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THE INFLUENCE OF ENTRANCE EXAM RESULTS, HIGH SCHOOL ACHIEVEMENT, AND TYPE OF HIGH SCHOOL ON THE ACADEMIC SUCCESS OF CIVIL ENGINEERING AND GEODESY STUDENTS

Abstract:

This paper analyzes the academic success of students enrolled in the Civil Engineering and Geodesy study programs at the Faculty of Architecture, Civil Engineering and Geodesy of the University of Banja Luka during the period 2012–2021. High school achievement was compared with entrance examination results, as well as differences in success with respect to the type of completed high school and entrance examination results between the study programs. Study completion by study program was also analyzed in relation to high school achievement and entrance examination results. In addition, differences in students' final academic success with respect to the type of completed high school were examined.

Keywords: academic success analysis, entrance examination, high school, statistical tests.

УТИЦАЈ РЕЗУЛТАТА КВАЛИФИКАЦИОНОГ ИСПИТА, УСПЈЕХА ИЗ СРЕДЊЕ ШКОЛЕ И ВРСТЕ СРЕДЊЕ ШКОЛЕ НА АКАДЕМСКИ УСПЈЕХ СТУДЕНАТА ГРАЂЕВИНАРСТВА И ГЕОДЕЗИЈЕ

Сажетак:

У раду је анализиран успјех студената који су уписали студијске програме Грађевинарство и Геодезија на Архитектонско-грађевинско-геодетском факултету Универзитета у Бањој Луци током периода 2012-2021. године. Поређен је успјех у средњој школи са успјехом квалификационом испиту, као и разлика у успјеху у односу на врсту завршене средње школе са успјехом на квалификационом испиту, између студијских програма. Такође је поређен завршетак студија, по студијским програмима, са успјехом у средњој школи и успјехом на квалификационом испиту, као и разлика у оствареним резултатима студената при завршетку студија у односу на врсту завршене средње школе.

Кључне ријечи: анализа успјеха, квалификациони испит, средња школа, статистички тестови.

1. INTRODUCTION

The study programs at the Faculty of Architecture, Civil Engineering and Geodesy (FACEG) of the University of Banja Luka are organized according to the European Credit Transfer System (ECTS) and are offered in three cycles. First-cycle programs include Architecture, Civil Engineering, Geodesy, and Interior Design, the latter being conducted jointly with the Academy of Arts, University of Banja Luka. Second-cycle programs include Architecture and Urbanism, Civil Engineering, and Geodesy, as well as the joint program Energy Efficiency in Buildings, conducted in cooperation with the Faculty of Mechanical Engineering, University of Banja Luka. The third cycle is offered in Civil Engineering, as well as in the joint program Renewable Energy Sources and Environmental Engineering, conducted together with the Faculty of Mechanical Engineering, Faculty of Electrical Engineering, and Faculty of Technology at the University of Banja Luka.

Since 2006, students in Bosnia and Herzegovina, including at FACEG, have been studying under the Bologna Process system, where the first-cycle studies last four years (eight semesters). The majority of enrolled candidates come from secondary technical schools and gymnasiums [1]. The analysis of students' academic success represents a significant component of institutional strategic planning, particularly in the context of defining admission policies and improving and adapting study program curricula [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14]. In [7], the importance of the entrance examination as a key criterion for admission to FACEG is highlighted. Over the past few decades, researchers have shown increasing interest in examining students' academic achievements based on the type of completed high school. Particular attention has also been given to the relationship between prior schooling and results on entrance examinations [1], [2], [5], [7], [8].

The scoring system for admission to FACEG is based on a total of 100 points, with the entrance examination evaluated at a maximum of 50 points, requiring a minimum of 15 points to qualify for admission, while high school achievement is also evaluated with a maximum of 50 points. Prior to the entrance examination, FACEG has been organizing preparatory courses for many years. These courses provide crucial support to future students, allowing them to thoroughly prepare for the entrance examination and acquire a solid knowledge foundation that will be essential throughout their studies [1], [7], [8].

