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STUDENT'S ATTENDANCE AND PROFESSOR IMPOSED REQUIREMENTS AS DETERMINANTS OF ACADEMIC ACHIEVEMENTS

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Abstract. Lecture attendance is an endogenous factor that depends on student's motivation and attitude toward the learning process. Homework assignments and midterm evaluation are exogenous requirements imposed by the lecturer in academic courses. It is widely spread conviction that these factors strongly influence the academic performance. This hypothesis is tested in classes taught in three consecutive academic years in two European universities with two different teaching systems - online and face-to-face learning. The first university is Bulgarian: the data are about autumn semesters of 2021 and of 2022. The second one is an Italian University during summer semester of 2023. The same courses were taught.

Methods. The sample consists of three comparable sets of data of approximately 30 students each. Statistical tests and Poisson regression analyses are conducted using STATA software. The model proved a good fit to the observed data.

Results. The findings of the Poisson regression model indicate that homework assignments, mid-term exams, and attendance significantly and positively impact students' final grades. Notably, homework assignments have the highest positive impact on students' overall performance.

Conclusions. When the professors commit themselves to prepare appropriate homework assignments and provide regular feedback to the students it will substantially enhance their academic achievements. The results of this study offer valuable insights to students, professors, and university administrators regarding the factors that influence academic achievement in higher education courses.

Keywords: undergraduate teaching; academic achievement; lecture attendance; homework assignments; midterm exam; cultural differences

JEL classification: A22, I21

1. Introduction

There is a certain misalignment between the student's and professor's priorities when considering the importance of lecture attendance, homework, and exam scores.

On one hand, we have the professors who firmly endorse the accepted dogma that student that attends lectures regularly, participates actively, submits homework and engages in class tend to outperform the ones who do not. Of course, the observed outliers in the form of absent individuals who achieve high marks on the final exams and serious, dedicated students who fail unexpectedly, are infrequent and should be regarded as exceptional cases. An experienced professor can usually read the students' body language and act accordingly. If they are confused, he will dedicate more time to explaining the topic. When the audience is bored or understimulated, he can skip over a minor topic and rearrange the lecture accordingly. Alternatively, he can view the homework notes or the mid-term notes and receive feedback on the students' actual understanding. But that can only happen if the students are present and active.

On the other hand, we have the college students, who are expected to obtain 30 ECTS credits every semester, which translates to visiting 6 to 8 lectures per semester at pre-determined times, their corresponding exercise sessions, read the recommended literature, submit the homework, all papers before their due date, score high on exam, all for the elusive promise of a better future after graduation. But of course, that can only happen if they actively socialize during their student year, make meaningful and lasting connections, find and perfect their clothing style, keep their physical and mental health in top condition, and deal with all the pesky details of living – laundry, cleaning, cooking, grocery shopping and so on. And all of that needs to happen parallel to their studies. And this subgroup is the one that is solely dedicated to graduating. It does not include the ones who need to work to support themselves, take care of family members, live with disabilities or deal with other life complications (Pilloff & Kling 2017). Such a lifestyle often leads to burnout in young adults. Considering that students too are rational individuals, they seek for options to minimize the demands on their times. A more detailed discussion on relationship of students' motivation and employers' willingness to hire them is provided in Kiranchev (Kiranchev 2021). The conclusion learners often turn to is to skip lectures and visit only review sessions and exercises believing that this will be sufficient for their success. They turn to alternative, less classical methods of learning – videos, websites, blogs, tutoring by advanced colleagues, and many others.

With the surge of cases of COVID-19 another problem emerged. Students and professors alike were forced to rapidly adapt to new, digital environments. The well-established methods of face-to-face teaching are replaced by online courses. Undeniably education plays an important role for the generations. Concerned with this problem, and the fact that a whole new way of interaction between teachers and students has been imposed the researchers continuously look for means to improve it and understand which factors influence, motivate and support the students.

The goal of this paper is to identify the factors that drive the student's success in the digital age. The object is the influence of homework assignments, midterm exam, and attendance on the final mark. The subject of the research is to compare a class studying in remote conditions with another similar classes taught face-to-face in Bulgarian and Italian universities.

The thesis of this paper is to examine whether the expected positive correlation between participation in lectures, midterm exam results, results on the submitted homework and the final grade is observed in the current sample and can we use these factors as a predictor for academic performance and to examine whether these factors are consistent on an international scale.

