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Connections between the Academic Achievement, Vocational Selection, and Careers of Pilots

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Abstract: Research demonstrates that a pilot should have specific skills and abilities. Therefore, professional aptitude tests developed by AGAI are used to select the best graduates for the pilot profession. This research investigates the connections between pilots' academic achievement, vocational selection, and careers. The sample comprises 52 subjects who started studying in 2009, 2010, and 2011. They were evaluated based on their maturity examinations, vocational selection, academic achievement, and professional career. We observed that the average scores for the pilots' Lithuanian language, mathematics, and physics maturity examinations are statistically significantly higher ($p < 0.05$) than the average scores of Lithuanian school graduates. The vast majority of the enrolled students completed their studies and began work in their field of specialty. The academic achievement of those working as pilots (a person who has completed 5 years of pilot studies and works as a captain or first officer) differ in that their average scores in physical study subjects are statistically significantly higher. The graduates who received higher study scores during this study show a statistically significant frequency in their employment as pilots (2–4 quartile). These research findings show that academic achievement and vocational selection are characteristics of those who work as pilots.

Keywords: pilot; vocational selection; maturity examination; academic achievement; professional career

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1. Introduction

Each profession requires different skills and abilities that lead to the easier, faster, and more efficient attainment of good results, and which determine success in a particular job. Research demonstrates that a pilot should have quick reactions as well as good decision-making, teamwork, and stress management skills (Goeters et al. 2004). For the past several decades, Antanas Gustaitis' Aviation Institute (hereinafter AGAI) of Vilnius Gediminas Technical University (hereinafter VilniusTech) has been organizing the selection of candidates for the specialty of Aircraft Piloting. In order to select the best graduates for the pilot profession, professional aptitude tests developed by AGAI are used, the passing of which gives the candidate the right to apply for a place in the aircraft piloting study program.

Upon graduation, prospective students take maturity examinations. For those entering the AGAI aircraft piloting study program, three main outcomes are assessed in the maturity examinations: Lithuanian language, mathematics, and physics. During a study year, study subjects are covered and evaluated, and a mean score is calculated according to the obtained results and the number of credits. Hence, a question arises: can the mean scores of the maturity examinations predict a successful career? Research reveals that the maturity examination assessments can only partially predict the success of the first year of studies (Noble and Sawyer 2002). Not all studies show that the subjects covered during the studies and the assessments obtained for them can be good predictors of a successful career (Jones 2013). Some authors argue that the mean score has a weak correlation with

further professional success. Nevertheless, in seeking to ensure the selection of appropriate candidates, a validated selection method is needed (Boulet et al. 2012). Other authors maintain that alternatives to calculating the mean score should be sought, allowing for greater prognostic potential (Volwerk and Tindal 2012). In addition, the mean score for studies is criticized for the fact that during the studies, students can choose easier, i.e., less complex, study subjects, which allows them to obtain better grades and raise their mean score (Bretz 1989). In the present study, we have not only included the mean score in our calculations but have also divided the study subjects into several meaningful groups and compared the mean scores of those groups.

The pilot profession comes with important responsibilities and requires specific skills (Goeters et al. 2004), and therefore cognitive skills and personality are valued in addition to maturity examination results when entering the piloting study program. The following cognitive skills are important for pilots: time distribution, spatial orientation, selective focus, speed of perception, calculating ability, memorization, and visualization (Goeters et al. 2004). Spatial abilities are particularly emphasized (De Kock and Schlechter 2009), speed of perception in particular (Johnson et al. 2017). Research has determined that selection tests are not an accurate measure for predicting the best students (10%) (Giddings 2020), suggesting that there are additional variables to consider when predicting whether a pilot's career will be successful.

By employing tests, AGAI assesses the main characteristics of its applicants: memory, attentiveness, ability to freely deal with numbers, stress management, health, physical condition, and psychological condition. Maturity examination scores are also taken into account. The results of personality selection are not examined in this study.

Our aim is to investigate the connections between pilots' academic achievement, vocational selection, and careers.

Objectives:

1. To explore the maturity examination scores of aircraft piloting graduates;
2. To compare the university academic achievement of pilots with that of professionals working in other fields;
3. To investigate the results of the professional selection tests taken by graduates from the aircraft piloting study program.

2. Research Methodology

2.1. The Sample

The present research includes an analysis of the admission data for the academic years 2009, 2010, and 2011. The aforesaid years were selected for study because the number of graduates was not affected by economic factors or by the COVID-19 pandemic. Table 1 provides a summary of the data on the graduates.

