



# Skills, Gender, and Performance Matter when Undergraduate Business Students Choose Specialisation within Business Courses

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The purpose of this article is to explore the heterogeneity among undergraduate Norwegian business students. This is made visible by the students' choice of subjects in their third year. The chosen methodology is the ordinary least square (OLS) regression model. By using dummy variables depending on the preferred discipline, we can analyse what impact the composition of students will have on their performance in the compulsory courses during the two first years. The students who are highest ranked by letter grades tend to select further studies in finance and accounting subjects. One should be aware of this in the design of study programmes.

*Keywords:* business students, major, performance, gender, quantitative analysis, learning, knowledge

## Introduction

There is a heterogeneous group of students at the Norwegian University of Technology and Science (NTNU) Business School. They vary in preferences, personal characteristics, academic abilities, and attitudes towards mathematics (Opstad, 2019). This has an impact on the undergraduate students' selection of a course major in the third year. There is an assortment of students depending on preferred major. Students with good quantitative skills want to specialise in financial subjects. Those who have anxiety towards mathematics and minor success in this subject tend to specialise in non-quantitative courses like marketing and management. The brightest students study finance while students performing below average prefer, to a larger extent, to study non-quantitative majors. We see the same pattern at other business schools (Aggarwal et al., 2007).

## Review of the Literature

According to prior research, there is a distinction in the quality of students who are attracted to different majors in business studies (Bycio & Allen,

2007). A lot of studies confirm differences in performance depending on the chosen major. Black and Duhon (2003) reported that management students underperform relative to other majors after controlling for GPA (Grade Point Average) score, age, and gender. Using a regression model, Bielinska-Kwapisz et al. (2012) found that students in marketing and management had a disadvantage in performance compared to accounting and finance majors. In the study of Bycio & Allen (2007), students completing the finance major performed significantly better than students with either marketing or management majors. However, Bagamery et al. (2005) did not notice any difference in student scores among the business majors.

Having talent in mathematics seems to be one of the main reasons for selecting a major in finance or accounting. Students who feel that they do not have control over their academic work are less motivated to select demanding and laborious disciplines. Many students avoid majors that have a reputation of requiring a lot of effort. The opportunity costs for achieving success are too high (Davies et al., 2016). Roach et al. (2012) suggest that job availability and job security might be more important than quantitative abilities when students choose a business major discipline.

Aggarwal et al. (2007) found that the quality of students differs depending on their course major. They suggest that marketing attracts students who are good in written and oral communication. Mathematical skills are an important factor in the decision process for selection of a major field. Those who do well in mathematics tend to prefer quantitative disciplines like economics, finance, or accounting. Tarasi et al. (2013) pointed out that students preferring a marketing major use quantitative tools less frequently. Aggarwal et al. (2007) observed that marketing and management attract students who score poorly in academic achievement compared to other business majors. American data from a variety of colleges show that students in marketing and management perform considerably weaker than students in other majors. The results are stable over many years (1982–2005) and stable over time. It is not clear why there is such a composition of students. Do the students take in marketing and management due to special interest in the field or because they consider this choice to be an easier way to get a bachelor's degree in business studies? Pappu (2004) reported that many students choose marketing because it gives a wide range of career possibilities and it is easy to combine with other business majors (Siegall et al. 2007). Another reason for choosing marketing is that students find the field interesting and exciting. Students who report being poor with numbers like marketing and management (Schlee et al., 2007).

There might be a gender difference in business studies. Some studies report that men get higher scores than women (Black & Duhon, 2003; Bagamery et al., 2005; Zeis et al., 2009). By examining multiple majors,

**Table 1** Chosen Major The Third Year

Item	GPA score*	Females		Males		Total
		N	%	N	%	
Finance	52.3	74	27.6	116	47.7	190
Accounting	51.6	45	16.8	37	15.2	82
Marketing	52.0	90	33.6	71	29.2	161
Management	51.7	59	22.0	19	7.9	78
Total		268	100.0	243	100.0	511

**Notes** \* From high school.

Bielinska-Kwapisz et al. (2012) found that males outperform females in all business majors (finance, accounting, management and marketing) with the highest gap in accounting. On the other hand, Bycio & Allen (2007) did not find any differences related to sex.

Numerous studies have shown that the GPA (Grade Point Average) score from upper secondary school is an indicator of performance in business studies (Bycio & Allen, 2007; Rook & Tanyel, 2009; Bielinska-Kwapisz et al., 2012; Ketcham et al., 2018). There is a significant positive correlation between GPA scores and success in business studies across all subjects and majors.

