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Assessment of Achievement Motivation of Technical University Students by Methods of Statistical Analysis

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Abstract

The purpose of the study was to assess the level of achievement motivation by students of technical specialties of the University. A study of the link between the level of achievement motivation and students' involvement in sports, scientific work, and academic performance. For the analysis, a set of research methods was used: testing, questionnaires, methods of primary statistical data processing, correlation

analysis, analysis of variance, multivariate analysis of variance. Research has shown a link between the level of achievement motivation and students' academic performance, as well as the level of achievement in sports and scientific work. Also, the level of achievement motivation varies statistically significantly depending on the course in which students' study.

Keywords: Achievement Motivation, Correlation Analysis, Analysis of Variance (ANOVA), Multivariate Analysis of Variance (MANOVA)

1. Introduction

Achievement motivation is one of the types of motivation, which is a person's desire to achieve a goal. Achievement motivation contributes to the better performance of any type of activity, manifests itself in a person's desire to make efforts and achieve certain results in the field of activity of interest to him ^[1].

Many studies focus on the study of achievement motivation ^[2-16].

A.A. Rean in his work ^[1] identifies the motivation for achieving success and the motivation for avoiding failures. There are also people who do not have a pronounced type of motivation, who, depending on the situation, may behave as motivated for success, or vice versa.

Motivation for success refers to positive motivation. With this motivation, when starting a business, a person has in mind the achievement of something constructive and positive. Human activity is based on the hope of success and the need to achieve success. Such people are usually confident in themselves, in their abilities, responsible, proactive and active. They are distinguished by their perseverance in achieving their goals and determination.

Motivation to fail refers to negative motivation. With this type of motivation, a person's activity is associated with the need to avoid disruption, censure, punishment, and failure. This motivation is based on the idea of avoidance and the idea of negative expectations. When starting a business, a person is already afraid of possible failure in advance, thinks about ways to avoid this hypothetical failure, and not about ways to achieve success.

People who are motivated to fail are usually characterized by increased anxiety and low self-confidence. They try to avoid responsible tasks, and if necessary, they can fall into a state close to panic. At least, their situational anxiety becomes extremely high in these cases. All this, however, can be combined with a very responsible attitude.

Achievement motivation is also an important predictor for academic performance ^[2, 16]. Many articles are devoted to the study of motivation of sports activity ^[16-22].

The purpose of the study is to assess the level of motivation to achieve success and motivation to avoid failure, to explore the link between the level of achievement motivation and students' involvement in sports, research work and academic performance.

To achieve this goal, a set of research methods and techniques was used: testing, questionnaires, methods of primary and secondary statistical data processing, methods of correlation and variance analysis of data, multivariate analysis of variance [23-25].

2. Assessment of achievement motivation using methods of statistical data analysis in the software package "Statistica"

The research was conducted based on the Belarusian State University of Transport, Gomel, Republic of Belarus.

The subjects were students of technical specialties "Traffic management" – 47%, "Transportation Management and Management in Road and Urban Transport" – 53%. The study involved first-year students (19%), second-year students (25%), third-year students (27%), and fourth-year students (29%). Girls made up 43%.

The sample size was 68 people.

The study was conducted in stages. At the first stage, students were surveyed in Google Forms to determine the level of achievement motivation.

The level of achievement motivation was measured using the questionnaire scale developed by A.A. Rean [1].

The questionnaire aims to identify the level of motivation for success and motivation for avoiding failure.

It consists of 22 statements [1]. The students had to choose the answer "Yes" or "No". The answers matching the key ones were summed up by one point.

The test results, according to the A.A. Rean questionnaire were evaluated using Table 1 [1]:

Table 1: Assessment of achievement motivation

	Achievement motivation level									
	low level			medium level				high level		
	1	2	3	4	5	6	7	8	9	10
The amount of points	2-9	10	11	12	13	14	15	16	17	18-19

At the second stage, three central components of students' achievement motivation were measured:

- students' academic performance and academic self-assessment;
- students' involvement in sports and their achievements in sports;
- students' participation in research work and their results.