The paper proceeds with a literature review, a description of the obtained data, an empirical models and analysis thereof, and a conclusion.

2. Literature Review

There are countless journals articles dedicated to examining teaching methods and their success rates. The topic has fascinated researchers during the last century.

Moore, R. (2004) offers empirical data on students' attendance as a determinant of final grades. He proposes a specific perspective. In his study, the author takes 307 "at-risk" biology students from the University of Minnesota. What distinguishes his study is that he explicitly states on the syllabus that attendance is a strong indicator of success in the course. His students were naturally divided into two different classes. One group just received the information about the connection between attendance and success on day one of the lectures and another was reminded of that finding during each consecutive meeting. Moore concludes that despite initial motivation, every week the average attendance declined. Regular repetition leads to more sustainable behavior. Moore concludes that in both groups the chances to achieve higher final exam results based on regular attendance do increase but in the latter one the average final grades are 14% higher.

Borde (2017) proposes more complicated list of determinants of student achievements in the field of economics. He conducts a regression analysis that is oriented to evaluate ten factors: sex, high-school attendance (public or private, within or outside US), high school grade points average, ethnical origin (African American, Hispanic, East Indian, Oriental using Caucasian as a reference group). He applies the binary dependent variables in his regression model. Important conclusion of his research is that professors should pay attention to certain student attributes and consider background factors that will support them in their interaction with different groups of students.

In modern university the traditional lecture that counts on presentation of main concepts and their application in real life, even when presented in a lively and engaging manner, is not sufficient as a means of mastering the material. It must be oriented to the individual characteristics of the learners. Students should also

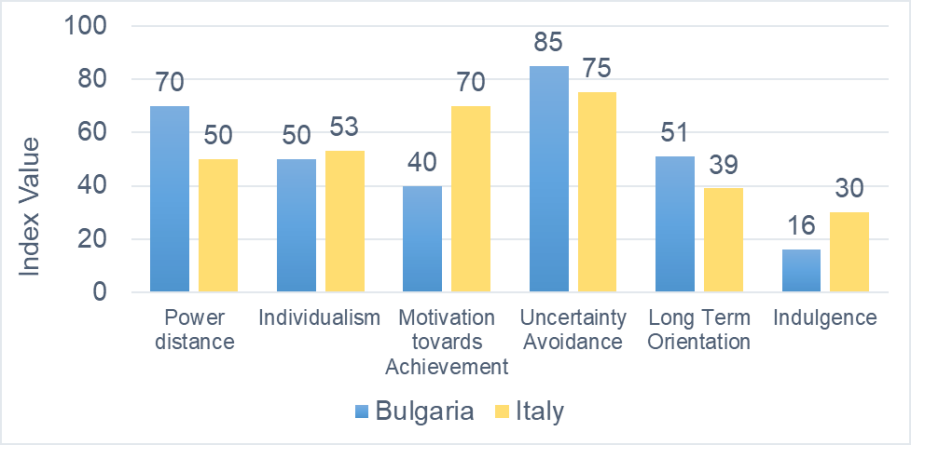
be required to work on assignments, solve certain problems, and after receiving feedback from the instructor on the solutions presented, rethink the material taught.

In contrast to Borde who concentrates mainly on personal identity of the students this research will follow the route of Chung (2004) who examines the behavioral determinants and devotes attention to instructor–student interaction. In digital world the multichannel communication with the professor is available. The trainee is not obliged to visit the office in the campus in specified hours. E-mail messages, Zoom or MS Teams meetings, Moodle platform and universities' Blackboards allow more regular and frequent contacts. Considering these options Chung defines as determinants of class achievements not just the attendance, but also total contact hours, total homework, total mini-quiz. Mini-quizzes are designed to take place at the beginning of some sessions. They aim not only to evaluate the ability to solve a problem similar to these provided in the homework but also to create atmosphere close to that of a real exam and support the self-confidence of the students in their knowledge and mastery.

The role of the professor, the course design and implementation of digital technology in teaching are also considered important determinants of student achievements. With the transformation of the role of universities when market competition prevails over the social educational function and the students are treated as "clients" their achievements are considered as analogous of customer satisfaction (Akimov, et al. 2018). Applying this business approach also draws attention to the customer's value to the firm, distinguishes between objective and perceived customer value, and reveals the importance of customer relationships in creating a value proposition (Netzeva-Porcheva 2012). Marinov (2023) made a valuable contribution to these studies by not only exploring the determinants that influence financial literacy, but also focusing the attention on investigating the effects on financial behavior.

