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GENDER DIFFERENCES IN THE ACHIVEMENTS OF CIVIL ENGINEERING STUDENTS

Abstract

The paper analyzes gender differences in the length of study and average grade between the number of enrolled and graduated students at the Faculty of Architecture, Civil Engineering and Geodesy in Banjaluka, during the period from 1996 to 2015. It was concluded that women, in civil engineering studies, are just as successful as men. However, it is noticeable that women in Bosnia and Herzegovina, enroll much less in engineering studies. Engineering studies need to be more popularized among women. The results of the analysis are presented using the SPSS statistical analysis software package

Keywords: gender differences, length of study, average grade

ПОЛНЕ РАЗЛИКЕ У ПОСТИГНУЋИМА СТУДЕНАТА ГРАЂЕВИНАРСТВА

Сажетак

У раду се анализирају полне разлике у дужини студија и просјечној оцјени између броја уписаних и дипломираних студената на Архитектонско-грађевинско-геодетском факултету у Бањалуци, у периоду од 1996. до 2015. године. Закључено је да су жене на студијама грађевинарства, једнако успјешне као и мушкарци. Међутим, уочљиво је да жене у Босни и Херцеговини много мање уписују инжењерске студије. Инжењерске студије требају бити више популаризоване међу женама. Резултати анализе представљени су помоћу статистичког софтверског пакета SPSS.

Кључне ријечи: полне разлике, дужина студија, просјечна оцјена

1. INTRODUCTION

In the recent years it has been observed the higher interest for enrollment at the technical departments at the universities in Bosnia and Herzegovina. A similar situation is also in the neighbouring countries, such as Serbia and Croatia. At some technical faculties in the neighbourhood potential students pass an entrance exam (for example Sarajevo, Belgrade, Zagreb), while at some, candidates don't take the entrance exam (for example Ljubljana).

In this paper, we were observed only the faculties of Civil engineering, in Banja Luka and neighbouring countries. At the Faculty of Civil Engineering in Sarajevo and at the Faculty of Architecture, Civil Engineering and Geodesy in Banja Luka (AGGF) a potential student can gain points based on secondary school GPA, secondary school grades received in specific subjects and the entrance test. Besides that, the Faculty additionally recognizes other achievements during the secondary education that are relevant to the field of potential studies [1], [2]. The Faculty of Civil Engineering at the University of Belgrade takes into account the secondary school GPA and the success gained at the Entrance Exam [3]. The secondary school GPA contributes with 40% to the maximum of gained points, while the entrance exams consisting of Mathematics only, adds 60%. The candidates that have been awarded with one of first three positions in national or international contests in mathematics are granted with waiver for the entrance exam. Faculty of Civil engineering at the University of Zagreb foresees the admission based on achievements in the secondary school GPA and State Secondary School Graduation Exam. Additional achievements like one of first three places on national contest in Mathematics or Physics can secure the direct admission to the potential candidates [4]. At the University of Ljubljana, undergraduate degree in civil engineering can be obtained at the Faculty of Civil and Geodetic Engineering. The admission procedure is not done at the University, but centrally through national admission facilitated by the Government (state high school exam). The common documents, pre-university educations certificates and Slovenian language proficiency proof are prerequisites, and applicants are required to take tests of ability, capacity and skills, which is designed for each field of study accordingly [5].

According to [6], [7] analyzing academic success is very important for higher education institutions from the aspect of strategic planning of enrollment policy, change and improvement of curriculum of study programs. The paper [8] shows the importance of the entrance exam for enrollment at the Faculty of Civil Engineering, as well as the connection between success in the entrance exam and success in taking mathematical subjects. Most of the candidates who enroll in AGGF University in Banja Luka are from construction schools and Gymnasium, and students from Gymnasium achieve the best results at the entrance exam [9].

The universities of the countries of the former Yugoslavia belonged to the so-called continental education system. In that system, education for the title of B.Sc. civil engineer lasted 5 years (10 semesters). However, due to the excessive duration of studies and thus its inefficiency, as well as the growing demand for highly educated engineers in all countries of the former Yugoslavia, the Bologna system of studies was introduced [10]. So, from 2006 in Bosnia and Herzegovina, as well as at the AGGF in Banja Luka, students begin to study according to the Bologna system of study, where civil engineering studies last 4 years (8 semesters).