The level of academic achievement of the students was

determined by the average exam scores in the sessions [Table 2].

The students' academic self-assessment was determined by the following statements:

- "I feel quite confident in my intellectual abilities, which are necessary for me in my field of knowledge."
- "I am not very confident in my intellectual abilities, which are necessary for me in my field of knowledge."

The level of sporting achievements was determined by the frequency of classes and the results of participation in sports competitions.

The level of achievements in research work was determined by the number of published articles, diplomas for participation in student paper competitions and presentations at conferences.

Table 2: Assessment of achievement

Achievement level	low level	medium level	high level
Academic performance	4 – 5	6 – 7	8 – 10
Achievements in sports	0 – 3	4 – 7	8 and more
Achievements in scientific work	0 – 3	4 – 7	8 and more

Using the methods of correlation data analysis [23], a close relationship was revealed between the level of achievement motivation and academic performance of students ($r = 0.83$), a moderate relationship between the level of achievement motivation and the level of achievement in sports ($r = 0.50$) and scientific work ($r = 0.68$) (Fig 1).

Variable	Correlations (Motivation)			
	Acad_Perf	Achiev_Sport	Achiev_Science	Motivation
Acad_Perf	1,00	0,60	0,79	0,83
Achiev_Sport	0,60	1,00	0,53	0,50
Achiev_Science	0,79	0,53	1,00	0,68
Motivation	0,83	0,50	0,68	1,00

Fig 1: Correlation analysis results

The use of analysis of variance (ANOVA) [24] in the statistical analysis software package "Statistica" made it possible to identify whether there is a significant difference in the level of achievement motivation and the level of sports achievements and achievements in students' research work, as well as academic performance (Figures 2-4).

Effect	Univariate Tests of Significance for Motivation (Motivation)				
	SS	Degr. of Freedom	MS	F	p
Intercept	6275,938	1	6275,938	849,0205	0,000000
Sport	157,115	1	157,115	21,2548	0,000019
Error	487,870	66	7,392		

a)

Effect	Univariate Tests of Significance for Motivation (Motivation)				
	SS	Degr. of Freedom	MS	F	p
Intercept	6108,110	1	6108,110	734,6320	0,000000
Science	96,227	1	96,227	11,5734	0,001141
Error	548,758	66	8,315		

b)

Fig 2: Results of analysis of variance a) "Sport", b) "Scientific work"

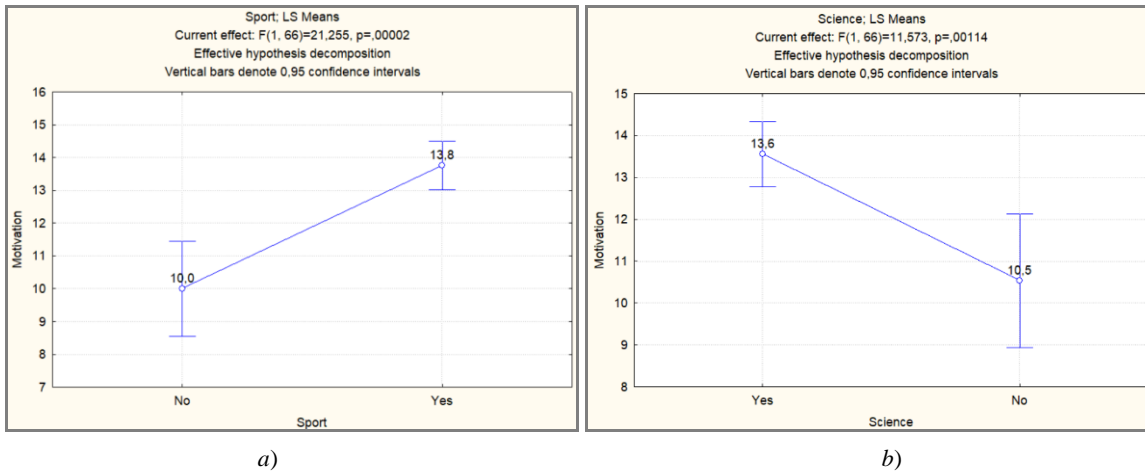


Fig 3: Graph of the analysis results for factors a) "Sport", b) "Scientific work"

