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Is first-year grade point average (GPA) a good predictor of success in business courses?

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Abstract

A key requirement within higher education is to identify which factors influence academic success. The current paper investigates students' performance at a business school in Scandinavia. This study includes around 200 students. By using a linear regression model, we analyse the impact of different explanatory variables. The results show that gender and age have little impact on grades achieved. Academic results from upper secondary school also have only a minor influence. The most important indicator of undergraduates' performance for subjects in the second and third year is GPA (grade point average) from the first year. But it depends on the kind of business course. There is a clear link between performance in a subject during the first year and later outcomes in the same field.

Keywords: GPA, undergraduates, business school, success, regression model

Introduction

Measuring student success can be done from different perspectives, like access to further studies, job opportunities, ranking of the students, and assessment of learning methods. Therefore, it is useful to identify elements that can explain success in higher education. There are many published articles on this topic, but with different approaches. According to Leitner et al. (2017), the purpose of much of the research is to use available statistics to create predictors for performance in higher education. This topic is especially interesting for business studies because there is great heterogeneity in the composition of subjects. Some of the courses are based on an approach without using mathematics (marketing, organizational theory, and more), while others use mathematics as an important tool in the presentation of the subject (economics, investment analysis, financial subjects, etc.). In addition, there are some methodology subjects (business mathematics, business statistics, quantitative and qualitative methods). Students have various interests, and they differ in their academic skills. The intellectual variables can include measuring of writing skills, oral presentation abilities, capacity to use technical tools, personality traits, collaborative ability, and insight into quantitative methods. In particular, many researchers have taken a closer look at the extent to which mathematics knowledge is a way to achieve good grades in business subjects (Opstad, 2019; Opstad & Årethun, 2020a; Smith & Schumacher, 2006). Unsurprisingly, the research shows a close link between mathematical background and success in quantitatively oriented subjects.

Students' performance or outcome can be measured in different ways, in addition to the letter grade achieved (Kumar et al., 2021). Possible measurement methods can be dropout rate, post-course outcome, oral presentation ability, collaborate ability, success in working life, and more. It can be challenging to ensure that the grades achieved in written school exams and long-answer questions are an objective method of measuring students' knowledge. There can be many factors that influence students' academic level (Opstad, 2021a).

 In this study, we will use achievement in traditional closed-book school exam as a measure of students' performance. We will try to identify factors that are linked to students' outcomes in the second and third years of a standard bachelor's degree program in business administration. The purpose is to gain knowledge on the factors that explain student performance. This is useful for educational administration, for planning study programmes, and for choosing the right pedagogical approach.

Literature Review

Gender and age

The research about the relationship between gender and performance among business and other students is mixed. According to Johnson et al. (2014), males get higher scores than females. Borde et al. (1998) suggest the same effect in corporate finance courses. Other studies find that females outperform males in business courses (Alfan & Otham, 2005; Yousef, 2011). Others do not observe any gender difference in students' performance (Parker, 2006; Rhodd et al., 2009; Yousef, 2019).

The research also shows no unambiguous correlation between age and students' outcome. Kaighobadi and Allen

(2008) suggest that older students perform better than others, while Koh and Koh (1999) report that younger students get higher grades than mature students. Other researchers do not notice any age impact on students' performance (Yousef, 2019).

GPA

Some articles suggest a positive relationship between GPA from upper secondary school (HSGPA stands for high school grade point average) and performance in business and economic courses (Brookshire & Palocsay, 2005; Cannonier & Smith, 2019; Opstad & Fallan, 2010). High GPA scores from upper secondary schools can be a good predictor for success in many business and economic courses.

Many authors claim that cumulative GPA (CGPA) is a key indicator of students' performance (Cui et al., 2019; Tatar & Düştegör, 2020). They find a strong significant positive relationship between CGPA and current performance in higher education. Alternatively, one can study the students' first-year GPA and later achievements in the bachelor's degree programme. There is a strong significant positive link between first-year results and later academic outcomes (Allen & Robbins, 2008; Kaighobadi & Allen, 2008; Opstad & Årethun, 2020b).