In [5], the authors analyzed the success of students enrolled in the Geodesy study program during 2012, 2013, and 2014. The present study expands upon [5] by analyzing the results of students enrolled not only in the Geodesy study program (SPG) but also in the Civil Engineering study program (SPCE) over a ten-year period (2012–2021). The paper consists of two parts. The first part examines the academic success of students enrolled in SPCE and SPG based on their high school grade point average and scores on the entrance examination. This section addresses the following research questions:

RQ1: Is there a statistically significant difference in high school achievement among students enrolled in SPCE and SPG?

RQ2: Is there a statistically significant difference in entrance examination results among students enrolled in SPCE and SPG?

RQ3: Is there a statistically significant difference in success according to the type of completed high school among students enrolled in SPCE and SPG?

RQ4: Is there a statistically significant difference in entrance examination results according to the type of completed high school among students enrolled in SPCE and SPG?

RQ5: Is there a correlation between high school achievement and entrance examination results among students enrolled in SPCE and SPG?

The second part of the study follows the same cohort of students throughout their studies from 2012 to 2021 and analyzes their academic success until the end of 2025. This part addresses the following research questions:

RQ6: Is there a statistically significant difference in the duration of studies between students who completed SPCE and SPG?

RQ7: Is there a statistically significant difference in the duration of studies between students who completed SPCE and SPG, with respect to the type of completed high school?

RQ8: Is there a correlation between high school achievement, entrance examination scores, and the duration of studies in relation to the study programs? Is there a correlation between high school achievement, entrance examination scores, and the duration of studies in relation to the type of completed secondary school?

2. SAMPLE AND RESEARCH METHODS

The study examined 10 cohorts of students enrolled in the Civil Engineering and Geodesy programs at the FACEG between 2012 and 2021. A total of 376 students joined the SPCE and 309 joined the SPG. By December 31, 2025, 243 students had completed their first-cycle studies, including 103 from SPCE and 140 from SPG. However, it is important to note that students enrolled in the Civil Engineering and Geodesy programs take the same entrance examination.

Statistical analyses were performed using the SPSS v.22 software package. Descriptive statistics were used to summarize the data, while parametric tests (ANOVA, independent t-test, and Tukey HSD), nonparametric tests, and Pearson's correlation coefficient were applied to examine relationships and differences [15], [16], [17], [18], [19].

3. RESULTS

The research results are presented in two parts: the students' achievements at the time of admission to the FACEG, and their achievements upon completion of studies.

3.1. STUDENTS' ACHIEVEMENTS AT ADMISSION TO FACEG

The lowest score based on secondary school success for SPCE was 23,1, while for SPG it was 23,75. The maximum score of 50 points during high school was achieved by 11 students enrolling in SPCE and 15 students enrolling in SPG. The average high school score for candidates enrolling in SPCE was 41,17 with a standard deviation (SD) of 6,45, whereas for SPG students the average was 41,22 (SD=5,76).

Regarding the entrance examination, the minimum score of 15 points was obtained by 43 students enrolling in SPCE and 45 students enrolling in SPG. The maximum score of 50 points on the entrance examination was achieved by eight SPCE students and four SPG students. The average entrance examination score for SPCE students was 28,45 (SD=10,37), while for SPG students it was 26,08 (SD=9,71).

Figure 1 presents the average scores achieved during high school and on the entrance examination for students enrolling in SPCE and SPG, by year of enrollment. Figure 2 shows the scores achieved during high school and on the entrance examination for candidates enrolled in SPCE and SPG over the entire study period.