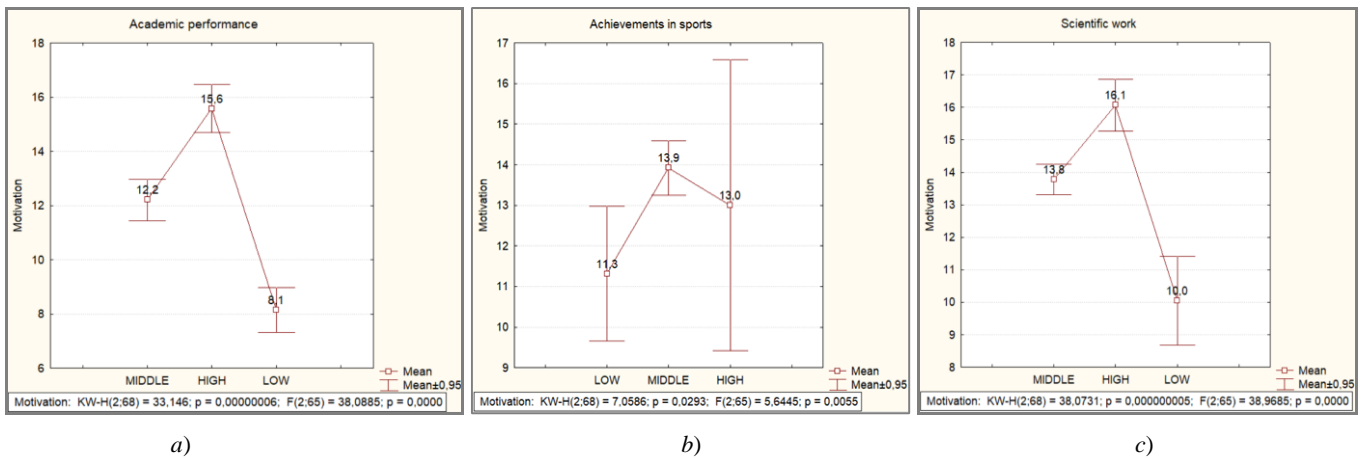


Fig 4: Graph of the analysis results for factors a) "Academic performance", b) "Achievements in sports", c) "Achievements in scientific work"

Since the significance level of $p < 0.05$ for the factors "Academic performance", "Achievements in sports", "Achievements in scientific work", the level of achievement motivation varies statistically significantly depending on the level of sports achievements, achievements in research work, as well as academic performance of students. The use of multivariate analysis of variance (MANOVA) [25] in the statistical analysis software package "Statistica" allowed us to identify whether there is a significant difference in the level of achievement motivation of students of different specialties, courses and gender (Fig 5).

does not result in intragroup variability being less than the total). So, the lower the value of Wilks lambda, the better the division into groups turns out to be. Since the significance level of $p < 0.05$ for the factor "Course", the level of motivation for students' achievements varies statistically significantly depending on the course in which students' study. The factors "Specialty" and "Gender" do not affect the level of achievement motivation ($p > 0.05$). Graphs of the achievement motivation level analysis for the factors "Course", "Specialty" and "Gender" are shown in Figures 6-8.

Multivariate Tests of Significance (Motivation)						
Sigma-restricted parameterization						
Effective hypothesis decomposition						
Effect	Test	Value	F	Effect df	Error df	p
Intercept	Wilks	0,015326	947,6736	4	59,0000	0,000000
Gender	Wilks	0,894490	1,7398	4	59,0000	0,153316
Course	Wilks	0,286284	7,8768	12	156,3908	0,000000
Specialty	Wilks	0,854802	2,5055	4	59,0000	0,051635

Fig 5: Results of multivariate analysis of variance

For the analysis, the Wilks lambda criterion is used. This is the ratio of the measure of intra-group variability to the measure of overall variability. Intragroup variability means that Wilks lambda can take values from 0 (groups are completely homogeneous) to 1 (dividing objects into groups