Mathematical skills

According to Ross and Wright (2020), quantitative skills and mathematical background are critical factors for success in finance courses. This finding is consistent with the research of others (Arnold & Rawaan 2014; Opstad, 2018).

Yousef (2011) reports a significant variation in students' performance in different business courses. Students with low scores in one quantitative course tend to do the same in other quantitative courses. There is a positive significant correlation, but those students may perform well in non-quantitative oriented courses

Accounting

Accounting courses are an important part of business studies. Lane and Porch (2002) report that students' accounting background does not correlate with further success in this field, and Al-Twaijry (2010) also finds no link between accounting background and performance in accounting at university level. However, he suggests a positive relationship between mathematics and achievement in accounting courses. Furthermore, he concludes there is a positive link between performance in the introduction course in accounting and later courses within this field. Alfan and Otham (2005) claim that prior knowledge in economics, mathematics, and accounting are critical factors for success in business and accounting programmes.

Hypotheses

Based on the literature review, this study poses the following research hypotheses:

H_1 (Hypothesis 1):   There is a strong link between first-year GPA and further success in business courses.

H_2 Hypothesis 2):   The relationship between performance in subjects in the first year and later in the study programme is particularly strong for subjects in the same subject area.

H_3 (Hypothesis 3):   Other factors such as gender, age, and performance in upper secondary school are correlated with second- and third-year achievements for studies in the bachelor's degree programme for business students.

The research shows that first-year GPA is a key indicator of performance further in the study. There is considerable heterogeneity in the subject portfolio within business administration bachelor's degree programmes. Therefore, it is assumed that the students' performances vary in the different subjects. Those who are well schooled in quantitative subjects are believed to do well in these subjects. Students who do not like quantitative presentation are assumed to have better success in non-quantitatively oriented subjects. It is also interesting to study how age, gender, and achievements from upper secondary school (HSGPA) affect students' outcomes.

Sample and Research Methods

The sample

In this study we have used administrative data from the NTNU Business School, Norwegian University of Technology and Science for 2017–2019. Due to the special conditions under COVID-19, we have only used data before 2020. A descriptive presentation of the data used in this analysis is presented in Table 1.

Table 1. Descriptive statistics (around 200 students in the sample)

	Mean	St. dev.	Skew-ness	Kurtosis
HSGPA (1 to 6, where 6 is top, high school GPA)	4.67	.35	-.868	3.600
Age (1:18–21, 2:22, 3:23, 4:24, 5:25–26, 6:27–30, 7:31–60)	3.79	1.40	.375	-.768

Gender (0:F, 1:M)	.50	.50	.010	-2.021
GPANQ (Non-quantitative subject first year: Marketing, Organizations and management, Business strategy) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.25	.66	-.377	-.040
GPAMET (Business mathematics, Business statistics) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.35	1.22	-.699	-.029
GPAEC (Microeconomics, Managerial economics and accounting) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.56	1.02	-.725	.543
Financial accounting with financial statement analysis (FA). (1st year) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.33	1.34	-.597	-.391
Investment and financial analyses (IF) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.63	.94	-.713	.898
Applied business statistics (ABS) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.50	1.13	-.630	.428
Quantitative and qualitative methods (QQ) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.17	1.00	-.568	.103
Organizational psychology (OS) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	2.72	.98	-.460	-.135
Commercial law (CL) (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),	3.03	.88	-.396	.094

Methodology

Based on the hypotheses, the following linear regression model is chosen:

$$Y_i = a_0 + a_1 X1_i + a_2 X2_i + a_3 X3_i + a_4 X4_i + a_5 X5_i + a_6 X6_i + a_7 X7_i + \varepsilon_i$$

where:

Y = grade attained in business subjects (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),

i = student,

α_0 = constant,

X_1 = gender (0: F, 1: M),

X_2 = upper secondary school HSGPA, mean score for all subjects (1: Fail, 6: Top grade)

X_3 = Student's age (1:18–19, 2:20, 3:21, 4:22 , 5:23, 6:24, 7:25–26, 8:27–30, 9:31–38, 10:39–60),

X_4 = GPANQ (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),

X_5 = GPAMET (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),

X_6 = GPAEC (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),

X_7 = FA (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),

ε = stochastic error.