### Sample and Research Methodology

The data used in this study were collected from business students in the NTNU Business School, Norway, within the 4-year period 2013 to 2016. The students in the undergraduate bachelor's programme have almost identical course portfolios in the first two years, but in the third year, they can select among different majors. In this study, we focus on four different majors: management, marketing, accounting, and finance. The average number of students completing the bachelor's degree is around 200 per year. The students can choose courses across majors. Around 40 per cent of the students overlap between the major courses in marketing and management. The proportion of crossovers is much lower for accounting and finance. In order to avoid double counting, we decided to exclude those students and those with unknown gender. A significantly greater share of males compared to females chooses the finance major, while female students have higher preferences for attending a major in management (Table 1).

Table 2 shows that there are differences in performance in compulsory courses during the first and second year, depending on the student major course of study. The finance major students have the highest score. The accounting students are second to the finance class, and both classes have higher letter grades than marketing and management students.

By using a linear regression model, we will analyse how the composition

**Table 2** Performance Depending on Chosen Major

Item	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)	3.01	2.92	3.15	2.10	2.22	3.38	3.76
(b)	3.12	3.00	3.25	2.31	2.54	3.46	3.70
(c)	3.24	3.18	3.31	2.28	2.77	3.52	3.81
(d)	2.94	3.00	2.90	2.53	3.07	2.82	3.08
(e)	2.96	2.98	2.96	2.71	2.82	2.75	3.26
(f)	3.02	3.12	2.95	2.44	2.35	3.16	3.38

**Notes** Column headings are as follows: (1) all, (2) female, (3) male, (4) management, (5) marketing, (6) accounting, (7) finance. row headings are as follows: (a) business mathematics and business statistics, (b) quantitative courses in economics and business studies (business economics, microeconomics and macroeconomics), (c) accounting (financial accounting and managerial accounting), (d) introduction to marketing, (e) management (organizational management and organizational psychology), (f) business law.

of students in different majors depending on their success in compulsory courses. The applied model is:

$$y_i = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + \alpha_3 x_3 + \alpha_4 x_4 + \alpha_5 x_5 + \varepsilon, \quad (1)$$

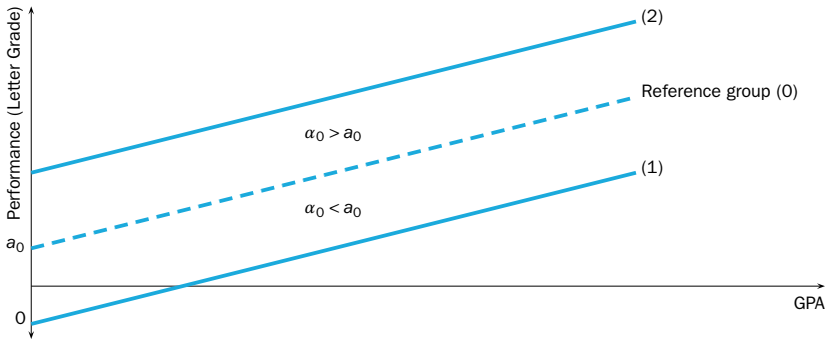
where  $y_i$  are Grades in the compulsory course  $i$  (0: F, 1: E, 2: D, 3: C, 4: B, 5: A),  $\alpha_0$  is constant,  $x_1$  is gender (0: F, 1: M),  $x_2$  is Grade Point Average (GPA) from upper secondary school,  $x_3$  is dummy variable for having chosen finance course (0: not chosen, 1: chosen),  $x_4$  is dummy variable for having chosen accounting (0: not chosen, 1: chosen),  $x_5$  is dummy variable for having chosen management course (0: not chosen, 1: chosen), and  $\varepsilon$  is stochastic error.

The literature shows that the GPA score and gender affect student performance in business courses. Hence, they are included as independent variables. To avoid multicollinearity, no dummy variables for marketing major are included in the regression model and this group will belong to the reference category, which also includes some students who have taken other courses the third year.

The focus of this study is to see how students preferring different majors perform compared to the reference group. If the value of the dummy variable is positive, the curve will shift upwards from (0) to (1). Those students will perform better than the reference group. On the other hand, if the coefficient ( $\alpha_i$ ) for the dummy variable is negative, the curve will shift downwards from (0) to (2). This means that the students belonging to this major underperform relative to the reference group.