If one abandons marketing terminology the idea of professor-student interaction is still in place. Based on systematically observed instruction in STEM courses Reimer et al. (Reimer et al. 2016) define three instructional practices that influence students' achievements: explicit instruction in epistemology or "thinking like a scientist", formative and summative assessment, and group-based or interactive learning. This paper will explore the last two of them. When the professor has extensive pedagogical training and interest in active learning technologies, courses are with relatively small enrollments (class size under 50) and rich instructional resources students tend to achieve higher results (Han & Finkelstein 2013).

Another aspect that needs to be examined is whether or not the chosen subsets are comparable. The two subsets encompass both Bulgarian and Italian students. It would be reminisced, not to consider what cultural differences may be present and influence the student's grades. Hofstede (Hofstede et al. 2010) and Minkov & Kaasa (2022) identify and measure cultural differences across the countries. Using the modified Hofstede's dimensions this paper gathers further valuable insights into the two data subsets.



Source: The Culture Factor Group (The Culture Factor Group, 2023)

Figure 1. Hofstede-Minkov's Dimensions Index Values

While there is some differences in the scores of the countries, they seem to share similar values.

Power distance is the measure of how hierarchical the culture is. Whether the power in the country is distributed unequally and whether the people understand and accept this distribution. In terms of this paper power distance can affect the way the students interact with the professors and teaching assistants. Bulgaria scores quite high with 70, whereas Italy has an average score of 50. This could mean that Italian students will be more likely to communicate openly with those in more authoritative positions, whereas the Bulgarian students will prefer to socialize with the other students.

Individualism is the measure determining whether a country is individually oriented or socially oriented. In individualist societies only the personal and close family success matters. In collectivist societies we could expect the individual to be highly involved in multitude of groups. Bulgaria and Italy score quite similarly on this dimension. They show no strong preference for either end of the scale. In terms of this study this score could describe the tendency of students to learn individually or form study groups to help each other. As neither country has a particular infinity, there most likely will not be significant differences in the study methods of the two groups.

Motivation towards achievement and success is a measure that examines what motivates people. The two ends of this scale are decisive and consensus oriented. A decisive society is driven by success and achievement. A consensus-oriented society is one, where quality of life is the deciding factor. Bulgaria has a score of 40, which places the country as a consensus country. This means that the people work

in order to live, but do not necessarily identify themselves by their achievements. They place high value on free time and flexibility. Italy scores as a decisive country. They are highly focused on success and status symbols. In terms of this paper these scores indicate that the Italian students would strive to obtain higher grades than the Bulgarian students.

Uncertainty avoidance is a measure that indicates how a country chooses to the deal with the uncertainty of the future. Both Bulgaria and Italy score high on this measure meaning that the people are uncomfortable in ambiguous situations. In this paper, it is expected that the students will start studying early for an exam to feel secure when the exam date inevitably comes. It also means that they would expect from the professor to provide clear guidance on what must be achieved in order for a student to excel.

Long term orientation examines whether a country prefers time-honoured traditions or is rather open to changes. With a score of 51 Bulgaria shows no preference in this regard. Italy however has a low score indicating that they are a rather normative culture. In terms of this paper this measure will be reflected in how well the students adapt to the switch in learning methods. It is expected that Bulgarian students would perform just as well during digital lectures as they will in in-person classes. What influence virtual education will have on Italian students is an interesting question for further analysis.

Indulgence, as the name suggest, is the tendency of people to indulge or resist desires and impulses. A low score indicates that the society is rather disciplined and places low value on immediate gratification. Italy is an example of such society. Bulgaria scores even lower on this measure. This measure could be translated as an expectation for both groups of students to submit their homework assignments and take their exams on time.

3. Empirical Data

3.1. Description of observed factors and results

The main objective of this research is to examine whether attendance, homework assignments, and mid-term exam are appropriate predictors for the student's final grades. And whether these factors are consistent regardless of the method of teaching (virtual and in-person) and across countries (Bulgaria and Italy).

The research of this paper is focused on comparing three data sets collected and compared by the professor teaching the course.

In the first semester the students were forced to participate in a purely virtual course, driven by the pandemic, where the professor and the students interacted solely with digital media in MS Teams classes. They had no personal contact. The homework assignments were submitted digitally and all the comments and recommendations were provided by the professor in MS Forms. If students had questions, further clarifications were sent via email. Follow-up discussions took

place during the MS Teams meetings before the start of the new lecture. There were 31 students in this subset.