Through the recent few decades there has been a trend in investigating the achievement of students in the higher education in relation to the gender. In [11] authors analyses the gender stereotypes and the perception about the assumed affinity between gender and areas and professions. This study confirms that there are still women-dominated professions, such as Nursing, Social Work and Education and men-dominated professions, such as Informatics, Mechanical and Civil Engineering (according to Eurostat, in 2015 in this area 74% students were men). In [12], [13] authors analyze differences between men and women in their experience of higher education.

The paper analyzes the number of enrolled and graduated students in relation to the gender at the AGGF during the period from 1996 to 2015, while students who transferred from other higher education institutions and who took less than half of the exams are not included in this study. The observed students studied according to the Law on the University (until an academic year 2006/07) where undergraduate studies lasted 5 years (10 semesters) and we call it **before the Bologna process**, and thereafter according to the Law of Higher Education, where studies lasted 4 years (8 semesters) and we call it **according to the Bologna process**. This paper aims to answer the following research questions (RQs):

RQ1: Are there gender differences between the number of enrolled and graduated students, all students together and separately according to the law under which they studied?

RQ2: Are there gender differences in the length of study, all students together and separately according to the law under which they studied?

2. SAMPLE AND ORGANIZATION OF RESEARCH

The Faculty of Architecture, Civil Engineering and Geodesy, University of Banja Luka consists of three study programs: Architecture, Civil Engineering and Geodesy. A sample of our study consists of 1314 Civil Engineering students (396 female and 918 male) of which 619 students graduated (207 female and 412 male). According to the Law of the University 687 students are enrolled (230 females and 457 males), and 353 students (124 females and 229 males) graduated. According to the Law of Higher Education 627 students were enrolled (166 females and 461 males), and 266 students graduated (83 females and 183 males).

For the statistical analysis we used the SPSS v.20 analytical-statistical software package, using descriptive statistics for presenting and summarizing data, χ^2 test, nonparametric Mann-Whitney U test, and Spearman's rank correlation coefficient [14], [15]. The variables observed in this study did not have normal distribution.

3. RESULTS AND DISCUSSION

According to the Law on the University, a total of 687 students were enrolled (230 females and 457 males), and 353 students graduated (124 females and 229 males). Using the χ^2 test, no statistically significant difference ($\chi^2 = 0.2823$, $p = 0.59522$) was obtained in the number of enrolled and graduated students by gender.

According to the Law on Higher Education, a total of 627 students (166 females and 461 males) were enrolled, and 266 students (83 females and 183 males) graduated. Using the χ^2 test, no statistically significant difference ($\chi^2 = 2.076$, $p = 0.14964$) was obtained in the number of enrolled and graduated students by gender.

According to the both laws, 1314 students were enrolled (396 females and 918 males), and 619 students graduated (207 females and 412 males). By applying the χ^2 test, no statistically significant difference ($\chi^2 = 2.1401$, $p = 0.1449$) was obtained in the number of enrolled and graduated students by gender.

In following three sections we analyze only the achievement of graduated students regarding to the Law of the University and the Higher Education law separately and both together.

3.1. THE ANALYSIS OF THE ACHIEVEMENTS OF STUDENTS WHO GRADUATED ACCORDING TO THE LAW OF THE UNIVERSITY

The average length of study was 2986.98 days (8.184 years). Female students have on average shorter studies (2972.67 days or 8.144 years) compared to male students (2994.73 days or 8.205 years). The shortest study (1635 days or 4.479 years) was achieved by one of the male students (Table 1).

Table 1. The length of studies before the Bologna process

Gender	N	Minimum	Maximum	Median	Mean	Std. Deviation
male	124	1748,0	8023,0	2747,000	2972,677	970,7478
female	229	1635,0	6262,0	2801,000	2994,729	783,5331
Total	353	1635,0	8023,0	2780,000	2986,983	852,6747

The Mann-Whitney U test showed that there was not a statistically significant difference ($z = -1.485$, $p = 0.138$, $r = 0.0779$) in the length of study in relation to the gender of students.

The average grade during studies was 7.5356 (among female students the average grade is slightly higher and amounts to 7.6651 compared to male students who had an average grade of 7.4654). The highest average grade (9.66) was achieved by students of both genders, and the lowest average grade (6.34) was achieved by one of the female students (Figure 1).