The age of the students is divided into intervals to reduce the value of skewness and kurtosis. In this analysis, we have chosen to look at the following compulsory courses for second- and third-year students: Quantitative and qualitative methods (QQ), Investment and financial analyses (IF), Organizational psychology (OS), and Commercial law (CL). IF is a typical quantitative oriented subject, while OS is based on non-quantitative presentation. In addition, we have included a law course (not quantitative subject) as well as a methodology subject (QQ).

Findings and Discussion

The link between first-year GPA and second- and third-year performance (Hypotheses 1 and 2).

The results from the regression model confirm (H_1) that there is a strong significant correlation between first-year GPA and performance for the selected subjects (Table 2 and 3). The findings show the same pattern as shown in available research articles. Students who perform well in their first year can expect to do well in the two following years of their bachelor's degree programme.

The findings also confirm the research of Yousef (2011). There is a significant difference in which subjects are strongly correlated with the achievements later in the study programme. There is a strong link between performance in GPANQ and OS, with a standardized coefficient of over 0.3 with a significance level of less than 1 per cent. Good grades in non-quantitative subjects in the first year are a good indicator of good results in upper secondary courses in this field. On the other hand, for this subject there is no statistically significant correlation with GPAMET and FA. For the quantitative subject IF, there is no significant relationship to scores in MPANQ, while there is a statistically strong significant correlation with GPAMET and FA. The findings of links for IF are quite the opposite than those observed for OS. Students who do well in one field can expect to have success later within this topic. This confirms

the assumption in Hypothesis 2. The result shows great heterogeneity in the composition of the students for business administrative subjects. Some students prefer quantitative subjects, while others are more comfortable with non-quantitative subjects. The difference is quite substantial. If we look at the subject QQ that contains both qualitative and quantitative topics, we find an interesting observation. The achievements are particularly strongly correlated with GPAMET, but there is also a positive significant correlation with GPANQ. Good performance in either quantitative or non-quantitative subjects in the first year is positively related to the performance in QQ. Here it is not the same clear distinction that was observed for the OS and IF.

Table 2. Result from regression model QQ and ABS (VIF between 1.0 and 3.0) (VIF= Variance Inflation Factor)

	Quantitative and qualitative methods (QQ)			Investment and financial analyses (IF)		
	St. B	t-value	Sig.	St. B	t-value	Sig.
HSGPA	-.053	-.657	.512	-.095	-1.063	.290
Age	-.075	-1.025	.307	-.047	-.591	.556
Gender	.117	1.499	.136	.057	.641	.523
GPANQ	.176	1.939	.055	.111	1.143	.256
GPAMET	.373	3.829	.000	.274	2.414	.018
GPAEC	-.008	-.073	.942	.184	1.434	.155
FA	.277	3.254	.001	.290	2.948	.004
	N = 132. Adj R^s = .403			N = 108. Adj R^s = .438		

Table 3. Result from regression model OS and CL (VIF between 1.0 and 4.0)

	Organizational psychology (OS)			Commercial law (CL)		
	St. B	t-value	Sig.	St. B	t-value	Sig.
HSGPA	-.001	-.008	.994	-.001	-.268	.789
Age	.063	.721	.473	.080	.945	.347
Gender	-.178	-1.859	.066	-.109	-1.205	.231
GPANQ	.334	3.123	.002	.071	.653	.515
GPAMET	-.123	-.996	.322	.026	.203	.840
GPAEC	.329	2.232	.028	.321	2.092	.039
FA	.049	.418	.676	.263	2.222	.028
	N = 132. Adj R^s = .403			N = 108. Adj R^s = .332		

The findings for the fourth subject in this analysis are also interesting. Commercial law is not significantly connected either to GPAMET or GPANQ. However, the performance of CL is strongly positively significant related to the FA and GPAE. Opstad (2018) suggests a positive correlation between business law and mathematical knowledge. One explanation was that good analytical ability is important for performing well in legal subjects. In addition, good written presentation skills are awarded. These characteristics lead also to success in economics and accounting subjects. This may be the explanation for the close link between performance in CL and success in GPAEC and FA. Therefore, it is reasonable that performance in GPAEC and FA are better predictors of success in business law than GPAMET and GPANQ disciplines.