In the second semester a different group of students took the same course. This time the COVID restrictions were lifted and in person participation was expected. There was no option for digital attendance. Communication in MS Forms and by email continued to take place on a regular basis, but students could discuss their reflections directly with the professor before each lecture. The second subset consists of 33 students.

In the third semester the professor taught this course to a diverse group of students in an Italian University as part of the European Program for teaching staff exchange. The lectures were also in person attendance. There were 30 students in this subset.

The study is conducted in autumn semester of 2021, autumn semester of 2022 and spring semester of 2023. For simplicity and clarity, the three subsets will be further referred by the year the course take place. The first will be denoted as 2021, the second as 2022 and the third one 2023.

The data is comparable. Almost the same teaching material was used for all groups. Since the course were taught in two consecutive academic years in during three almost subsequent semesters minor changes have been made to the materials. The students received the same literature, lecture slides, tests and homework assignments. All the subsets have approximately the same number of around 30 participants. One can assume that the data are approximately normally distributed. The age range was quite similar, as both the Bulgarian and Italian universities degrees are typically acquired after high school graduation. None of the groups had a language advantage as the course was thought solely in English, which is not native for either group.

The final results from education process are student's semester grades. In statistical models they will be considered dependent variable.

Both of the universities are located in the European Union. As such they have internal scoring system that can be translated to the ECTS matrix, making the grades of the students comparable.

The following table compares the Bulgarian score system with the Italian score system and their conversion to the ECTS.

Table 1. Grade Comparison Table – ECTS, Bulgarian, Italian Systems

Labels for the Grades	ECTS Grades	Bulgarian Grading System	Italian Grading System
Excellent	A	5.50 – 6.00	26 – 30
Very Good	B	4.50 – 5.49	21 – 25
Good	C	3.50 – 4.49	19 – 21

Fair	D	3.00 – 3.49	18
Fail	Fx, F	<3.00	0 – 17

Source: ECTS users' guide 2015 (Directorate-General for Education, Youth, Sport and Culture (European Commission), 2015)

In Bulgaria, the grading system consists of a range from 2 to 6. A mark of 2 indicates that the student did not pass the exam, while a mark of 6 signifies an exceptional understanding of the material. It is uncommon for a Bulgarian student to receive a grade of 4.34, which would be rounded to 4.

In Italy, on the other hand, the grading system spans from 0 to 30 points. The student fails if he achieves less than 18 and achieves outstanding results if it has 30 points.

For example, a mark of 5.50 by the Bulgarian system is comparable with a 26 point grade in the Italian and an A according to the ECTS Grade and will be referenced in this paper as a student having an excellent mark.

In both systems the grades are discrete values and aim to reflect the students' comprehension and ability to apply the presented concepts.

For simplicity and visualization, the Italian grades have been converted to the Bulgarian system.

Attendance is an endogenous independent variable. Students are expected to attend lectures, following the universities' regulations but no strict obligation policy is imposed by the lecturer.

Some professors reward the regular attendance by additional points or penalize the absenteeism withdrawing points from final results. In this course the instructor strongly holds the opinion that academic results should be based on student's abilities to apply the course concepts, and not on the means to achieve the final results – attendance being one of them. If the self-studying process is more effective for the student in time consumption, efforts, emotional energy it is acceptable, although not recommended. There are neither penalties for absence nor rewards for appearance calculated in the final grading. The attendance lists collected is used only for statistical purposes in preparation of this paper. The general expectation is the attendance would still influence the final mark.

Homework assignments and mid-term on the other hand are also independent variables but exogenously imposed on the students by the professor. Not every course has them, as it involves additional work for the teaching staff.

The class requires preliminary knowledge of algebra, is challenging and difficult without significant commitment which inspired the professor to add the homework assignments and mid-term to the syllabus.

They aim to apply the course concepts in real life and support student's comprehending of the material. Each of the homework assignments and midterm exam are designed in such a way, that a student does not need to attend the lectures, but does need to read, understand and be able to reproduce the required reading material to master them.

The assignments are distributed and collected in MS Forms across all three groups.

The proposed determinants set a higher requirement to the instructors. In addition to delivering lectures, they also spend extra time preparing teaching materials for distribution and investing additional working hours in reviewing and providing feedback on trainee homework assignments. At the same time, they impose additional tasks to students and force them to rearrange their priorities paying more attention to regular work during the semester. The methodology avoids the overestimation of attendance on final achievements.

