis. Here, absenteeism rate, age, and gender serve as independent variables, with mathematics performance as the dependent variable (Fig 2). We have used the multiple linear regression method to find out the factors affecting students' performance.

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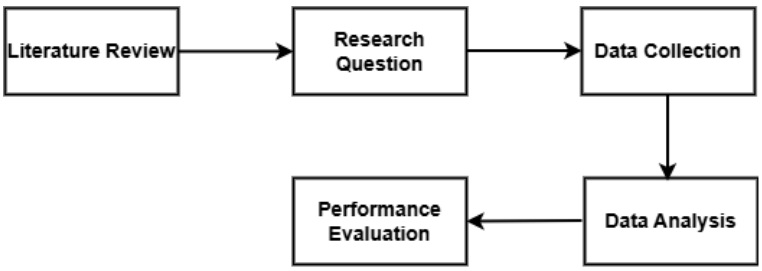

Fig 2. Methodology of research

3.1. Why MLR?

We selected multiple linear regression (MLR) because it allows for using several independent variables, such as absenteeism, gender, and age, to predict the dependent variable, mathematics marks. In an MLR model, independent variables can be metric, ordinal, or nominal, while the dependent variable must be metric. Our aim is to assess whether the predictors—absenteeism, gender, and age—significantly influence mathematics marks. We conducted an MLR analysis to determine if these independent variables are significant predictors of mathematics performance.

The MLR model will be in the form$\hat{y} = b_1x_1 + b_2x_2 + b\ \ x_3 + \ldots + a$. For unit change of the independent variable x_1, the dependent variable will increase or decrease by b_1 unit. The multiple linear coefficient R measures the correlation between the dependent variable and the predictors. Greater correlations give a better regression model. The regression coefficient, R2, indicates the proportion of variance in mathematics marks explained by absenteeism, gender, and age. However, R2 tends to be overestimated when multiple independent variables are included. To address this, we calculated the adjusted R2, which provides a more accurate estimate by accounting for the number of predictors. The standardized coefficient (β) reveals which variable has the greatest impact on the dependent variable, mathematics marks. Variables with a p-value below 0.05 are considered statistically significant.

4. Results

To address our research questions, we gathered data from a sample of 489 students, comprising 272 males and 217 females. The students represented various age brackets ranging from 18 to 47 years, which we categorized into three distinct groups. The recorded age data shows a mean of 23.18 years with a standard deviation of 5.79. The mean age of 23.18 suggests that most participants are in their early twenties. The standard deviation of 5.79 years highlights moderate variability in the ages of the participants, with most individuals falling nearly six years above or below the mean.

4.1. Descriptive Statistics

Table 1 provides the descriptive statistics for the students' math marks and their absenteeism, including the mean and standard deviation. Scores range from 0 to 100, indicating the full spectrum of performance, from very poor to perfect. A standard deviation of 25.69 marks indicates a substantial variability in scores, with a wide spread of student performance. Furthermore, the normality of the data was assessed using skewness and kurtosis values. As shown in Table 1, the skewness and kurtosis values of marks are within the acceptable range of -2 and +2, indicating a fairly normal distribution. A slight negative skewness in marks indicates that the distribution slightly leans towards the high scores, suggesting fewer students performed poorly or a majority of students scored high marks. The kurtosis value of math marks shows that the distribution is slightly flatter than the normal curve (platykurtic).

Absenteeism rates vary from 0% to 88.46%, showing a significant disparity. The mean value of 19.11 shows that students miss nearly one-fifth of their classes. A standard deviation of 17.99 reflects

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the significant differences in student absenteeism rates, highlighting substantial variation in attendance patterns. The heavily right-skewed distribution (1.61) indicates that a large proportion of students have lower absenteeism rates, while only a few exhibit very high rates. The distribution is leptokurtic (kurtosis 1.95), indicating a concentration of students with relatively low absenteeism rates, with a small number of outliers exhibiting very high absenteeism (Hatem et al., 2022).