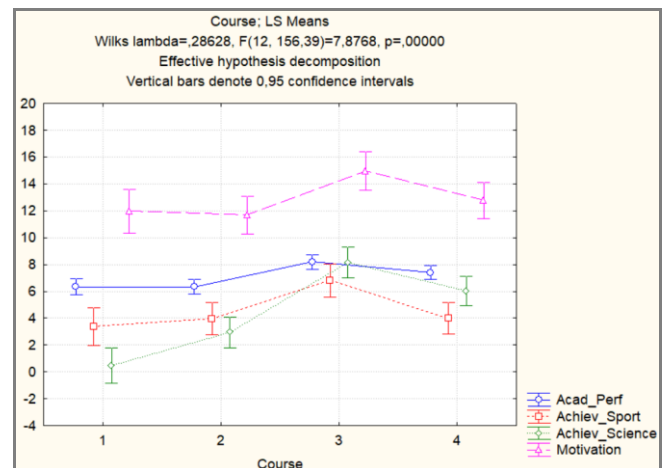


Fig 6: Graph of the analysis results for the factor "Course"

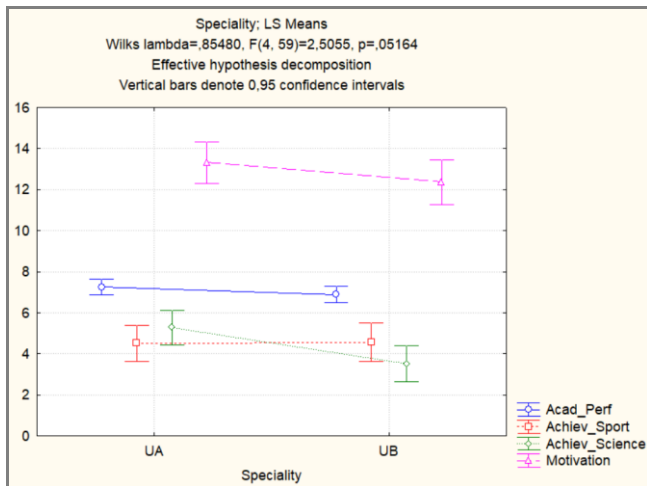


Fig 7: Graph of the analysis results for the factor "Specialty"

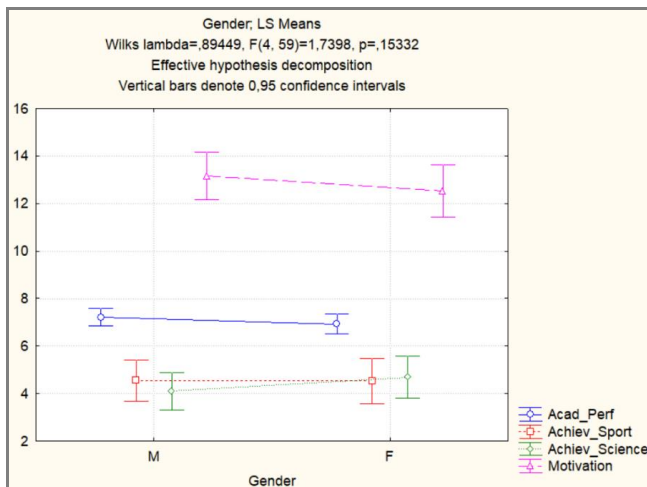


Fig 8: Graph of the analysis results for the factor "Gender"

Considering the issue of students' academic self-assessment, it is interesting to note that among the survey participants who noted that they feel quite confident in their intellectual abilities, it turned out that 43% have an average level of achievement motivation, and 12% have a low level of achievement motivation.

3. Conclusions

Achievement motivation has a great impact on students' academic and research success.

Also, one of the necessary conditions for creating interest in the content of academic disciplines, in educational activities themselves, and in research work is the opportunity to show mental independence and initiative in learning. Thus, a high level of achievement motivation is needed to improve academic performance and overall learning activities.

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