3.2. Descriptive statistics

The data set includes all the 94 students enrolled for the course. The data are collected personally by the professor teaching the course. All the statistical analyzes are conducted using the STATA software. The primary data are summarized in Table 2.

Table 2. Descriptive statistics

	Students	Min	Max	Average	Standard deviation
Grades	**94**	**2**	**6**	**3.76**	**1.4420**
2021	31	2	6	3.58	1.3850
2022	33	2	6	3.67	1.4069
2023	30	2	6	4.03	1.5421
Poisson Grades	**94**	**0**	**4**	**1.74**	**1.4512**
2021	31	0	4	1.54	1.4104
2022	33	0	4	1.67	1.4068
2023	30	0	4	2.03	1.5421
Attendance in %	**93**	**0**	**100**	**51.96**	**30.2001**
2021	31	8	100	58.03	33.0862
2022	32	0	100	48.97	31.3024
2023	30	7	87	48.87	25.5825
Homework in %	**93**	**0**	**97**	**49.32**	**29.5320**
2021	31	0	97	45.74	31.9249
2022	32	0	89	48.00	32.4256
2023	30	0	92	54.43	23.3632
Midterm in %	**94**	**0**	**95**	**47.60**	**23.4017**
2021	31	0	89	57.52	17.3702
2022	33	0	95	36.85	26.7910
2023	30	15	87	49.17	20.3233

Source: Own data collected over the three semesters. Descriptive statistics of the variables grades, Poisson grades, attendance, homework and midterm. The observations for the whole set and the three subsets by the year. Reported are the values for the number of observations, minimum, maximum, average, and standard deviation.

Looking at the table the following values are noteworthy.

The average grade over the whole period in the course was 3.76. The 2023 students had overall the highest average mark with 4.03. The MS Teams students had the lowest average mark.

The average attendance was highest for the Teams students and almost equal for the other two subsets. This most likely is the result of convenience of online classes.

The average midterm value was highest for the Teams students and lowest for the class of 2022.

The students show highest dedication to their homework with highest average and lowest standard deviation.

Poisson grades is a transformation of the variable grade. In the Poisson regression model one of the requirements is that the dependent variable is a count starting from zero.

3.3. Analysis of Variance (ANOVA)

An ANOVA test is performed to check if the three groups had significant differences in the means of the final grade.

For the whole sample, containing 93 students, the null hypothesis cannot be rejected with a p value of 0.4331, which means that there is no difference between the groups.

The MS Teams group is compared against the Bulgarian students with a resulting p value of 0.8063. Against the Italian students the p value is 0.2322. In both cases the null hypothesis that the means are equal cannot be rejected.

When comparing the Italian and Bulgarian students' means of final grade the corresponding p value is 0.3276. There is no significant difference between the two groups.

3.4. Dependent Variable

Final grade for the course. All the homework assignments jointly contributed to 25% of the final grade. The mid-term took place in the eight week of the semester and was weighted as 25% of the final grade also. The final exam has a weight of 50%. On midterm and final exam points are assigned for each correctly or partially correctly solved problem, they are summed, a percentage is calculated of the total number of points and according to a scale a grade is defined.

3.5. Independent variables

Percentage of attendance. The attendance in MS Teams is measured in minutes as a percentage of the total designated time of the sessions. If there is an Internet failure and the student reestablishes the connection the total time in session is considered. For personal attendance sessions the student is either present or missing. The percentage actually reflects the number of visited lectures to all the lectures during the semester. The row data are in Figure 2.

Percentage of successfully completed homework assignments. As per established practice the professor assigned 10 homework assignments during the course and graded each one as a percentage value (attained points divided by the total available points). The homework assignments are individual. All the participants receive feedback on each of the problems they struggle with. In the beginning of the next lecture the problems are solved in class.

Percentage of successfully solved problems and answered questions in a midterm exam. It is held during the eighth week of the semester and covers the material already discussed. Its purpose is to validate the basic knowledge of concepts on which the second part of the course would build on.

3.6. Correlation of factors

A standard correlation coefficient was calculated over the whole period and for each year. Both analyses show strong, positive correlation between the variables. All the results are significant even at 1% level. The fact should be expected as the final mark is a linear combination of submitted homework assignments, the results of the midterm and the solutions of the problems on the exam. Logically the independent variables are correlated between themselves. Students who have never attended, usually do not provide homework exercises. That leads to inability to solve midterm problems and ultimately failure in the final exam of the course.