Table 1. Descriptive Statistics for the Students' Math Marks and Absenteeism

	Min	Max	Mean	SD	Skewness	Kurtosis
Math Marks	0	100	62.28	25.69	-0.54	-0.46
Absenteeism (%)	0	88.46	19.11	17.99	1.61	1.95

Table 2 provides the descriptive statistics for the students' math marks (in terms of their gender and age), including the mean and standard deviation. Female students have an average score of approximately 70%, with a standard deviation of 23.52, indicating better performance compared to their male counterparts, having a mean score of 56.30, with broader variation in their scores. Female students generally have lower absenteeism rates, with some variation in attendance. However, male students, on average, miss more classes than female students, and a higher standard deviation indicates more variability in absenteeism among male students.

Students aged 20 and below demonstrated relatively strong performance in mathematics, with an average score of 67.08, outperforming the other age groups. Interestingly, students aged 31 and above slightly surpassed those aged 21 to 30 years. All age groups exhibit considerable variability in their scores, as indicated by the standard deviation.

The age group 20 and below has a relatively low absenteeism rate of 17.49% compared to the 21 to 30 (20.68%) age group and those aged 31 and above. The third group exhibits greater variability in absenteeism compared to the other two groups.

Table 2. Descriptive Statistics for the Students' Math Marks and Absenteeism in terms of their Gender and Age

Variables	Categories	Math Marks		Absenteeism (%)	
		Mean	SD	Mean	SD
Gender	Female	69.77	23.52	16.77	15.13
	Male	56.30	25.82	20.98	19.83
Age	20 and below	67.08	24.50	17.49	16.33
	21 to 30	57.10	25.46	20.58	18.60
	31 and above	59.42	27.44	20.78	21.24

4.2. Regression Analysis

We conducted multiple linear regression (MLR) to investigate the extent to which absenteeism, age, and gender can predict students' math marks. As Table 3 reveals, there is only one model with three predictors. This indicates that absenteeism, age, and gender were examined as the predictors of students' math marks. There is a moderate positive relationship between these variables and student's math marks, as indicated by R = 0.64. This suggests that the variation in these predictors is directly proportional to the changes in the dependent variable. In other words, when the predictor

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changes, then there is a corresponding and meaningful change in math marks, reflecting a moderate level of predictive accuracy.

Since there are three predictors, an adjusted R2 of 0.40 offers a more precise assessment of how effectively the predictors account for the variability in the dependent variable. This ensures a more accurate and reliable evaluation of the model's explanatory power. The higher F value of 109.88 suggests that at least one of the predictors significantly contributes to explaining the variance in math marks. The p-value of 0.1% indicates that the results are statistically significant, which strongly supports the validity of the model.

Table 3. Multiple Regression Analysis for Active Students' Math Marks

Model	Predictor	R	R^2	Adjusted R^2	F	p
1	Absenteeism, Age, Gender	0.64	0.40	0.40	109.88	.001

Beta coefficients (Table 4) also show that the association between absenteeism, gender, and students' math marks is negative and significant (β = -0.50, p < .001, β = -0.19, p < .001). Absenteeism has a significant negative impact (β = -0.58) on math performance. A strong association underscores the importance of regular attendance for achieving better academic outcomes. However, no significant association is observed between age and students' math marks (β = -0.05, p > .05). This indicates that age does not meaningfully influence math marks in this model. Gender also has a moderate negative influence on math marks. This indicates that gender difference plays a measurable role in predicting math marks.

Table 4. Standardized Coefficients

Model	Beta	Sig.
(Constant)		0.000
Absenteeism	-0.58	0.000
Age	-0.05	0.194
Gender	-0.19	0.000

In summary:

- Absenteeism has the strongest and most significant negative impact on math performance (Beta = -0.58, p = 0.000), indicating a robust relationship where higher absenteeism leads to lower math marks.
- Gender also significantly affects math performance (Beta = -0.19, p = 0.000), but its effect is weaker compared to absenteeism.
- Age, on the other hand, does not have a statistically significant influence on math marks in this model (Beta = -0.05, p = 0.194).

These findings highlight absenteeism as the most critical factor affecting academic performance in this context.

4.3. Correlational Analysis (Gender)

The Pearson product-moment correlation was used to investigate the possible correlations between absenteeism and math marks in females (Table 5) and males (Table 6).

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As Table 5 reveals, absenteeism is negatively correlated with female students' math marks (r = -.64, p < .001). That is, more absences lead to lower math marks in females. A strong negative correlation of -0.64 between absenteeism and math marks indicates that as absenteeism increases, math marks tend to decrease in female students.