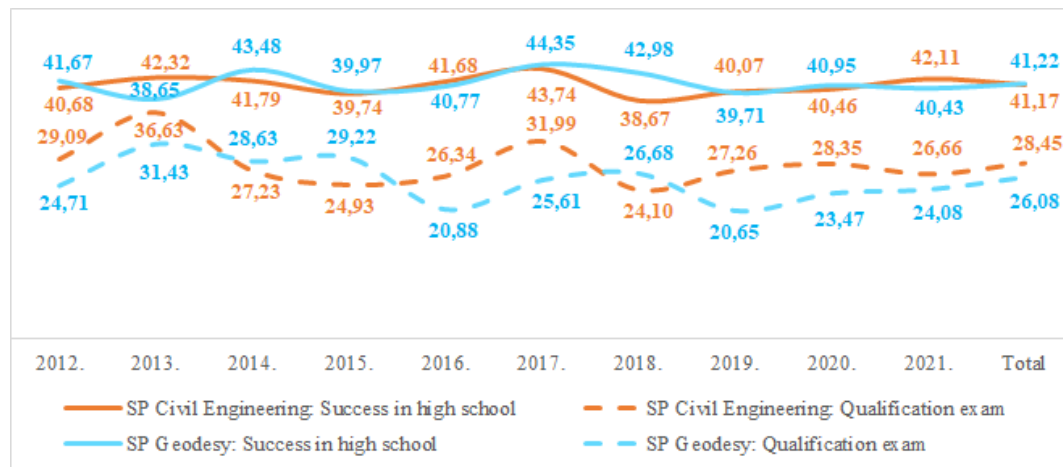


Figure 1. Average scores achieved during high school and on the entrance examination by students enrolled in SPCE and SPG, by year of enrollment (created by author).

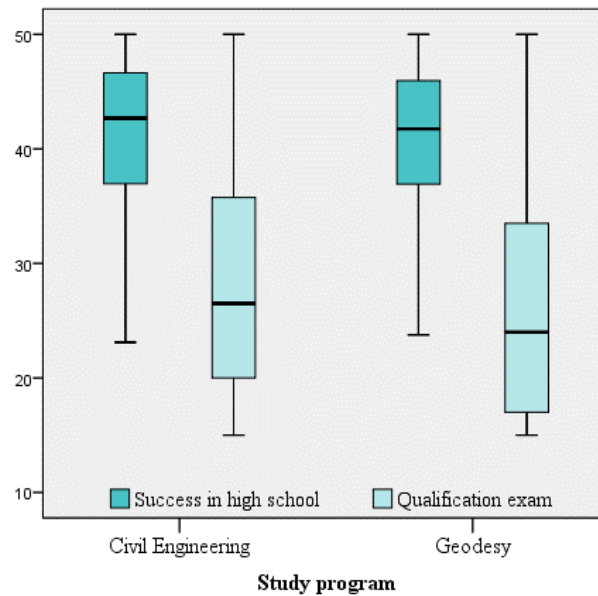


Figure 2. Scores achieved during high school and on the entrance examination by students enrolled in SPCE and SPG over the study period (created by author).

Answers to RQ1 and RQ2: Using the Independent Samples t-test to compare students enrolled in SPCE and SPG, no statistically significant difference was found in high school achievement ($t = -0,093$, $p = 0,926$). However, a highly statistically significant difference was observed in the scores obtained on the entrance examination ($t = 3,003$, $p = 0,003$).

For a more detailed data analysis, the high schools completed by the enrolled students were divided into three groups: Gymnasiums (Gym), Civil Engineering Schools (CS), and Other Schools (OS). Table 1 presents the distribution of enrolled students according to the type of completed high school and the study program.

Table 1. Enrolled students by type of completed high school

Secondary school (groups)		Study program		Total
		Civil Engineering	Geodesy	
Gymnasium	N	126	89	215
	%	33,51%	28,8%	31,39%
Construction school	N	150	157	307
	%	39,89%	50,81%	44,82%
Other schools	N	100	63	163
	%	26,6%	20,39%	23,79%
Total	N	376	309	685
	%	54,89%	45,11%	100,0%

Since some students transferred from other faculties to FACEG, high school scores were recorded for 371 SPCE students and 302 SPG students, while entrance examination scores were recorded for 359 SPCE students and 296 SPG students (Table 2).

Table 2 also presents the scores achieved during both high school and the entrance examination, by study program, in relation to the type of completed high school. From Table 2, it can be seen that among SPCE students, the highest average high school score was achieved by those who completed OS (42,8), while the lowest was recorded for students from CS (39,81). A similar pattern is observed for SPG students, with the highest average high school score for students from Other Schools (43,26) and the lowest for those from CS (40,58).