Table 1. Descriptive statistics of the graduates (source: created by the authors).

Year of Admission	The Matriculates	The Graduates		Males		Females		Working as Pilots	
	Number	Number	%	Number	%	Number	%	Number	%
2009	18	17	94.4	18	100	0	0	12	70.6
2010	17	16	94.1	14	82.4	3	17.6	12	75
2011	17	15	88.2	14	82.4	3	17.6	10	66.7
In total	52	48	92.3	46	88.5	6	11.5	34	70.8

Table 1 reveals that the majority of the respondents were male. Due to the small number of females, possible gender differences have not been addressed. The proportion who graduate from the aircraft piloting study program is significantly higher (92.3%) than the overall Lithuanian average of 73% (according to The Lithuanian Department of Statistics (2021)). In addition, the proportion of aircraft piloting graduates who find work in

accordance with their acquired specialty is more than twice the general Lithuanian average (70.8% and 34%, respectively) (according to the data of STRATA (2021)).

2.2. Data Collection and Analysis

Observing the principles of anonymity and confidentiality, data on the assessment scores for the state maturity examinations (Lithuanian language, mathematics, and physics), study outcomes, and assessments of the professional aptitude tests were collected for aircraft piloting students enrolled in the academic years 2009–2011.

The data were processed using the SPSS Statistics 22 software package. After considering the small sample and checking the data against the normal distribution according to the Kolmogorov–Smirnov and Shapiro–Wilk tests, it was determined that some of the data differed from the normal distribution ($p < 0.05$). Therefore, non-parametric criteria were chosen (Mann–Whitney U tests were used for the comparison of two samples, Kruskal–Wallis H tests for comparisons of three or more samples, and the correlations were calculated using Spearman criteria), except when comparing the maturity examination results with those of the general sample of Lithuanian school graduates. In this case, the parametric Student t criterion was applied.

3. Results

We will first review the graduates' maturity examination scores. Figure 1 presents the correlations of the assessment scores for the Lithuanian language, mathematics, and physics maturity examinations with the year of admission and their comparison with the examination scores of the general sample of Lithuanian school graduates.

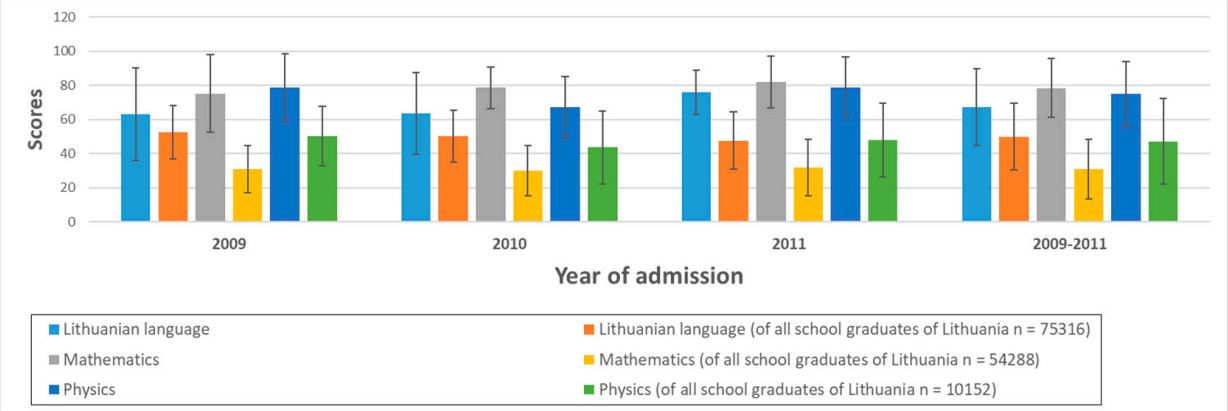

Figure 1. Correlation of the maturity examination assessment scores with the year of admission (source: created by the authors).

Figure 1 reveals that the all maturity examination scores of the students enrolled in the aircraft piloting study program were higher than the mean scores of the school graduates who took maturity examinations. Moreover, these differences were statistically significant (Table 2).

Table 2 shows that the maturity examination results of students who studied aircraft piloting were statistically significantly higher than the national average. The biggest difference was observed in the mathematics maturity examination ($\Delta = 47.57$ points). The students enrolled in the aircraft piloting study program passed the physics examination by $\Delta = 27.9$ points, better than the national average, whereas the smallest difference was noted in the Lithuanian language examination ($\Delta = 17.29$ points). No statistically significant difference was found when comparing the maturity examination scores of students enrolled in the study program in different academic years. Nor could we distinguish statistically significant differences when comparing the maturity examination scores for students who worked as pilots after graduation and those who chose another profession (Figure 2).