4. Poisson Regression Model

4.1. Requirements to apply the model

The regression model that best fits our data is the Poisson model. All of the necessary conditions were fulfilled.

– The dependent variable grades are count variables that could not be negative. The students grade of 2, 3, 4, 5, and 6 were transformed to grades 0, 1, 2, 3, and 4.

– The observations are independent. The grades the students achieved in 2021, do not in any way influence the grades in 2022. There is no student that has taken this course more than once in the three periods observed.

– The mean rate is constant. Across all observed periods, the average grade that the students get is comparably equal.

– Mean and variance equality. The mean of the whole sample lies at 1.7447 and the variance is 2.1061. These values also signify that there is no overdispersion. A Pearson Chi^2 test was performed to test if the mean and variance deviate from each other. The p value was 0.658, which means that the null hypothesis cannot be rejected. The observed counts do not differ significantly from the expected counts. The assumption of equal means and variance holds supporting the Poisson distribution.

– There is no serial correlation.

– There is an adequate sample size, both for the main analysis and the year-by-year comparison. In each class there were a minimum of 30 students.

4.2. Regression coefficients

In the Poisson model the final grade of the students can be explained as a function of a constant, homework, attendance and mid-term grade.

There are two things we need to keep in mind when examining the effect of the independent variables on the dependent variable final grade:

As previously mentioned, to fit the Poisson model the dependent variable needs to be a count variable starting from 0. Each value was lowered by two. This makes no difference for the results of the regression, just make the interpretation harder. When interpreting the model, a value of 1, would mean 3 by the Bulgarian system.

The Poisson regression model is a logarithmic function. The *i* denotes the observed student in the sample.

The regression formula is

$$ln(FinalGrade_i) = ß_0 + ß_1 Homework_i + ß_2 Attendance_i + ß_3 MidTerm_i$$

This means that the coefficients of the independent variables would not have a linear influence on our dependent variable. If we observe a 1 unit change in Homework, keeping all other factors constant, the new final grade would be

$$\ln(NewFinalGrade_i) = ß_0 + ß_1(Homework_i + 1) + ß_2 Attendance_i + ß_3 MidTerm_i$$

The results from the Poisson regression are summarized in Table 3.

Table 3. Poisson regression results for the sample of students and the three subsets: years 2021, 2022 and 2023

Entire Sample		**Number of observations**	**93**
		Prob > chi²	**0.0000**
Final Grade	**Coefficient**	**Standard Deviation**	**p Value**
Homework	0.0267	0.0026	0.000
Attendance	0.0081	0.0020	0.000
Mid-Term Grade	0.0035	0.0018	0.052
Constant	-1.7825	0.1939	0.000

2021		**Number of observations**	31
		Prob > chi²	0.0000
Final Grade	**Coefficient**	**Standard Deviation**	**p Value**
Homework	0.0230	0.0051	0.000
Attendance	0.0062	0.0027	0.024
Mid-Term Grade	0.1389	0.0082	0.093
Constant	-2.2758	0.4698	0.000

2022		**Number of observations**	32
		Prob > chi²	0.0000
Final Grade	**Coefficient**	**Standard Deviation**	**p Value**
Homework	0.0233	0.0053	0.000
Attendance	0.0160	0.0047	0.001
Mid-Term Grade	0.0002	0.0027	0.934
Constant	-1.9122	0.2996	0.000

2023		**Number of observations**	30
		Prob > chi²	0.0000
Final Grade	**Coefficient**	**Standard Deviation**	**p Value**
Homework	0.0118	0.0057	0.037
Attendance	0.0216	0.0060	0.000
Mid-Term Grade	0.0071	0.0031	0.020
Constant	-1.6889	0.3513	0.000

Source: Own calculations. Statistical results from Poisson regression model. Summary statistics of the Poisson regression model for the whole sample and a breakdown per years

For the entire sample of data, there are 93 observation and the model seems to be a good fit. It has an overall p value of 0.0000, making it significant even at 1% confidence level. So, the null hypothesis that all the regression coefficients are simultaneously equal to zero will not hold and at least one of the coefficients is different from zero. Final grade is influenced by at least one of the independent variables.

Carefully examining the whole sample, the following conclusions can be made.