Regarding the entrance examination, SPCE students who graduated from Gym achieved the highest average score (30,89), while those from OS scored the lowest (26,18). For SPG students, the highest average entrance examination score was achieved by students from OS (28,87), and the lowest by students from CS (25,33).

Table 2. Students' achieved results according to their completed secondary school

Study program	Secondary school (groups)		Secondary school success	Entrance exam result
Civil Engineering	Gymnasiums	N	124	121
		Minimum	26,92	15,00
		Maximum	50,00	50,00
		Median	42,69	31,00
		Mean	41,51	30,89
		Std. Dev.	6,36	10,82
	Construction schools	N	148	141
		Minimum	24,89	15,00
		Maximum	50,00	50,00
		Median	40,21	26,00
		Mean	39,81	27,93
		Std. Dev.	6,64	9,75
	Other schools	N	99	97
		Minimum	23,10	15,00
		Maximum	50,00	50,00
		Median	43,91	24,00
		Mean	42,80	26,18
		Std. Dev.	5,87	10,16
Geodesy	Gymnasiums	N	87	86
		Minimum	26,25	15,00
		Maximum	50,00	44,00
		Median	41,09	24,00
		Mean	40,92	25,49
		Std. Dev.	5,64	8,52
	Construction schools	N	154	151
		Minimum	23,75	15,00
		Maximum	50,00	50,00
		Median	41,28	23,00
		Mean	40,58	25,33
		Std. Dev.	5,76	9,51
	Other schools	N	61	59
		Minimum	28,33	15,00
		Maximum	50,00	50,00
		Median	44,38	28,00
		Mean	43,26	28,87
		Std. Dev.	5,54	11,40

Figure 3 presents the students' achieved results in relation to their completed secondary education.

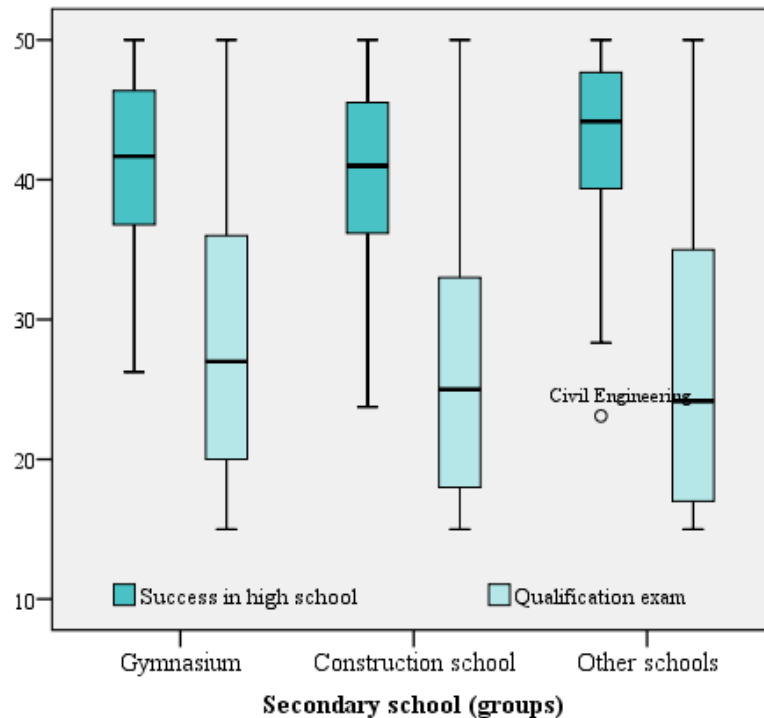


Figure 3. Students' achieved results according to their completed secondary school (created by author).

Answers to RQ3 and RQ4: Application of the One-Way ANOVA test revealed a highly statistically significant difference in the number of points achieved during secondary education among candidates who completed Gym, CS, and OS ($F = 10,992$; $p < 0,001$). However, no statistically significant difference was found in the number of points obtained on the entrance exam among the same groups of candidates ($F = 2,545$; $p = 0,079$).