## Findings

For all courses, there is a significant positive link between GPA score and performance. There is a clear positive connection between gender and



**Figure 1** The Link between GPA and Performance Depending on the Dummy Variables

**Table 3** Dependent Variable: Performance in Mathematics and Statistics

Item	Business math		Business statistics	
	(1)	(2)	(1)	(2)
Constant	0.16		-0.425	
Gender	0.088 (0.167)	0.528	-0.107 (0.172)	-0.63
GPA	0.049 (0.025)	1.98 **	0.055 (0.026)	2.12 ***
Finance	0.993 (0.194)	5.10 ***	1.369 (0.199)	6.88 ***
Accounting	0.683 (0.246)	2.78 ***	1.236 (0.251)	4.92 ***
Management	-0.441 (0.260)	-1.70 *	-0.373 (0.271)	-1.38
R <sup>2</sup>	0.139		0.199	
N	328		328	

**Notes** Column headings are as follows: (1) coefficient, (2) t-value. Standard error difference in parenthesis; \*, \*\* and \*\*\* denote significance at the 10%, 5% and 1% level, respectively; VIF (variance inflation factors) values are between 1.0 and 2.0.

macroeconomics, while this effect is negative for introductory courses in marketing and business law. Except for marketing and organisational management, the dummy variable for finance major has a positive impact on performance. The same tendency applies for accounting majors as well. There is, however, no significant positive impact from an accounting major on the performance in marketing. Unlike the finance major, the accounting major has a positive influence on organisational management, but not on organisational psychology. For all other courses, there is a positive correlation. The picture is the opposite for a management major. Consistently significant negative effects are present. The exception is in the following three

**Table 4** Dependent Variable: Performance in Quantitative Courses in Economics and Business Studies

Item	Business economics		Micro-economics		Macro-economics	
	(1)	(2)	(1)	(2)	(1)	(2)
Constant	-0.908		0.879		-0.586	
Gender	0.096 (0.158)	0.61	-0.163 (0.130)	-1.26	0.213 (0.119)	1.79 *
GPA	0.068 (0.023)	2.92 ***	0.038 (0.019)	1.95 *	0.067 (0.018)	3.80 ***
Finance	0.490 (0.184)	2.66 ***	0.0967 (0.150)	6.43 ***	0.74 (0.139)	5.32 ***
Accounting	0.733 (0.233)	3.14 ***	0.852 (0.192)	4.45 ***	0.663 (0.176)	3.76 ***
Management	-0.781 (0.244)	-3.19 ***	-0.266 (0.203)	-1.31	-0.687 (0.180)	-3.81 ***
$R^2$	0.121		0.175		0.245	
$N$	338		328		322	

**Notes** Column headings are as follows: (1) coefficient, (2) t-value. Standard error difference in parenthesis; \*, \*\* and \*\*\* denote significance at the 10%, 5% and 1% level, respectively; VIF (variance inflation factors) values are between 1.0 and 2.0.

**Table 5** Dependent Variable: Performance in Accounting

Item	Managerial accounting		Financial accounting	
	(1)	(2)	(1)	(2)
Constant	0.350		-1.403	
Gender	0.44 (0.166)	0.26	-0.130 (0.171)	-0.76
GPA	0.05 (0.025)	2.10 **	0.083 (0.025)	3.37 ***
Finance	0.662 (0.195)	3.39 ***	0.693 (0.200)	3.46 ***
Accounting	0.669 (0.245)	2.73 ***	0.750 (0.250)	3.00 ***
Management	-0.897 (0.259)	-3.46 ***	-0.698 (0.272)	-2.57 **
$R^2$	0.132		0.139	
$N$	318		284	

**Notes** Column headings are as follows: (1) coefficient, (2) t-value. Standard error difference in parenthesis; \*, \*\* and \*\*\* denote significance at the 10%, 5% and 1% level, respectively; VIF (variance inflation factors) values are between 1.0 and 2.0.

subjects: microeconomics, business statistics, and organisational psychology. Notice that this result appears when we compare with students in the