Table 2. Comparison of the maturity examination results of the students enrolled in the aircraft piloting study program with the mean scores of the school graduates of Lithuania (source: created by the authors).

Admission Year	Lithuanian		Mathematics		Physics	
	t	p	t	p	t	p
2009	2.86	0.0043	13.6	0.0001	6.83	0.0001
2010	3.57	0.0004	13.69	0.0001	4.56	0.0001
2011	6.96	0.0001	12.42	0.0001	5.84	0.0001
Overall	6.3694	0.0001	19.7866	0.0001	8.0227	0.0001

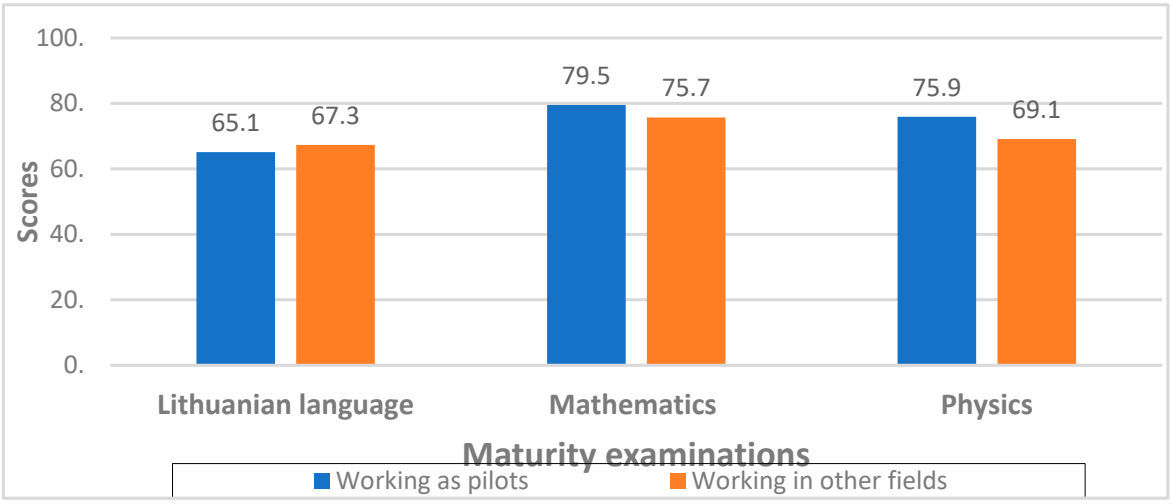

Figure 2. Comparison of examination scores of those working as pilots and those who chose other professions (source: created by the authors).

Figure 2 demonstrates that although no statistically significant differences were observed between the maturity examination scores of the graduates working as pilots and the scores of those working in other professions, the mathematics and physics examination scores turned out to be higher for the graduates working as pilots. In contrast, the Lithuanian language examination scores were higher for those who chose other professions. The biggest difference was observed in the results of the physics maturity examination (Δ = 6.8 points). Since the research sample was not large, the observed tendencies in the differences in maturity examination scores could presumably be statistically significant if a larger sample were explored.

Table 3 presents the highest and lowest maturity examination scores for the graduates working as pilots and those working in other fields.

Table 3. Highest and lowest maturity examination scores of the graduates working as pilots and those working in other fields (source: created by the authors).

Work	Lithuanian Language		Mathematics		Physics	
	Min.	Max.	Min.	Max.	Min.	Max.
Working as pilots	9	93	32	100	30	98
Working in other fields	28	99	29	97	23	96

Table 3 demonstrates that the lowest maturity examination scores in mathematics (by 3 points) and physics (by 7 points) were higher for pilots compared with those in other jobs. On the other hand, the Lithuanian language examination score was lower (by 19 points). Thus, even when analyzing the minimum and maximum maturity examination scores, the

same tendency could be observed: among the graduates working as pilots, the mathematics and physics maturity examination scores were higher and the Lithuanian language scores were lower compared with the scores of those working in other fields.

Below we will review the study process of the matriculates. The study results are presented in Figure 3.