Table 5. Correlational Analysis Between Absenteeism and Math Marks in Females

		Absenteeism	Math Marks
Absenteeism	Pearson Correlation	1	-0.64**
	Sig. (2-tailed)		.000
	N	217	217
Math Marks	Pearson Correlation	-0.64**	1
	Sig. (2-tailed)	0.000	
	N	217	217

**. Correlation is significant at the 0.01 level (2-tailed).

As Table 6 reveals, absenteeism negatively correlates with male students' math marks (r = -.58, p < .001). That is, more absences lead to lower math marks in males. The Pearson correlation between absenteeism and math marks in male students is -0.58, indicating that as absenteeism increases, math marks tend to decrease in male students. For the sample size of 272, the p-value shows a strong significance. The results of Table 5 and Table 6 highlight that absenteeism negatively affects both female and male students' math performance, but the effect appears to be stronger for females.

Table 6. Correlational Analysis Between Absenteeism and Math Marks in Males

		Absenteeism	Math Marks
Absenteeism	Pearson Correlation	1	-0.58**
	Sig. (2-tailed)		.000
	N	272	272
Math Marks	Pearson Correlation	-.58**	1
	Sig. (2-tailed)	.000	
	N	272	272

**. Correlation is significant at the 0.01 level (2-tailed).

4.4. Correlational Analysis (Age)

The Pearson product-moment correlation was used to investigate the possible correlations between absenteeism and math marks in the three age ranges of 20 years and below (Table 7), 21 to 30 years (Table 8), and 31 years and above (Table 9).

As Table 7 reveals, absenteeism is negatively correlated with the math marks of the students below 20 years (r = -.53, p < .001). That is, more absences lead to lower math marks in this age range. For this age group, absenteeism has a moderate but statistically significant negative effect, as indicated by the Pearson correlation of -0.5.

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Table 7. Correlational Analysis Between Absenteeism and Math Marks for 20 Years and Below

		Absenteeism	Math Marks
Absenteeism	Pearson Correlation	1	-0.53**
	Sig. (2-tailed)		0.000
	N	237	237
Math Marks	Pearson Correlation	-0.53**	1
	Sig. (2-tailed)	0.000	
	N	237	237

**. Correlation is significant at the 0.01 level (2-tailed).

As Table 8 reveals, absenteeism is negatively correlated with students' math marks between 21 and 30 years ($r = -0.63$, $p < .001$). That is, more absences lead to lower math marks in this age range. Absenteeism has a significant and noticeable negative impact on math performance for this age category.

Table 8. Correlational Analysis between Absenteeism and Math Marks for Students between 21 and 30 Years

		Absenteeism	Math Marks
Absenteeism	Pearson Correlation	1	-0.63**
	Sig. (2-tailed)		0.000
	N	180	180
Math Marks	Pearson Correlation	-0.63**	1
	Sig. (2-tailed)	0.000	
	N	180	180

**. Correlation is significant at the 0.01 level (2-tailed).

As Table 9 reveals, absenteeism is negatively correlated with the math marks of the students above 31 years ($r = -.71$, $p < .001$). That is, more absences lead to lower math marks in this age range. Among all three age groups, this group has a very strong negative association between absenteeism and math marks. This means that absenteeism has a substantial and impactful effect on math performance, and the p – p-p-value shows that the correlation is statistically significant.

Table 9. Correlational Analysis between Absenteeism and Math Marks for 31 Years and above

		Absenteeism	Math Marks
Absenteeism	Pearson Correlation	1	-0.71**
	Sig. (2-tailed)		.000
	N	72	72
Math Marks	Pearson Correlation	-0.71**	1
	Sig. (2-tailed)	0.000	
	N	72	72

**. Correlation is significant at the 0.01 level (2-tailed).

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5. Discussion

The data reveals that most students achieve moderate success in mathematics, but the broad range and variability indicate varying levels of academic achievement. Regarding absenteeism, while most students have relatively low absence rates, the positively skewed distribution emphasizes a small group with significantly high absenteeism, which may require attention for potential academic interventions. Female students outperform males in mathematics scores and have a more consistent absenteeism rate. In the age-wise analysis, younger students are scoring better in mathematics and have low absenteeism. Other age categories show reduced performance and higher absenteeism rates. Strategies should be developed to improve male performance in mathematics and address the higher absenteeism in both males and females. Further investigations are needed to find the factors guiding lower performance and higher absenteeism of older students. Initiatives should be designed to reduce absenteeism, particularly among male students and those above 21.