**Table 6** Dependent Variable: Performance in Non-Quantitative Courses

Item	Introduction to marketing		Organisational management		Organisational psychology		Business law	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Constant	0.756		-0.533		0.582		-3.011	
Gender	-0.172 (0.103)	-1.67 *	-0.184 (0.127)	-1.45	-0.115 (0.128)	-0.90	-0.501 (0.199)	-2.57 **
GPA	0.045 (0.015)	2.92 ***	0.072 (0.019)	3.84 ***	0.040 (0.019)	2.13 **	0.116 (0.032)	3.68 ***
Finance	0.119 (0.120)	0.99	0.144 (0.147)	0.98	0.577 (0.148)	3.91 ***	0.646 (0.234)	2.76 ***
Accounting	-0.212 (0.152)	-1.40	-0.697 (0.192)	-3.63 ***	0.211 (0.193)	1.09	0.669 (0.282)	2.37 **
Manag.	-0.523 (0.159)	-3.28 ***	-0.532 (0.195)	-2.72 ***	-0.011 (0.200)	-0.05	-0.840 (0.373)	-2.25 **
$R^2$	0.078		0.123		0.065		0.290	
$N$	338		328		336		120	

**Notes** Column headings are as follows: (1) coefficient, (2)  $t$ -value. Standard error difference in parenthesis; \*, \*\* and \*\*\* denote significance at the 10%, 5% and 1% level, respectively; VIF (variance inflation factors) values are between 1.0 and 2.0.

reference group, i.e., mainly students choosing courses in the marketing discipline. If we look at financial accounting, students who have chosen further studies in this field (accounting) or in finance achieve grades that are about 0.75 points better (three quarters of a letter grade) on average, while those belonging to management will underperform with grades that are about 0.7 lower when compared to the reference group. Furthermore, with a significance level below 1 per cent, there is a strong link between performance in business statistics and mathematics and in selection of further studies within finance or accounting.

## Discussion

The substantial variety of student preferences is reflected in the choice of courses and majors in their third year. The composition of students differs depending of the field selected in the third year reflecting different preferences, skills and interests.

GPA from upper secondary school has an impact on achievement in all business courses. The link is positive and significant for all presented courses. Besides mathematical skills, GPA is the most important factor to determine study success (Opstad, 2018). However, there are some variations in the unstandardised coefficient for GPA. For instance, this value is distinctly higher for business law than for other courses. This could be related to the fact that business law is a non-quantitative course that re-

quires significant analytical skills and good writing ability. High GPA scores show academic capacity and the students get rewarded in disciplines like business law. Pitts et al. (2005) confirm this finding.

For the majority of the courses, there is no significant gender impact. However, there are some exceptions. In macroeconomics, males perform better than the females, but the opposite is true for management and business law. Some studies confirm this tendency. The female students struggle more with quantitative courses relative to male students, but they do better in non-quantitative subjects. This might indicate a gender gap in favour of men (Naqvi & Naqvi, 2017). Daymont and Blau (2008) however, reported higher scores for female students than their male peers. Based on such findings, the results in this research make sense. However, prior studies do not give a clear answer for the gender effect. Many studies have not found any significant gender gap in law studies (Sigfried, 1980; Terry et al., 2015; Fordyce et al., 2017).

This study shows that the undergraduate business students at the NTNU Business School are not a homogenous group. This is clearly evident by looking at the coefficients of the dummy variables. If there were no diversities in the composition of students choosing different pathways through their major studies, the coefficients of the dummy variables would not vary when we compare the preferred fields with the reference group.

Our study shows that there is a substantial difference in quantitative skills depending on the selected major. This is in line with findings of Newell et al. (1996) and Tularam (2013). Those who have decided to specialise in finance subjects perform about one letter grade better in business statistics and business mathematics. The reason is probably that subjects in finance are quantitative oriented, and business statistics are definitely an important tool in this field. The magnitude of this impact is modest, but still substantial and significant for quantitative business courses. Compared to students choosing the marketing field (reference group), the dummy coefficient for finance major appears to be significantly positive for organisational psychology and business law as well (with a coefficient around 0.6). On average, the finance group students outperform the reference group by more than half of a letter grade.

The same tendency is also seen among the students who prefer to specialise in accounting. The students who select to study this discipline outperform the reference group in quantitative courses. There is a strong positive link, but the coefficients are marginally smaller than for the finance students. For the non-quantitative courses, the results are more mixed. A significant influence occurs for two courses, and notice that it is with an opposite sign. In organizational management, the link is negative.

The picture is quite the opposite among students who choose manage-



ment compared to those taking further studies in finance and accounting. When considering that the reference group consists mainly of students who prefer marketing, it means that students who have chosen to specialise in marketing outperform those who take added courses in management. Among the students who prefer management there is a strong negative link for almost all courses.