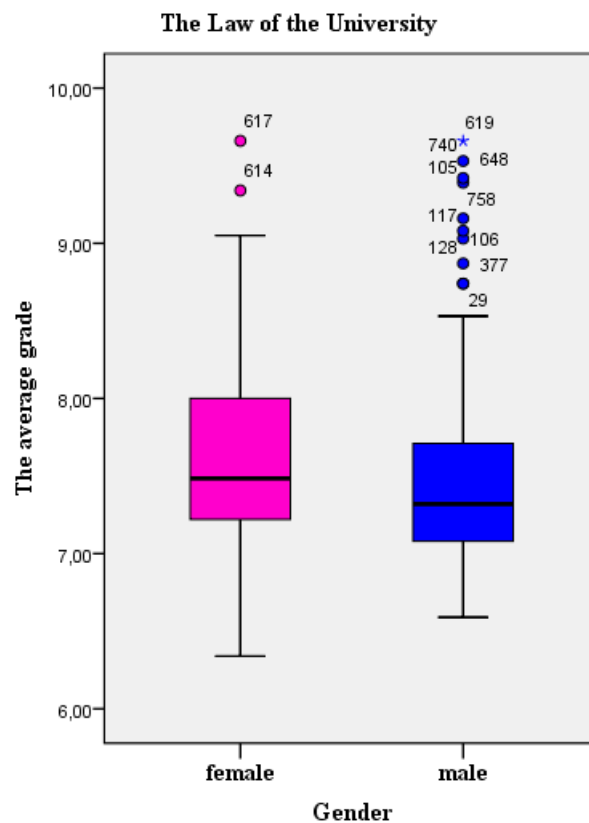


Figure 1. *The average grade in relation to the gender of students before the Bologna process*

Using the Mann-Whitney U test, a highly statistically significant difference ($z = -3.458$, $p = 0.001$, $r = 0.184$) was obtained with the average grades in relation to the gender of students.

3.2. THE ANALYSIS OF GRADATED STUDENTS ACHIEVEMENT FOR ALL STUDENTS TOGETHER, ACCORDING TO THE BOTH LAW

Using the Mann-Whitney U test, a highly statistically significant difference ($z = -3.302$, $p = 0.001$, $r = 0.1365$) was obtained with the average grade in relation to the gender of the students, regardless of the law according which they studied (female students had an average rank of 345, and male students had an average rank of 294).

Both, female ($z = -2.826$, $p = 0.005$, $r = 0.1959$) and male students ($z = -5.581$, $p = 0.000$, $r = 0.2746$) had a highly statistically significantly higher average grade when studying according to the Bologna process. The average grades of students according to the both laws are presented in Figure 2.