Homework, attendance and the constant are significant at the 1% level, whereas the mid-term grade is significant at the 5% level. At the 5% confidence level all of the independent variables are significant.

Homework has a positive and the most significant effect on the final grade. When all other factors are held constant, we can examine the increase of a student grade. If a student were to increase his homework score by 1 unit, the difference in the logs of expected counts would be expected to increase by 0.0267. The effect on the final grade will be a count of exponent to the power of 0.0267 ($e^{0.0267}$=1.0271).

Holding all other variables constant an increase of 1 unit in the attendance of the student would lead to a difference in the logs of expected counts of 0.0081. The attendance still has a positive effect on the final grade. Increase in attendance will increase the student's final grade. However, attendance has a lower effect on the final grade compared to the homework. The coefficient by which it would influence the expected count is $e^{0.0081}$=1.0081.

The mid-term grade also has a positive, significant effect on the final grade. Its effect on the dependent variable is the lowest. Compared to the other two independent variables the mid-term has the least effect on the final grade.

The regressions comparing the results by years gives us the option to look deeper in the different factors. The regression models are significant at 1% confidence level in each and every year.

The 2021 and 2022 samples show similar results. The variable mid-term is not significant at the 5% significance level.

Homework and attendance are both significant at 5% and both influence positively the final grade. The homework, has a higher influence on the dependent variable.

In 2023 all the coefficients are significant at 5% and have a positive influence on the dependent variable. In this subset attendance has the highest influence on the final grade, followed by homework and the mid-term is the least influential.

5. Discussion. Interpretation of results

The obtained results confirm the Moore's conclusion (Moore, 2004) that attendance influences the final grade of the student. The average attendance rate is 52%, which aligns more closely with the figure of 60% mentioned by Romer (1993) , as opposed to the 40% cited by Akimov et al. (2018) and 30% reported by Moore et al. (2003). Absence from class has an impact not only on the individuals who are not present, but also on the overall classroom environment, particularly in smaller groups. This may result in certain participants feeling uneasy and hesitant to actively participate in discussions. In this set of students while the attendance is an important factor homework proved to have even higher influence on the student's final performance.

Historically education is believed to be a social process that requires active interaction between a student and a professor and between students themselves. The expectation that there will be a substantial difference between the final grades of the students taking class in digital environment MS Teams and face-to-face does not prove valid in this set of students as the means and standard deviations are close to each other. The only observable difference is the absolute value of the coefficients. The MS Teams group, with a value of 0.0062 had a lower impact of the attendance on the final grade. For comparison in 2022 the value was 0.0160 and in 2023 it was 0.0216.

For future research it would be interesting to examine the new generations switch from real life to digital and see what impact it would have.

Having a feedback loop via homework assignments and mid-term exams benefits both the students and the professors. This confirms Borde's (2017) findings, that increased interactions ensure better performance. This is also in consistency with the results of Chung (2004) and Han & Finkelstein (2013).

According to OECD research (OECD, 2014) there are two poles of time spend by students on homework in different countries with the corresponding standard deviation (in brackets). In China it is 13.84 hours per week (0.3) and in Finland 2.8 hours (0.1). In between are the both groups that we observe Italy – 8.7 hours (0.1) and Bulgaria 5.6 hours (0.2). The data reflect the pro-homework oriented teaching systems that create pressure imposed by external influence for success versus desire for personal freedom based on internal motivation.

Hofstede's predictions about the expected cultural differences between the groups remain unconfirmed. This could be due to the small sample size, all the overlapping factors, such as age, university course, learning the course in a foreign language and others. The only difference of the Bulgarian and Italian students is the homework. The Italian students have a slightly higher average score on the submitted homework assignments.

6. Conclusion

In conclusion, the findings of the Poisson regression model indicate that homework assignments, mid-term exams, and attendance significantly and positively impact students' final grades. Notably, homework assignments have the highest positive impact on students' overall performance. Despite the additional effort required from professors to prepare and grade assignments, it is advantageous for students to engage more frequently with the study material and receive feedback on their knowledge gaps.

The regression models reveal minimal differences among the three subsets, namely virtual education, in-person education in Bulgaria, and in-person education in Italy. Students perceive the information similarly across these groups, and the final grades in all three categories are influenced by homework assignments and attendance.

The results of this study offer valuable insights to students, professors, and university administrators regarding the factors that influence academic achievement in higher education courses.

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