There is no clear intuitive explanation for why GPAEC is positively correlated to OS, but not IF. The same applies to the link between QQ and FA. On the other hand, as expected, there is a positively significant relationship between IF and FA. Both subjects focus on business analysis. This is consistent with the findings in previous studies (Al-Twaijry, 2010; Alfan & Otham, 2005).

Gender, age and HSGPA (Hypothesis 3)

Previous research shows mixed results when it comes to the association between gender and performance in business administrative subjects. Prior research does not give any clear answer about this topic. Due to greater gender equality in recent years, gender is perhaps to a lesser extent a factor explaining success in business subjects. Hence, there are many recent studies that do not find any gender differences in student performance in business subjects (Opstad, 2021b; Terry et al., 2015). Traditionally, men have performed better than females in economics and quantitative courses (Borg & Stranahan, 2002; Johnson et al., 2014). In this study, there are generally no substantial gender differences in terms of performance. The only exception is OS, where women perform better than men (with a 10 per cent significance level). Some previous research confirms this tendency in management courses (Friday et al., 2006). Previous research gives a mixed picture about the relationship between age and achievements in business courses.

This study does not find any age impact. Note that most of the undergraduates in this sample are around 23 years of age (Figure 1). In order to study the age effect more closely, it would have been desirable to have more variation in age among the students included in the survey.
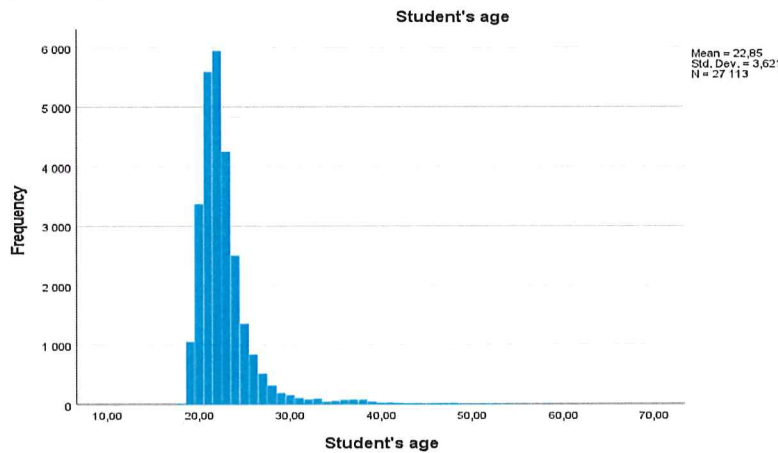

Figure 1. Distribution of age

In the model presented in this article, HSGPA does not have any impact on the performance in business courses after the first year for undergraduates in business courses. Based on previously published articles, this is a somewhat surprising result.

We can conclude this research does not confirm H_3.

Conclusions and Limitations

This research confirms the assumption that GPA in the first year of study is a very good predictor of further success for business students. This is consistent with the available literature (Allen & Carter, 2007; Parrish, 2013).

The independent variables explain between 33 and 45 per cent of the variation in success in the different subjects (see adjusted R square). These are rather high values. If we only keep GPA from the first year as an explanatory variable, this will have little impact on R square; the values will be approximately the same.

This study shows that undergraduates at the NTNU Business School are not a homogenous group. This suggests there is a close relationship between the students' success in the introductory course and their later performance in courses within the same field. This is in line with the findings of Bernardi and Bean (2002). Students' characteristics like age and gender seem to have minimal impact on the performance in business courses.

This study has clear limitations. Data are only from one business school in Scandinavia, and only administratively available data are used. Therefore, no conclusions can be drawn on other possible factors, including students' behaviour and degree of effort.

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