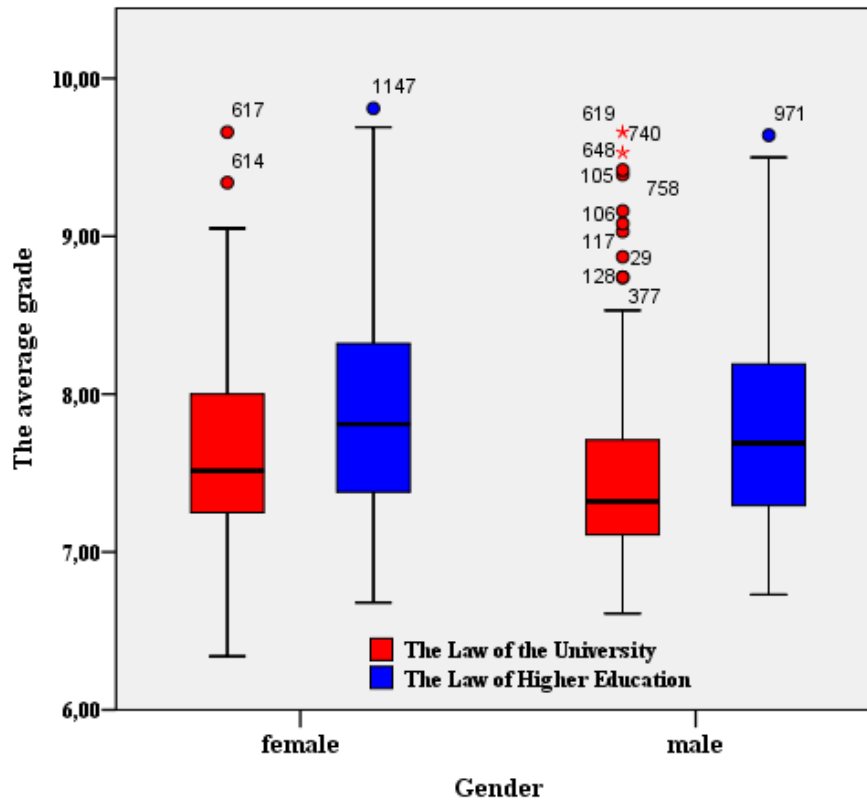


Figure 2. The average grades of students before the Bologna and according to the Bologna process

The average grades of student according to the both lows, years of enrollment and gender of students are shown in Figure 3.

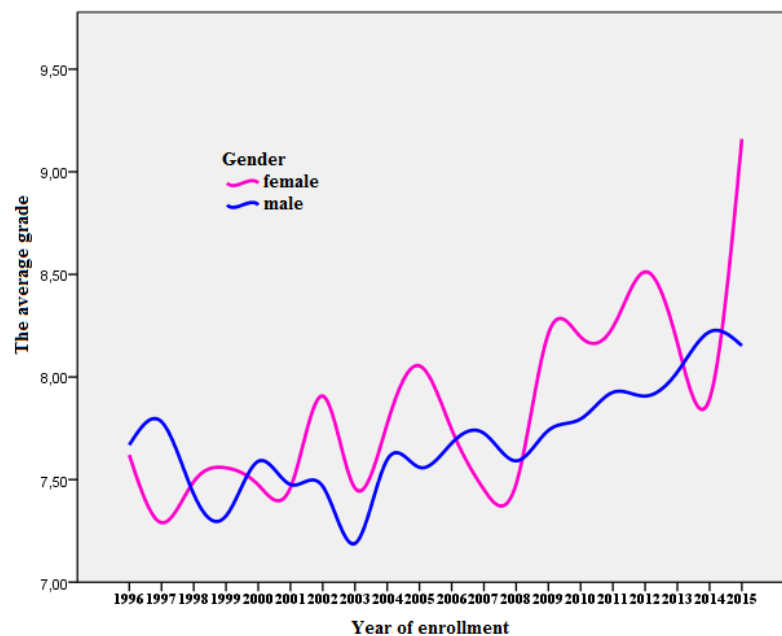


Figure 3. The average grades of student according to the both lows, years of enrollment and gender

4. CONCLUSION

Based on the obtained results, it was concluded that there is no statistically significant difference between the number of enrolled and graduated students by gender, according to the both Laws under they studied. It is significant to note that under both laws, female students were less likely to enroll in civil engineering studies (the ratio of men and women is about 2.5:1). About, half of the number of all enrolled students graduated, for both gender, and according to the both laws.

According to the both laws (before the Bologna process and according the Bologna process) there was not a statistically significant difference in the length of study in relation to the gender of students.

A highly statistically significant difference was obtained with the average grades in relation to the gender of students, for students who graduated according to the Law of the University. Among female students the average grade is slightly higher and amounts to 7.67 compared to male students who had an average grade of 7.47. According to the Law of Higher Education there was not a statistically significant difference of the average grade in relation to the gender of students. But, we can noticed that this students have higher average grades than students who graduated according to the Law of the University. The average grade during studies was 7.82 (among female students the average grade is slightly higher and amounts to 7.94 compared to students who had an average grade of 7.77). Both, female and male students had a highly statistically significantly higher average grade when studying according to the Bologna process.

From all the above and the results obtained, we can conclude that women, in civil engineering studies, are just as successful as men. The Bologna process yielded slightly better average grades during the studies. However, it is noticeable that women in Bosnia and Herzegovina, as well as in other neighboring countries, enroll much less in engineering studies [12], [13], [16]. The reason for that is the possible length of the study, as well as the fact that women still consider that is the job of a civil engineer just for men. Engineering studies need to be more popularized among women and prejudices broken down.

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