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GENDER DIFFERENCES IN GRADE POINT AVERAGE AMONGS THE UNIVERSITY OF BANJA LUKA` S STUDENTS FROM DIFFERENT FIELDS

Summary: *Some fields are often thought of as mainly "male" or "female" domains, with uneven gender participation and achievement levels. We wanted to examine if there are gender gaps in the average university grades (GPA) between different fields of study, which are not attributable to the general intelligence (g) differences. The sample comprised 745 University of Banja Luka's students (61.1% females) from 14 fields of study. After adjusting for g (η_P^2=.014, p=.002) and a year of study (η_P^2=.021, p<.001), there were between-field GPA differences (η_P^2=.123, p<.001), but no overall gender differences. However, there was a gender-field interaction (η_P^2=.046, p=.001): the males had higher GPAs in Biology, Chemistry, and Psychology, while the females had higher GPAs in Philology, Economics, and Electrical & Computer engineering. Thus, some field specific "gender gaps" in the GPA amongst University of Banja Luka's students do exist, but they do not necessarily point to typical gender-stereotypical pattern of field differences.*

Keywords: *achievement gaps in higher education, gender differences, grade point average (GPA), intelligence*

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Introduction

There are many jobs and professions often colloquially referred to as "men's" or "women's". For example, it is often suggested that fewer women than men pursue careers in so called STEM fields (science, technology, engineering, and mathematics) (Hill, Corbett, & Rose, 2010; O'Dea, Lagisz, Jennions, & Nakagawa, 2018). Potential explanations for this are numerous. Authors are pointing to different cognitive abilities and variabilities between genders, different motivational factors, values, communal goals, and choices, different prior expectations and achievements, and even straight-up sexism, and so on (Alon & DiPrete, 2015; Diekman, Brown, Johnston, & Clark, 2010; Halpern et al., 2007; Kuchynka et al., 2018; Moss-Racusin, Molenda, & Cramer, 2015; Nicholls, Wolfe, Besterfield-Sacre, Shuman, & Larpkiattaworn, 2007; O'Dea et al., 2018; Rask, 2010; Wang & Degol, 2013; Wang, Eccles, & Kenny, 2013).

On the other hand, however, women are much more likely to seek degrees in health and biomedical sciences, psychology, liberal arts and humanities, and education/teaching, with roughly equal gender distributions in business and certain multidisciplinary and social sciences (National Center for Education Statistics, 2018, 2019).

Regardless of the underlying mechanisms, the fact remains that there are significant "gender gaps" in many disciplines and fields of study. This preliminary research focuses on gender disciplinary differences in college achievement. Specifically, we are interested in examining if there is a pattern of differences in the average grades (i.e., grade point averages – GPAs) between female and male students in stereotypically "male" and "female" disciplines (fields of study). We are limiting our examination to the B&H students, studying at the University of Banja Luka. Due to well-known association between intelligence and scholastic achievement (e.g., Roth et al., 2015), we will also take general intelligence into consideration.

Method

Sample and procedure

The sample comprised 745 university students (61.1% females), years I through V[1] (I – 3.1%, II – 35.0%, III – 38.7%, IV – 21.5%, V – 1.7%), currently studying at the University of Banja Luka, Republic of Srpska, B&H. All the students had permanent or temporary address inside the B&H at the moment of testing. The testing was done anonymously, during 2015/16 and 2016/17 academic years, using pen & paper procedure. Testing times were not strictly measured of limited (including the administration of matrix reasoning intelligence test).

Table 1. Gender frequencies for 14 fields of study

Field of study	Frequencies	
	Females	Males
Biology	41	10
Ecology	12	11
Physics	30	10
Earth sciences	10	11
Chemistry	55	14
Mathematics	48	35
Economics	29	25
Law	32	34
Philology (language studies)	22	12
Urban planning	15	31
Electrical & Computer engineering	20	31
Agriculture	20	31
Medicine & Dentistry	44	19
Psychology	77	16
Total	455	290

[1] Note that all the year I students were tested during the second semester, i.e., after they had a chance to take at least several exams. All the students are from the BA level of studies, including those from year V.