The model includes only one set of predictors: absenteeism, age, and gender, which were analyzed as factors affecting students' math scores. According to the results, these three predictors explain 40% of the variance in students' math marks ($R^2 = 0.40$). There is a significant negative relationship between absenteeism, gender, and math marks. However, no meaningful link is found between age and math marks. However, 60% of the variance in math performance is likely influenced by other factors which are not included in this model.

For female students, absenteeism is strongly negatively correlated with math scores, meaning that more absences lead to lower math marks in this group. The same trend is observed in male students, where more absences also correspond with lower math scores. For students under 20, absenteeism is negatively associated with math marks, showing that increased absences lead to lower math scores in this age group. This pattern continues across age groups, with a strong negative correlation for students aged 21 to 30 and for those over 31, where more absences are linked to lower math marks. As age increases, the negative impact of absenteeism on performance appears to strengthen. However, this contrasts to some extent with the argument presented by Bijmans and Schakel (2018). The relationship is weakest among those 20 and under and strongest in above 30. This suggests that older students may face more significant challenges or consequences related to absenteeism than younger students (Gottfried, 2014). This may reflect older students' age-related challenges in balancing academic and other life responsibilities.

6. Conclusion

Absenteeism has a negative correlation with students' performance. This relationship emphasizes the need for regular attendance to achieve good grades. Another significant factor influencing students' performance is their gender, suggesting that male and female students may have different educational experiences and outcomes. Also, it has been observed that there is a significant association between students' age group and math marks concerning absenteeism. We classified the age groups into three categories: 20 years and below, 21 to 30 years, and 31 years and above. In all these groups, there was a significant correlation between absenteeism and students' performance, demonstrating that the impact of absenteeism is consistent among different age groups. Also, the study observed that there is an association between the students' gender and Mathematics marks, implying that gender variations may influence students' performance in this subject. Gender is regarded as an important factor in mathematics performance, as a substantial body of global literature suggests differences in performance between boys and girls. To achieve educational equity, these disparities should be analyzed and addressed when identified (Musimenta et al., 2020).

The study clearly shows that absenteeism has a negative impact on students' academic performance in mathematics modules. Therefore, the concerned authority should implement

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appropriate measures to reduce student absenteeism, considering the unique environment of the higher education institution. To prevent absenteeism, it is crucial to prioritize early interventions for at-risk students as an early warning system, implement measures tailored to regional conditions, and foster collaboration with stakeholders, particularly families. Additionally, educational institutions at all levels are encouraged to adopt a systematic approach to the issue and establish systems that enable quicker communication with parents (Akkus & Çınkır, 2022). The university, college management, and tutors can take this action. We need to conduct further studies to identify other factors that contribute to class absenteeism, explore ways for tutors to increase class attendance, and motivate low-performing students to prioritize attendance. Additionally, expanding the study to include other modules in the same program could provide a more comprehensive understanding of the impact of absenteeism on students' academic performance.

This study has certain limitations that should be considered. First, other background factors may influence performance, which were not included in our analysis. Additionally, the scope of the study is restricted to a specific region, time, and subject. A broader study could have included multiple regions, various disciplines, and different academic years of semesters to provide more comprehensive insights.

7. Suggestion

Our study could lead to the following strategic implications for improving student attendance:

1. Implement targeted intervention programs such as peer tutoring, mentoring, etc., to support male students.

2. Implement proactive monitoring systems to detect students at risk of persistent absenteeism and offer necessary support.

3. Since the factors we used (Absenteeism, Gender, and Age) explain only 40% of the variance in mathematics scores, further studies should explore other influential factors.

4. tailored academic support such as specialized tutoring, workshops on mathematical skills, etc., to be given to older students. This can help to improve their performance by addressing external factors like work commitments, family responsibilities, and other obligations.

5. HEIs should plan to provide resources for attendance monitoring, mentorship, and additional support.

6. If absenteeism among certain age groups has valid justification, efforts to make hybrid learning effective should be considered.

Declarations

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Ethical Approval. All data collection and data storage procedure were approved by research committee of Gulf college, Oman (GC/RD/REC/23/01).
Data Availability Statement. The data can be provided by the corresponding author upon request.

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