Further analysis using Post Hoc Tests, specifically the Tukey HSD test, was conducted for pairwise comparisons between schools. A highly statistically significant difference in the number of points achieved during secondary education was found between candidates who completed CS and OS ($t = -2,77$; $p < 0,001$), as well as a statistically significant difference between candidates who completed Gym and OS ($t = -1,71$; $p = 0,020$).

Answer to RQ5: Academic success in secondary school and results achieved on the entrance exam showed a highly statistically significant correlation across the overall student sample ($r = 0,228$), as well as among SPG students ($r = 0,241$), whereas no statistically significant correlation was observed among SPCE students ($r = 0,183$) (Table 3).

When analyzed according to the type of completed secondary school, a highly statistically significant correlation was found among students who completed Gym ($r = 0,292$), while no statistically significant correlation was observed for students who completed CS ($r = 0,159$) or OS ($r = 0,251$) (Table 4).

3.2. STUDENTS' ACHIEVED RESULTS AT THE COMPLETION OF STUDIES

By 31 December 2025, 103 SPCE students (27,39% of the total enrolled) and 140 SPG students (45,31% of the total enrolled) had completed the first-cycle study program. Among SPCE students, 32 graduates had completed Gym (25,4% of those enrolled), 42 had completed CS (28% of those enrolled), and 29 had completed OS (29% of those enrolled). Among SPG students, 48 graduates had completed Gym (53,93% of those enrolled), 60 had completed CS (38,21% of those enrolled), and 32 had completed OS (50,79% of those enrolled) (Figure 4).

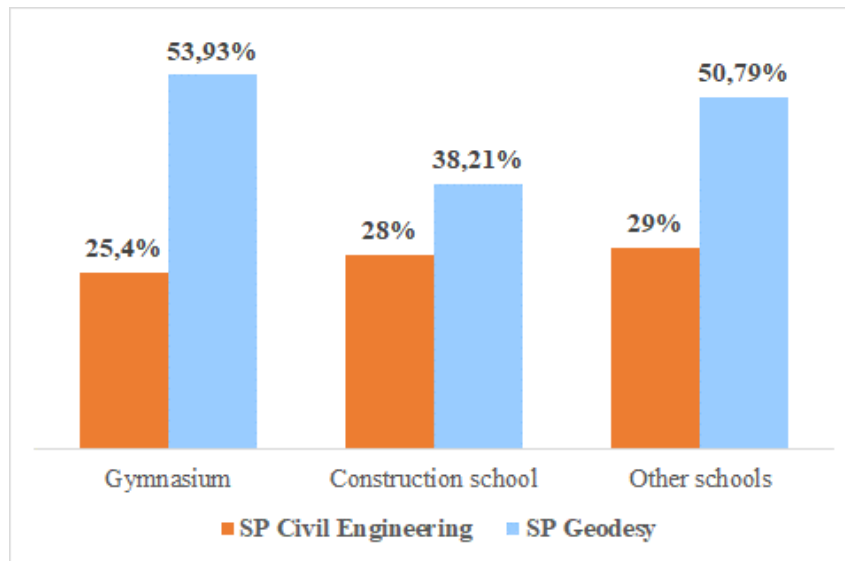


Figure 4. Completion rates of the first-cycle study program by 31 December 2025 (created by author).

The shortest duration of study at SPG was 1 424 days and at SPCE 1 478 days (for students who completed Gym), while the longest duration was 4 426 days at SPG and 4 019 days at SPCE (also for Gym graduates). The average duration of study for all students who completed the first-cycle program was 2 084 days (SD= 534,95). At SPCE, the average duration was 2 167,91 days (SD = 502,55), whereas at SPG, it was 2 023,55 days (SD = 551,37) (Figure 5).