The sample used in this article is a subsample drawn from a larger, continuously expanding dataset; in order to obtain certain numbers of female and male student participants per groups, only 14 fields of study were retained, for which we had no less than 10 of both male or female participants. To increase statistical power, some otherwise similar fields were collapsed into same categories (e.g., Medicine & Dentistry; Serbian, Germain, English, etc. were grouped under joint Philology category, etc.). Sample gender frequencies per fields of study are shown in Table 1. Females are more prevalent in seven fields, males in three, with roughly similar distributions in the remaining four. Note that these numbers do not represent the exact student gender breakdowns for the given fields, but they are close approximations of the actual proportions.

Measures

The GPA was reported by the students themselves. We asked students to report their average grades calculated from all the exams they have passed up to that point, rounded up to two decimal places. GPA distribution was roughly normal (*Sk*=0.31, *Ku*=-0.32), with a mean of 7.86 (*SD*=0.78), on a possible 6-10 grade range. All other SES and related variables, including gender, field of study, year of study, etc., were also self-reported. In many instances, students were administered additional questionnaires, unrelated to this article's topic.

General intelligence was measured using the ICAR's (International Cognitive Ability Resource; Condon & Revelle, 2014) Matrix Reasoning test. This is a short general intelligence (*g*) test, which consists of 11 tasks, resembling those used in Raven's Progressive Matrices. Internal consistency of the test obtained on this sample is acceptable: $\alpha \approx \omega \approx .76$. The obtained average Matrix Reasoning test score is 5.93 (*SD*=2.89). Note that only 8.7% of students gave 10/11 correct answers and 2.6% gave 11/11 correct answers.

Results

Differences in the GPA were examined according to Gender, Field of study, and a Year of study. We also specified the Gender*Field of study interaction, which is, in fact, of the primary research interest. Year of study was only entered as the main effect, with no specified interactions with other factors, since the levels of this variable were very unevenly spread throughout other factors. Furthermore, General intelligence (g) was treated as a covariate. The results are given in Table 2. After adjusting for *g* (positively related to the GPA, explaining 1.4% of its variance) and a year of study (positively related to the GPA, explaining 2.1% of its variance), significant between-field GPA differences are obtained (explaining 12.3% of the GPA's variance), but no overall gender differences are observed (in isolation, female gender is only slightly related to higher GPA: $F(1, 743)=6.04$, $\eta_P^2=.008$, $p=.014$).

Table 2. *ANCOVA test of differences in the GPA*

Factors	*df*	*F*	*p*	η_P^2
Year of study	1	15.42	<.001	.021
General intelligence (*g*)	1	10.04	.002	.014
Gender	1	0.01	.910	<.001
Field of study	13	7.69	<.001	.123
Gender*Field of study (interaction)	13	2.65	.001	.046
Error	715			

Note: Dependent variable=GPA; explained GPA's variance: $R^2=.192$; $R^2_{Adjusted}=.159$.

The GPA differences between the fields of study are shown in Figure 1. It is noticeable that Psychology, Chemistry, Biology, and Medicine & Dentistry students tend to get higher average grades, while Economics and Mathematics students tend to get lower grades.