For organisational psychology, the effect is also negative, but not significant. Notice also that for the other management course (organisational management) there is a substantial negative relationship. The conclusion is that students with the weakest achievements in compulsory courses tend to select further studies in management.

Our finding is consistent with some previous studies. This is the same pattern as Aggarwal et al. (2007) had noticed. The quality of the students is different depending on their chosen field. Management majors get the lowest score (representing the line below the reference group). The best students prefer specialisations in accounting and finance (indicated by the line (1) in the figure).

The difference between the student mean letter grade in the compulsory courses for those who have chosen finance major and management major is substantial. Based on the values on the dummy coefficients, the calculated difference is more than one letter grade for most of the business courses. This means that there is a large variation in student academic skills among the different majors. The data in this survey does not provide a complete answer to these findings. We know from other studies that mathematic skills and attitudes can be an explanatory factor. Students with practical mathematics from upper secondary school demonstrate a substantially poorer performance in quantitative courses (Opstad, 2018). Those students tend to prefer non-quantitative majors. Our investigation confirms this result, because the difference in success between students choosing finance and management major, respectively, is significantly less in courses where the student performance does not depend on mathematical skills (for instance in the introductory course in marketing).

Other research papers show that there is a close link between the student success in the introductory course and their later performance in desired course within the same field (Bernardi & Bean, 2002; Opstad & Årethun, 2020). This positive selection may be due to preferences, interest, skills and success.

### Limitation and Contribution

The present dataset is from one business school only. In the regression model, there are few independent variables besides the dummy variables. This creates some limitations and can explain the low *R*-square values.

Adding additional independent variables to our analyses would probably increase the *R*-square values, and it could have led to a slightly different result regarding the effects of gender and GPA on performance.

The causal effect is not obvious. Our regression model has explored how characteristics among the students choosing different pathways in the third year have influenced the performance in compulsory courses. The composition of students within various disciplines differs. However, an obvious interpretation of the results is that performance in compulsory courses is a key factor to explain student selection in the third year. Students who are being successful in the two first years tend to prefer specialisations in finance and accounting. They may have the most promising and prosperous careers in business ahead of them. Therefore, those with the best letter grades tend to choose this lane. Among those who achieve poorer grades, further studies in management are more tempting.

Using data from a Norwegian business school, this research confirms that there are differences in performance among students depending on their chosen major. This information is useful for ensuring a diverse study programme that may be adapted to the individual student interests. There is a discussion about requiring theoretical mathematics as a criterion for enrolment into business schools. The result will be another selection of students and will probably improve the student performance. On the other hand, this will likely lead to fewer students choosing non-quantitative majors. One should consider both these effects when determining the level of math skills as entry ticket to business studies.

A different composition of the students may have an impact on the grading practice. If the instructor is not aware of this or if he or she ignores it, the result will be different grading practice depending on student choice of major. It will then become harder to achieve good grades in subjects with many skilled undergraduates (Opstad, 2020).

### **Conclusion and Further Research**

The results of this study confirm the findings from other business schools. By dividing the students according to their choice of discipline, significant differences are revealed among the student performance and their reasons for choice of course portfolio. There is a substantial heterogeneity among undergraduate business students. The evidence or indicator is student selection of specialisation in the third year. Undergraduates who choose further studies in finance or accounting tend to have higher average grades in the compulsory courses, while the opposite is the case for those who take extra courses in management. There might be some gender effects as well. Female students favour some non-quantitative courses.

There is a need for further research to explore why there is such a con-

siderable difference among the undergraduates' choice of pathways in the third year. Why do various disciplines attract different kinds of students?