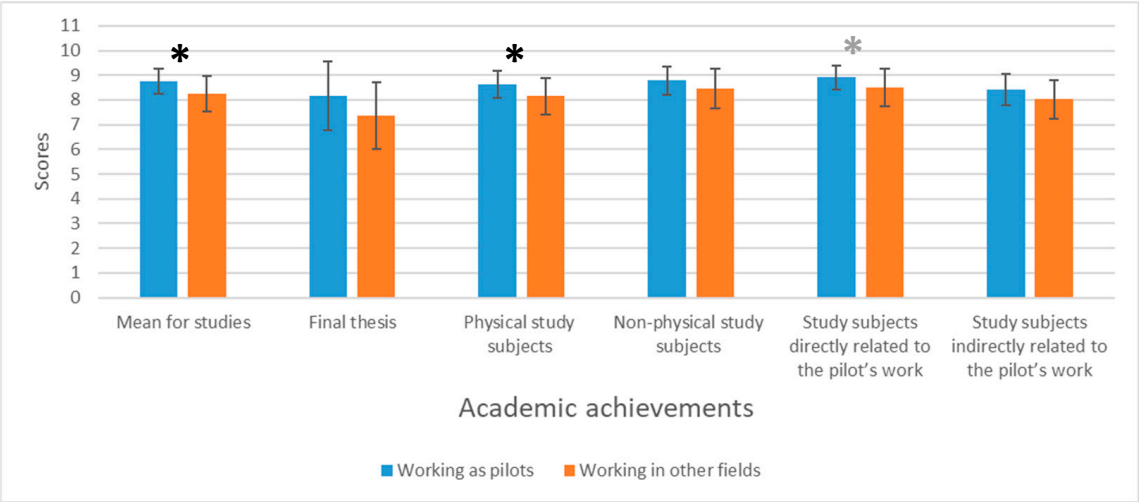

Figure 3. Study outcomes (source: created by the authors). Statistically significant differences are marked. Black asterisk: $p < 0.05$; grey asterisk: $p = 0.05$.

Figure 3 shows the groups into which the study subjects were divided, the overall mean study scores, and the evaluations of the final theses. It was determined that the mean study scores were statistically significantly higher for those who worked as pilots after their studies (Mann–Whitney U 142 (in this case, the value of U < 149 shows that there was a statistically significant difference between the explored groups), $p = 0.005$). On the other hand, the final thesis evaluations did not differ in a statistically significant manner, although those working as pilots had higher scores than those working in other professions.

The study subjects were divided into several groups. First, all the study subjects were divided into physical and mathematical groups, which require specific knowledge. Another group included humanities subjects (Figure 3, physical and non-physical subjects). After consulting with the working pilots, all aircraft piloting study subjects were divided into two groups: those directly related to the practical work of the pilot and those with less direct relevance to the pilot's profession. Comparing the study outcomes of the graduates working as pilots and those having chosen other professions, it was observed that there was a statistically significant difference in the physical subjects group (Mann–Whitney U 140.5, $p = 0.016$). In addition, the difference in the assessment results for the subjects directly related to the pilot's work was very close to statistically significant (Mann–Whitney U 149, $p = 0.05$) when comparing the graduates working as pilots and those working in other professions.

The analyses of the differences between physical and non-physical study subjects and those directly and indirectly related to the pilot's work revealed no statistically significant difference between the physical and non-physical subjects. However, when comparing the assessment results of the subjects directly related to the pilot's work with those of the subjects indirectly related to the pilot's occupation, it was found that the assessment results of subjects directly related to the pilot's work were statistically significantly higher for students who chose the pilot's profession after graduation (Mann–Whitney U 710.5, $p = 0.000$).

When analyzing the data according to the admission year, the mean scores in the humanities subjects were statistically significantly higher in 2009 (chi-square 7.232, $p = 0.027$) (Figure 4).

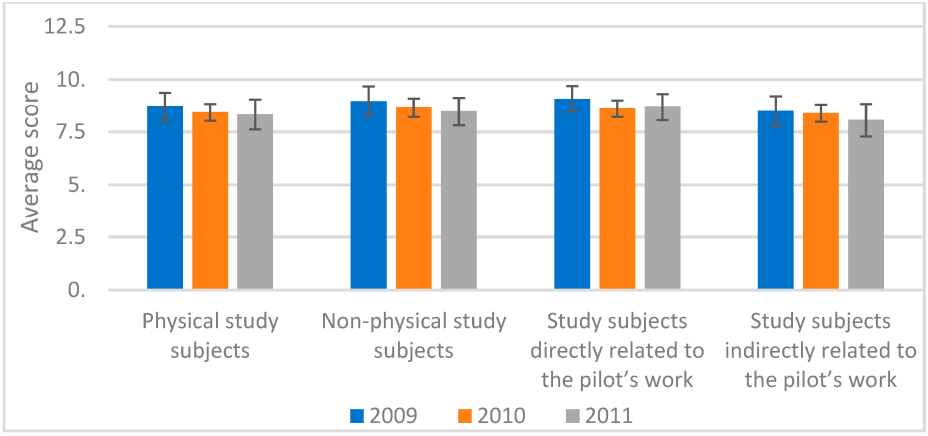

Figure 4. Assessment results for the study subject groups in different admission years (source: created by the authors).