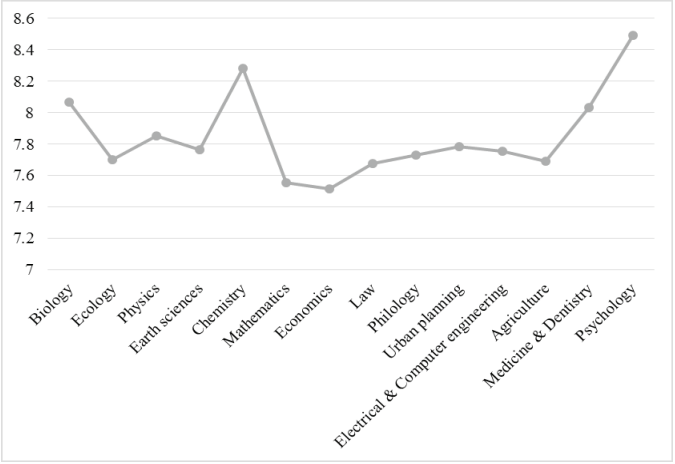

Figure 1. Average GPAs for different fields of study.

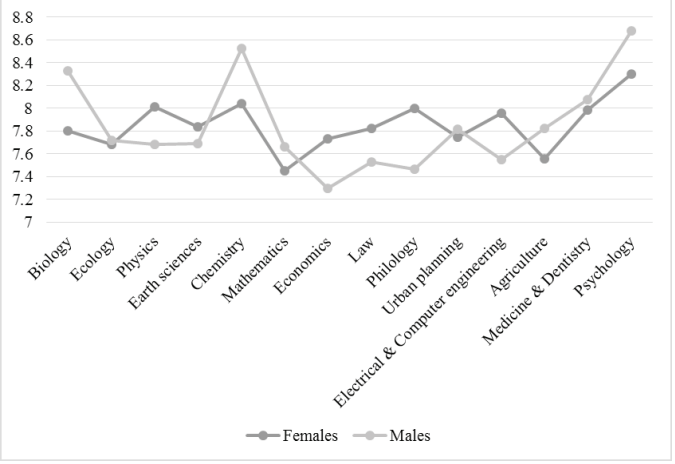

Figure 2. Average GPAs for different fields of study, for females and males. Significant post hoc comparisons: Biology (p=.038) – males>females, Chemistry (p=.025) – males>females, Economics (p=.025) – females>males, Philology – females>males (p=.039), Electrical & Computer engineering (p=.050) – females>males, Psychology (p=.050) – males>females.

Despite the lack of significant main Gender effect, there is, in fact, a Gender*Field of study interaction (explaining 4.6% of the GPA's variance) (see Table 2): the males have higher GPAs in Biology, Chemistry, and Psychology, while the females have higher GPAs in Philology, Economics, and Electrical & Computer engineering. This is shown in Figure 2.

Discussion

Our results show that there are some obvious field specific "gender gaps" in the GPA amongst University of Banja Luka's students, but they do not necessarily point to typical gender-stereotypical pattern of field differences. For example, males have clear GPA advantages in Psychology, which is typically thought of as a "female" field (National Center for Education Statistics, 2018). Conversely, females are more successful in Electrical & Computer engineering, which is stereotypically a "male domain" (National Center for Education Statistics, 2018, 2019).

Conforming to stereotypical trends (Hill et al., 2010), male students are better in some STEM fields, namely chemistry and biology, which are, coincidently, here mostly populated by females. However, there is no gender achievement difference in other "core" STEM fields, such as Mathematics or Physics, latter of which, in fact, shows slight female advantage, albeit insignificant (and is also more populated by females). Conforming to the stereotypical trends from the female side, female students obtain better grades in Philology (language studies). Furthermore, in some typically "gender equal" fields, such as Economics, females obtain better achievement. Although, three highest average achievements, namely Psychology, Chemistry, and Biology, all belong to male students. Note that none of these achievement differences are due to underlying general cognitive ability differences, since the means are adjusted for the general intelligence, which, surprisingly, explains very little of the GPA's variance.[2]

It should be pointed out that, obviously, the sample is not large enough and is not well balanced, both in terms of what is included (e.g., fields are not evenly equated by a year of study), and what is lacking (e.g., some very

[2] Another common predictor of scholastic achievement, not included in this study, is Conscientiousness personality trait. Note, however, that we did have that info for a segment of the sample, on which inclusion of that variable did not produce any significant alterations in the observed GPA differences trends.