## References

- Aggarwal, P., Vaidyanathan, R., & Rochford, L. (2007). The wretched refuse of a teeming shore? A critical examination of the quality of undergraduate marketing students. *Journal of Marketing Education, 29*(3), 223–233.
- Bagamery, B. D., Lasik, J. J., & Nixon, D. R. (2005). Determinants of success on the ETS Business Major Field Exam for students in an undergraduate multisite regional university business program. *Journal of Education for Business, 81*(1), 55–63.
- Bernardi, R. A., & Bean, D. F. (2002). The importance of performance in intermediate accounting on performance in a subsequent accounting course. *The Accounting Educators' Journal, 14*, 1–13.
- Bielinska-Kwapisz, A., Brown, F. W., & Semenik, R. (2012). Is higher better? Determinants and comparisons of performance on the Major Field Test in Business. *Journal of Education for Business, 87*(3), 159–169.
- Black, H. T., & Duhon, D. L. (2003). Evaluating and improving student achievement in business programs: The effective use of standardized assessment tests. *Journal of Education for Business, 79*, 90–98.
- Bycio, P., & Allen, J. S. (2007). Factors associated with performance on the Educational Testing Service (ETS) Major Field Achievement Test in Business (MFT-B). *Journal of Education for Business, 82*, 196–201.
- Davies, M. A., Tikoo, S., Ding, J. L., & Salama, M. (2016). Motives underlying the choice of business majors: A multi-country comparison. *The International Journal of Management Education, 14*(1), 50–61.
- Daymont, T., & Blau, G. (2008). Student performance in online and traditional sections of an undergraduate management course. *Journal of Behavioral and Applied Management, 9*(3), 275–294.
- Fordyce, J., Jepsen, L. K., & McCormick, K. (2017). Predicting first-year law school performance: The influences of race, gender, and undergraduate major. *Eastern Economic Journal, 43*(1), 64–77.
- Ketcham, D., Nigro, P., & Roberto, M. (2018). Do persistence and passion matter: Evidence from the educational testing service major field test in business. *Journal of Education for Business, 93*(3), 112–118.
- Naqvi, A., & Naqvi, F. (2017). A study on learning styles, gender and academic performance of post graduate management students in India. *International Journal of Economics & Management Sciences, 6*(3), 1–6.
- Newell, S. J., Titus, P. A., & West, J. S. (1996). Investigating the undergraduate student decision-making process of selecting a business specialisation: A comparison of marketing and non-marketing business students. *Journal of Marketing Education, 18*(3), 57–67.
- Opstad, L. (2018). Success in business studies and mathematical background: The case of Norway. *Journal of Applied Research in Higher Education, 10*(3), 399–408.

- Opstad, L. (2019). Different attitude towards mathematics among economic and business students and choice of business course major in Norway. *Social Sciences and Education Research Review*, 6(2) 6–30.
- Opstad, L. (2020). Why are there different grading practices based on students' choice of business major? *Educational Process: International Journal*, 9(1), 43–57.
- Opstad, L. & Årethun, T. (2020). Factors that explain undergraduate business students' performance in their chosen field: Does gender matter? *Global Conference on Business and Finance Proceeding*, 15(2), 2–21.
- Pappu, R. (2004). Why do undergraduate marketing majors select marketing as a business major? Evidence from Australasia. *Journal of Marketing Education*, 26(1), 31–41.
- Pitts, S. T., Doss, D. A., & Kamery, R. H. (2005). What are the effects of part-time instruction on final grades in the business law course? *Academy of Educational Leadership Proceedings*, 10(2), 75–80.
- Roach, D. W., McGaughey, R. E., & Downey, J. P. (2012). Selecting a business major within the college of business. *Administrative Issues Journal*, 2(1), 107–121.
- Rook, S. P. & Tanyel, F. I. (2009). Value-added assessment using the Major Field Test in Business. *Academy of Educational Leadership Journal*, 3(1), 87–94.
- Schlee, R. P., Curren, M. T., Harich, K. R., & Kiesler, T. (2007). Perception bias among undergraduate business students by major. *Journal of Education for Business*, 82(3), 169–177.
- Siegall, M., Chapman, K. J., & Boykin, R. (2007). *Assessment of core courses and factors that influence the choice of major: A 'major' bias*. <https://www.westga.edu/bquest/2007/bias7.pdf>
- Siegfried, J. J. (1980). Factors affecting student performance in law school economics courses. *The Journal of Economic Education*, 12(1), 54–60.
- Tarasi, C. O., Wilson, J. H., Puri, C., & Divine, R. L. (2013). Affinity for quantitative tools: Undergraduate marketing students moving beyond quantitative anxiety. *Journal of Marketing Education*, 35(1), 41–53.
- Terry, N., Macy, A., Clark, R., & Sanders, G. (2015). The impact of lecture capture on student performance in business courses. *Journal of College Teaching & Learning*, 12(1), 65–74.
- Tularam, G. A. (2013). Mathematics in finance and economics: Importance of teaching higher order mathematical thinking skills in finance. *e-Journal of Business Education and Scholarship of Teaching*, 7(1), 43–73.
- Zeis, C., Waronska, A., & Fuller, R. (2009). Value-added program assessment using nationally standardized tests: Insights into internal validity issues. *Journal of Academy of Business and Economics*, 9(1), 114–128.

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