Spearman correlation coefficients were calculated for the selected study subject groups for the pilots seeking to conduct a deeper analysis of the relationships between the study subjects. The obtained results are presented in Table 4.

Table 4. Connections between the assessment results in different study subjects for pilots (source: created by the authors).

Study Subject Group	Spearman Correlation Indicator	Physical Study Subjects	Non-Physical Study Subjects	Study Subjects Directly Related to the Pilot's Work	Study Subjects Indirectly Related to the Pilot's Work
Physical study subjects	Correlation coefficient		0.592 **	0.768 **	0.890 **
	p-value		0.001	0.000	0.000
Non-physical study subjects	Correlation coefficient			0.898 **	0.778 **
	p-value			0.000	0.000
Study subjects directly related to the pilot's work	Correlation coefficient				0.795 **
	p-value				0.000

** Correlation is statistically significant when $p < 0.01$.

Table 4 reveals a strong and statistically significant positive correlation between all study subject groups for the pilots ($p < 0.01$).

The mean study scores of the graduates working as pilots were analyzed. A histogram of the mean study scores is provided in Figure 5.

The mean scores of the studies of the graduates working as pilots varied [7.83:9.93]. Four study quartiles were identified. Employment rates according to the quartiles of the mean study scores are presented in Figure 6.

Figure 5 shows that the lowest number of pilots were employed in the first quartile of the mean study scores (with the lowest average), whereas the highest numbers were in the second and third quartiles. This difference is statistically significant (chi-square 12.153, $p = 0.007$).

When analyzing the vocational selection test data, the mean test scores were calculated and no major differences were found between the individual tests (all test results were normalized and could therefore be averaged). The mean of the previous selection tests was within the range [50; 95.38], with a standard deviation of 11.7. No statistically significant difference was observed between the mean scores of the graduates working as pilots and those of the graduates working in other professions. When analyzing the mean study

quartiles, the highest test scores in the third study quartile and the lowest in the fourth quartile were found to be statistically significant (chi-Square 9.308, $p = 0.025$).

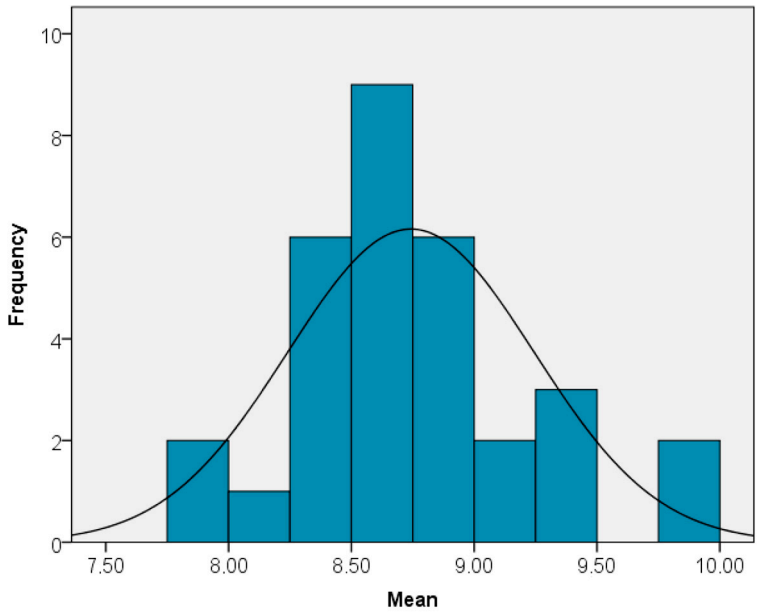

Figure 5. Histogram of the mean study scores of the pilots (source: created by the authors).