"gender typical" fields, such as Early Education or Mechanical engineering were omitted, due to too few either male or female participants). However, results still suggests that while gender achievement gaps in higher education might be real, University of Banja Luka's students' patterns do not necessarily follow the international "gender gap footprints". Specifically, judged from our data, we did not observe a pronounced male-STEM-centeredness often asserted in Western studies (Hill et al., 2010). Some analyses suggested that STEM gender differences are more due to choices rather than ability (Wang et al., 2013). Men stereotypically prefer to work with things, and women prefer to work with people (Su, Rounds, & Armstrong, 2009) and value communal goals when choosing careers (Diekman et al., 2010). We also know that individuals who have both high math and verbal skills are less likely to go into STEM fields compared to individuals who are high in math skills but have moderate verbal skills (Wang et al., 2013). The thing to point out is that there are more females amongst the group with high math and high verbal ability (Wang et al., 2013). In other words, that implies that there *could* be more females in STEM if the choices were different. One thing that could drive choices and preferences is an economic situation. For example, in the Republic of Srpska, the "market basket" (i.e., an estimate of total of life expenses) is more than double of the average paycheck (Republic of Srpska Institute of Statistics, 2019; Savez sindikata RS, 2019). Coincidently, in the B&H, electrical engineering jobs and other professions that assume "working with things" are amongst the best payed (Republic of Srpska Institute of Statistics, 2019). Therefore, it might be that female advantage in Electrical & Computer engineering, Economics, etc. is simply a sign of most capable females actively competing for the future top jobs, STEM or otherwise, in a scarce economy environment.

Admittedly, the scope of our research is limited and regional specific, and findings are preliminary. However, regionally specific patterns also deserve to be examined more closely, especially when they differ from the expected global trends. We would suggest future research to consider the importance of economic drivers and motivational factors, goals, values, and expectations (Diekman et al., 2010; Rask, 2010, Wang & Degol, 2013), and also to investigate possible grading biases if we are to determine if our findings point to an actionable problem, stemming from some systematic bias, or is it, in fact, nothing to worry about.

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POLNE RAZLIKE U PROSJEČNOJ OCJENI TOKOM STUDIRANJA KOD STUDENATA UNIVERZITETA U BANJOJ LUCI IZ RAZLIČITIH NAUČNIH OBLASTI

Sažetak: *Neke naučne oblasti se često smatraju „muškim“ ili „ženskim“ i u njima postoje nejednake polne zastupljenosti i nivoi postignuća. Ovim istraživanjem smo pokušali da ustanovimo postoje li polne disproporcije u prosječnoj ocjeni tokom studiranja, kod studenata iz različitih naučnih disciplina, koje se ne mogu pripisati generalnoj inteligenciji (g). Uzorak je obuhvatio 745 studenata sa Univerziteta u Banjoj Luci (61.1% žene) iz 14 užih naučnih disciplina. Nakon kontrole g faktora (η_P^2=.014, p=.002) i godine studija (η_P^2=.021, p<.001), javile su se razlike u prosječnoj ocjeni između užih naučnih oblasti (η_P^2=.123, p<.001), ali bez značajnog glavnog efekta pola. Međutim, javila se značajna interakcija pola i uže naučne oblasti (η_P^2=.046, p=.001): muškarci su ostvarivali višu prosječnu ocjenu na biologiji, hemiji i psihologiji, dok su žene imale više ocjene na filologiji, ekonomiji i kompjuterskom i elektroinženjerstvu. Odnosno, utvrđeno je da postoje određene polne disproporcije po užim naučnim oblastima na Univerzitetu u Banjoj Luci, ali one ne upućuju na tipične polne-stereotipne obrasce razlika.*

Ključne riječi: *razlike u postignuću u visokom obrazovanju, polne razlike, prosječna ocjena tokom studiranja, inteligencija.*