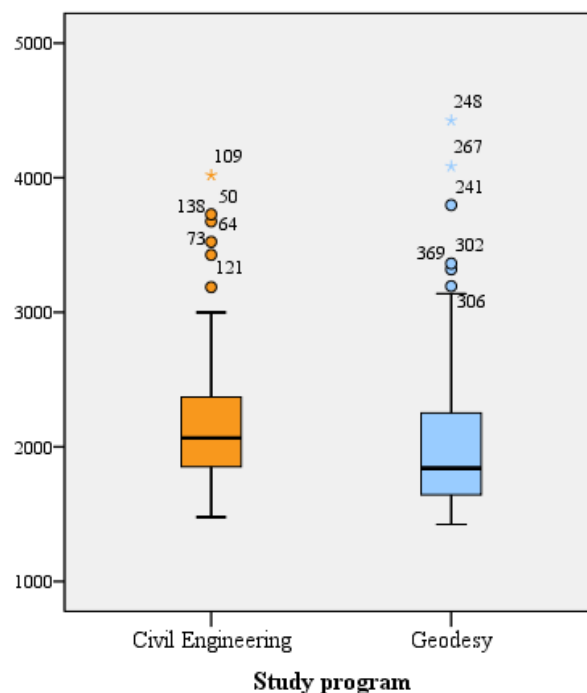


Figure 5. Duration of study (in days) of students who completed the first-cycle program by 31 December 2025 (created by author).

Answer to RQ6: Application of the Independent Samples t-test, comparing students who completed their studies at SPCE and SPG, revealed a statistically significant difference in the duration of study ($t = 2,093$, $p = 0,037$).

Figure 6 presents the duration of study (in days) for students who completed the first-cycle program by 31 December 2025, according to the type of completed secondary education (groups).

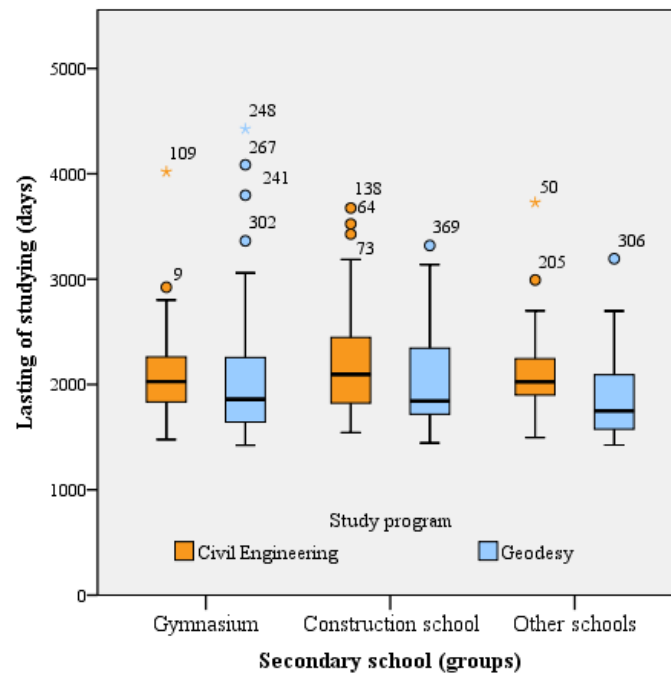


Figure 6. Duration of study (in days) of students who completed the first-cycle program by 31 December 2025, according to the type of completed secondary education (groups) (created by author).

Answer to RQ7: Application of the Kruskal–Wallis test revealed no statistically significant difference in the duration of study (expressed in days) according to the type of completed secondary education ($\chi^2 = 1,887$; $p = 0,389$). Using the Mann–Whitney U test to compare the duration of study (in days) between SPCE and SPG students who previously completed:

- Gym: no statistically significant difference was found ($z = -1,012$, $p = 0,312$);
- CS: a statistically significant difference was observed ($z = -2,040$, $p = 0,041$);
- OS: a highly statistically significant difference was observed ($z = -2,600$, $p = 0,009$).

Correlations between the duration of study (in days), secondary school success, and entrance exam results, in relation to the study programs, calculated using Pearson's r coefficient, are presented in Table 3.

Answer to RQ8: Examining the correlation between the duration of study (in days) and secondary school success, highly statistically significant negative correlations were observed for the overall student sample ($r = -0,291$) and for SPG students only ($r = -0,373$), while a statistically significant negative correlation was found for SPCE students only ($r = -0,197$).