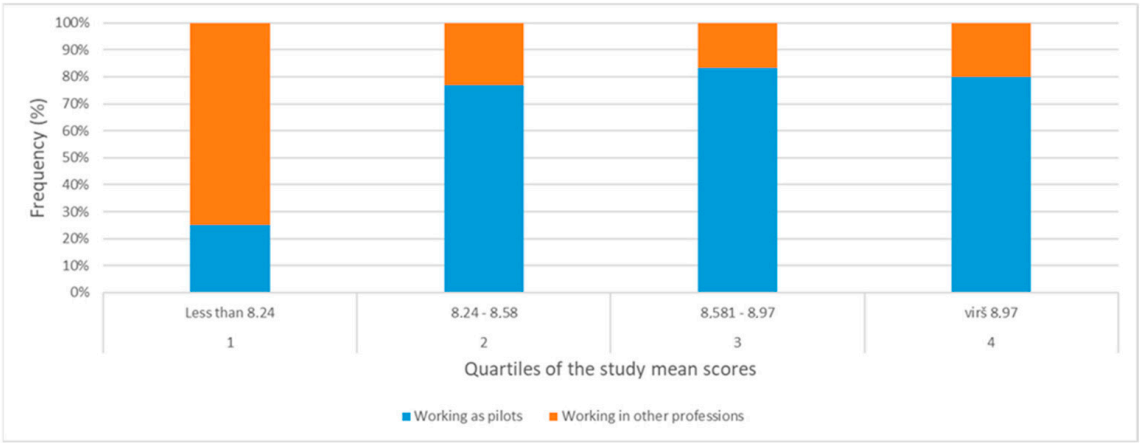

Figure 6. Frequency of employment as pilots according to the quartiles of the mean study scores (source: created by the authors).

4. Discussion of the Findings

Having analyzed the obtained results, it was determined that at the time of admission to their study programs, the maturity examination scores of school graduates were already much higher than the national average. It is interesting to note that the scores for the mathematics and physics maturity examinations were higher and the Lithuanian language scores lower for the graduates working as pilots than for those working in other professions. This suggests that the successful employment as a pilot can already be predicted from the scores of school maturity examinations. However, additional research would be required to confirm this hypothesis.

The mean study score remained high during the study period. It varied depending on the year of admission [8.44; 8.84]. When analyzing the employment data by study quartiles, it appeared that most of those employed in a profession belonged to the third quartile, i.e., not the worst students (first quartile), but not the best students (fourth quartile). If we suppose that lower employability is more predictable for students with lower mean study

scores, then lower employment rates for those with the best mean study scores would suggest that academic knowledge alone is sufficient to ensure success as a pilot. These findings are similar to those of a study by Giddings (2020). However, the question of what else is important and how one can predict whether a student will be a pilot requires further study.

Since we sought to determine whether there are differences between the study subjects, several groups of study subjects were distinguished according to the content of the study subject: physical subjects and humanities subjects as well as subjects that are directly relevant to the practical work of a pilot and those that are not. Interestingly, all the distinguished groups were related to each other in a statistically significant manner, and no differences were found between the scores for the different study subject groups among working pilots. This suggests that the specialty of a pilot cannot be strictly confined to the physical sciences. In seeking to become a pilot, a student must acquire knowledge of both physical and humanities subjects. As expected, the scores for the physical study subjects were statistically significantly higher. The scores for the study subjects related to the pilot's work approximated statistical significance for the graduates working as pilots.

Analyzing the vocational selection test data, interesting findings were obtained: most of the graduates currently working as pilots did not receive the highest evaluation scores in the vocational selection tests at the time of admission. An analogy can be made when considering the mean scores for studies. Based on these results, we assume that neither academic achievement nor professional testing data alone can predict whether a graduate will go on to have a successful professional career as a pilot. Further research and analyses are needed to gain a more exhaustive picture of the conception of a 'good' pilot and its component properties.

5. Conclusions

1. The vast majority of the enrolled students successfully completed their studies.
2. Twice as many graduates from the aircraft piloting study program work in their field of specialty compared with the national average.
3. The average scores of graduates from the aircraft piloting study program for the Lithuanian language, mathematics, and physics maturity examinations were statistically significantly higher ($p < 0.05$) than the average scores of Lithuanian school graduates. The biggest difference was observed for the mathematics state examination ($\Delta = 47.57$).
4. The academic achievement of those working as pilots differed: the average physical study subject scores were statistically significantly higher.
5. The graduates who received higher study scores showed a statistically significantly higher frequency of employment as pilots (2–4 quartile).
6. The average professional selection test score of the enrolled students was 72.75.
7. Academic achievement reflects the diversity of the pilot's specialty: no statistically significant differences were observed between the assessment results for physical and humanities subjects.

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