The duration of study (in days) and results achieved on the entrance exam were highly statistically significantly negatively correlated for all students ($r = -0,200$) and for SPG students only ($r = -0,275$), whereas no statistically significant correlation was observed for SPCE students only ($r = 0,179$).

Table 3. Correlations between duration of study (in days), secondary school success, and entrance exam results in relation to study programs.

Variable		Secondary school success			Entrance exam result		
		SPCE	SPG	Total	SPCE	SPG	Total
Lasting of studying (days)	r	-0,197*	-0,373**	-0,291**	-0,179	-0,275**	-0,200**
	p	0,046	0,000	0,000	0,073	0,001	0,002
	N	103	138	241	101	136	237
Success in high school	r				0,183	0,241**	0,228**
	p				0,067	0,005	0,000
	N				101	136	237

** . Correlation is significant at the 0,01 level (2-tailed)

* . Correlation is significant at the 0,05 level (2-tailed)

Correlations between the duration of study, secondary school success, and entrance exam results according to the type of completed secondary education, calculated using Pearson's r coefficient, are presented in Table 4.

Examining the correlation between the duration of study (in days) and secondary school success, a highly statistically significant negative correlation was observed for students who completed CS ($r = -0,374$), whereas no statistically significant negative correlations were found for students who completed Gym ($r = -0,203$) or OS ($r = -0,203$).

The duration of study (in days) and results achieved on the entrance exam were statistically significantly negatively correlated for CS students ($r = -0,199$), while no statistically significant negative correlations were observed for Gym students ($r = -0,185$) or OS students ($r = -0,218$).

Table 4. Correlations between duration of study (in days), secondary school success, and entrance exam results according to the type of completed secondary school.

Variable		Secondary school success			Entrance exam result		
		Gym	CS	OS	Gym	CS	OS
Duration of study (days)	r	-0,203	-0,374**	-0,203	-0,185	-0,199*	-0,218
	p	0,073	0,000	0,120	0,107	0,048	0,094
	N	79	102	60	77	100	60
Success in high school	r				0,292**	0,159	0,251
	p				0,010	0,113	0,053
	N				77	100	60

** . Correlation is significant at the 0,01 level (2-tailed)

* . Correlation is significant at the 0,05 level (2-tailed)

4. DISCUSSION

The results of the study on a sample of 685 students indicate that secondary school success and entrance exam results play a significant role in predicting academic achievement during university studies. Regarding admissions, no statistically significant difference was found between SPCE and SPG students in terms of secondary school success, whereas a highly statistically significant difference was observed in entrance exam results, favoring SPCE students. These findings suggest that the entrance exam acts as a differentiating factor during admissions between study programs, while secondary school success shows a relatively uniform level among enrolled candidates.

Analysis according to the type of completed secondary school revealed a statistically significant difference in secondary school success between candidate groups, with students from Gymnasiums and Other Schools achieving higher results compared to students from Construction Schools. However, differences in entrance exam results between these groups were not statistically significant. A positive and statistically significant correlation was also observed between secondary school success and entrance exam results for the overall sample, as well as for SPG students, indicating a certain degree of consistency in academic success prior to enrollment.

Regarding study completion, the proportion of graduates was considerably higher at SPG (45,31%) compared to SPCE (27,39%). A statistically significant difference in the duration of study was also observed between the two programs, with SPG students, on average, completing their studies faster. However, when analyzed according to the type of completed secondary school, no general statistically significant difference in study duration was found.

A particularly important finding concerns the negative and statistically significant correlation between study duration and secondary school success, as well as between study duration and entrance exam results (both for the overall sample and specifically for SPG students). These results indicate that students with higher secondary school grades and better success on the entrance exam tend to complete their studies in a shorter period of time.

5. CONCLUSION

Based on the results obtained, it can be concluded that secondary school success and entrance exam results represent relevant predictors of students' future academic achievement; however, their significance varies depending on the study program and the type of completed secondary school. These findings can serve as a basis for improving admission policies, adjusting the scoring system

for enrollment, and introducing additional support for students with weaker prior knowledge, with the aim of increasing pass rates and reducing the average duration of studies [3], [4], [5], [6], [9].

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